RENEWABLE ENERGY MASTER PLAN

Lismore City Council

November 2014

SustainableBusiness CONSULTING

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1. Executive Summary

Introduction

Lismore City Council set itself the target to generate 100% of its electricity needs from renewable energy sources by 2023. This arose from the *Imagine Lismore* process, through which the community's vision for Council as a *model of sustainability* was articulated. The target for renewable energy was aligned with this vision, and 2023 is aligned with the 10-year outlook of the *Imagine Lismore* process.

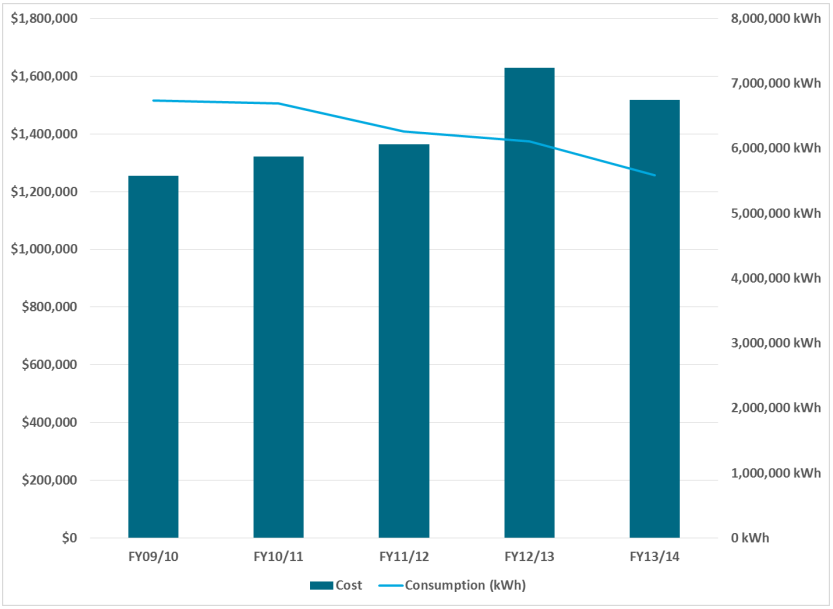
Achieving this goal will position Lismore City Council as a leader in carbon management and sustainability nationally, with the 100% target exceeding those in place in other jurisdictions at local, state and national levels. The Lismore Local Government Area is already a leader in the adoption of solar technologies, within NSW and nationally. As such, Council's goals are also aligned with the practices being adopted by the Lismore community.

Review of Lismore City Council's energy use and conservation actions

Lismore City Council recognised the need to respond to climate change many years ago, and has participated in programs such as *Cities for Climate Protection* (CCP). Council has tracked and reported on its energy use and greenhouse gas emissions for several years, and has implemented a range of energy efficiency and renewable energy improvements to facilities across its portfolio. Council and Essential Energy have worked together to implement upgrades to street lighting across the LGA.

The result of all of these actions is that Council's has reduced its electricity use in the past five years by 22% in total, including by 17% across all owned facilities, and by 38% in street lighting consumption. However rising electricity prices have meant that these savings have served to mitigate some of the increase in the cost of electricity at Council-owned properties, as shown below.

Figure 1: Council's facilities electricity consumption (kWh) and cost ($) from FY09/10 to FY13/14



Positive action by Council over the last several years means that a 2023 target that could have been as high as 10,000 MWh of savings in electricity use and electricity from renewables has been reduced. Including expected growth in electricity use – e.g. from upgrading of the South Lismore STP, Wyrallah Road Materials Recovery Facility as well as modest population growth – it is estimated that energy efficiency and renewables will need to reduce grid purchases by about 8,900 MWh in 2023.

The process via which this will be achieved is the Renewable Energy Master Plan (REMP). This document presents Council's first REMP and Action Plan, which will inform Council's decisions and actions to reduce electricity consumption and increase renewable energy generation in the short to medium term. Council expects to review and update its Action Plan on an annual basis, and a major review of the REMP and Action Plan will be carried out periodically over the course of the target period.

Engagement process for the development of the REMP

The development of the REMP has been a consultative and collaborative process, reflecting the engagement sought from the community in developing the *Imagine Lismore* plan. Sustainable Business Consulting developed the REMP and action plan by analysing Council's electricity consumption, undertaking site visits, and by extensively consulting with stakeholders through one-on-one meetings and a number of workshops. Council's preferred technologies were analysed in depth and presented to stakeholders, leading to the selection and development of seven energy efficiency and renewable energy solutions that will underpin the achievement of the 100% self-generation target.

For Lismore City Council to reach its target of 100% self-generation it is best to execute the work in two stages, which will be described on the following pages.

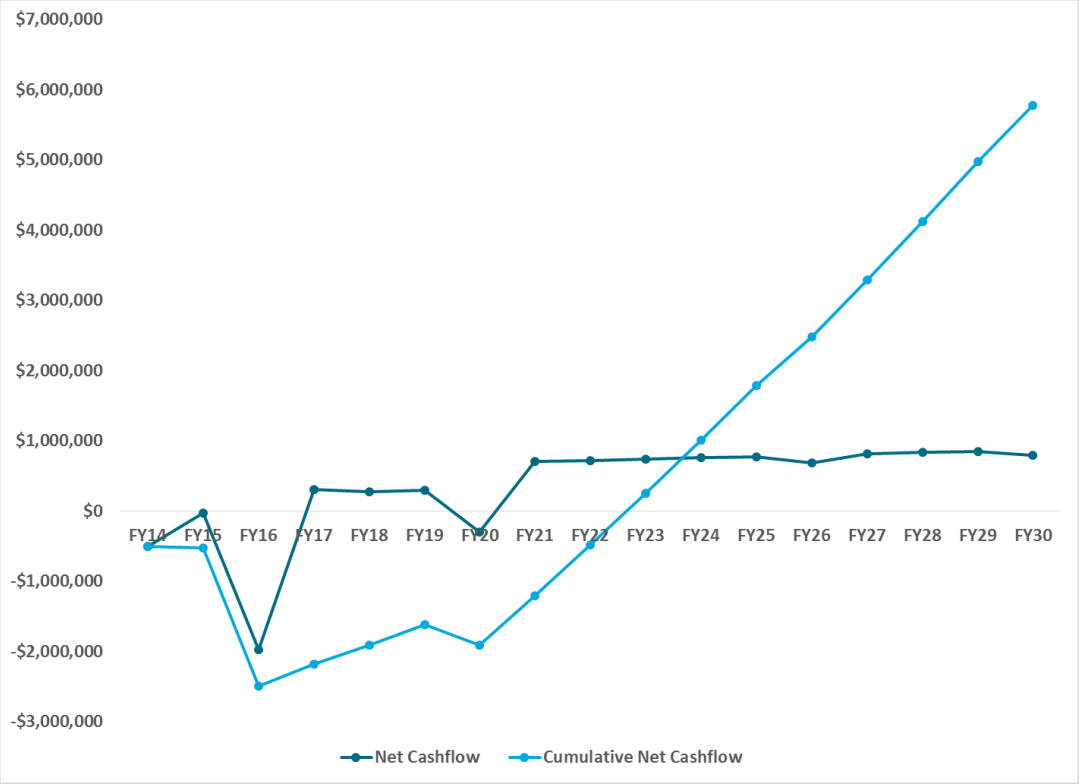
Stage 1 – implementing commercially viable solutions

In the first stage, a range of energy efficiency and 'behind-the-meter' solar PV systems can be implemented to deliver a significant part of the target, up to 2,697 MWh per year in reduced grid electricity consumption. The initiatives underpinning the achievement of this saving are commercially available and viable now, or will be within the next few years (e.g. main road LEDs), and are therefore taken to be capable of implementation now. Those initiatives should be undertaken before FY19/20.

The following table shows the electricity savings achieved with implementing the business cases. Stage 1 is up to and including business cases 1 to 6-a, being 2,697 MWh, excepting virtual net metering and storage solutions ('6-b'), which will occur in stage 2. The investment needed for stage 1 is close to $4 million and all projects combined attract a 15% internal rate of return (between 6 and 7 year payback period).

Bus Case #	Description	Electricity saved p.a.
1	Major sites EE	488 MWh
2	Ross St pump VSD	70 MWh
3	Facilities lighting EE	178 MWh
4	Other facilities EE	150 MWh
5	Street lighting	759 MWh
6-a	Solar PV 'Behind-the-meter'	1,053 MWh
Total	**Total all stage 1**	**2,697 MWh**

Based on these assumptions of annual investments, net and cumulative cash flow for these investments could look like the following chart.



Stage 2 – 100 % self-generation

The second stage of works is a larger and more ambitious undertaking, involving the implementation of solar energy generation at scale, augmented by solar PV storage and virtual net metering solutions as these become available.

Large-scale solar energy generation is still in its infancy in Australia, with just a handful of projects built or planned, and these rely on generous incentives or feed-in-tariffs to be viable. However, solar technology costs are continuing to fall, and are expected to become cost-competitive with conventional generation technologies within a few years.

A 3.8 – 4.7 MW solar plant within the Lismore LGA would underpin this stage of the REMP, and could potentially be built on Council-owned land that has been identified through this work. A 3.8 MW solar PV plant, for example, could potentially generate 5,400 MWh per year, delivering the majority of the stage 2 target.

Within the Northern Rivers region several organisations are working closely with regulatory and network authorities to try and make local renewable energy generation technologies more economically viable; virtual net metering and community-based energy retailing for examples. Progress in these areas could potentially lead to cost savings in the delivery of locally-generated renewable energy to consumers in the region, such as Lismore City Council.

Energy storage technologies are also rapidly approaching commercial viability and it is expected that increased penetration will be seen in the residential and small commercial markets in coming years. These developments will underpin the remainder of Council's stage 2 work, allowing available land and roof space on several Council properties to be used for generation, storage and then consumption to reduce peak demand and supply facilities' energy needs when solar energy availability is low.

The total contribution by stage 2 towards Council's target is expected to be about 6,107 MWh per year by FY22/23. The total cost of this stage is unknown – at present, technology costs of more than $15 million would be expended, with low returns. However, as technology costs fall and energy prices continue to rise over time the total cost will fall, potentially to less than $10 million.

Action plan

An action plan has been developed as part of the REMP and will facilitate the planning and implementation of the REMP annually during the target period. The action plan process will ensure that budgets and resources are available for implementation and will support the communication of the REMP to the community and Council. A sustainability team within Council will lead and implement the plan with overall leadership at the General Manager and Executive Committee level.

Funding

This initial REMP has developed budget estimates for stage 1, which amounts to nearly $4 million. A potential implementation scenario has been developed between now and FY19/20, with Council determining actual spending priorities as part of the action plan process. At this stage it is likely that funding of stage 1 will come from Council's balance sheet. Council may also consider low interest loan financing, such as through the *Clean Energy Finance Corporation* (CEFC).

For the larger stage 2 works Council will consider a range of funding options, including Council's balance sheet, loan financing, but also partnerships with energy services organisations.

2. Introduction

Lismore City Council set itself a target of becoming 100% renewable by the end of 2023. In order to achieve this the Council engaged Sustainable Business Consulting to deliver a Renewable Energy Master and Action Plan to map out the path towards this target.

This document is the **Renewable Energy Master Plan (REMP)** for Lismore City Council. It is the blueprint for energy efficiency and renewable energy projects to be deployed between now and the end of 2023.

2.1. Lismore City Council's target of 100% renewables by 2023

The '*Imagine Lismore*' 10-year strategic plan included a commitment by Council to:

> *"…becoming self-sufficient in electricity from renewable sources within the next ten years….This will save Council approximately $1.2 million each year.*
>
> *We will also look to create a partnership with other organisations within our region to recognise and realise opportunities in sustainability. We want to assist and promote the excellent work done by Sustain Northern Rivers and will become a key partner. "*

Council's engagement with its community has shown that Lismore residents want the Council to be a model of sustainability. Already, the Lismore LGA has the highest number of roof top solar installations of any LGA in New South Wales.

Achieving 100% renewables by 2023 is an ambitious target and there are not a lot of communities here in Australia, and abroad, that have achieved this. Reaching this target will establish Lismore Council as a leader in sustainability.

The following list shows a few of the targets that other LGAs, States/Territories, and Australia itself have set themselves:

- Sydney: capacity for 100% local generation by 2030
  including 30% renewables and 70% trigeneration[1]
- ACT: 90% renewables by 2020[2]
- South Australia: 50% renewables by 2025[3]
- Australia: 20% renewables by 2020
  under the *Renewable Energy Target* (RET) scheme, with negotiations to determine if this remains as a fixed 41,000 GWh target or is amended to a 'real 20%' target of 26,000 GWh by 2020

[1] Sourced from http://www.cityofsydney.nsw.gov.au/__data/assets/pdf_file/0003/153282/Renewable-Energy-Master-Plan.pdf, p2
[2] Legislated under *Climate Change and Greenhouse Gas Emission Reduction Act 2010*
[3] Sourced from http://www.abc.net.au/news/2014-09-23/sa-commits-to-50-per-cent-renewable-energy-target/5763640

When Lismore City Council went through the process of developing its Renewable Energy Master Plan (REMP), Council agreed on the following definition of its target:

'Self-generate all of Lismore City Council's electricity needs from renewable sources by 2023'

The focus was put on 'self-generate', so that it was clear that the electricity had to be generated within the boundaries of the Council LGA, and that the purchase of Renewable Energy Certificates for the purposes of meeting the target was not acceptable.

2.2. Methodology and structure of the Renewable Energy Master Plan (REMP)

Sustainable Business Consulting adopted a staged approach to the project delivery as outlined in the figure below.

Figure 2: Methodology for project delivery

Central to the methodology at all stages of the work was the consultation with LCC stakeholders, from inception, through site visits and data analysis, and through workshops and subsequent engagement at all levels to develop, communicate and gain consensus on REMP Actions. The stages of the project are summarised below:

1. The '*Stakeholder Engagement and Consultation*' stage started with a project inception meeting with staff from Lismore City Council. Council provided information about their electricity consumption, about their goals, ideas and vision, future plans of Council and how they affect the energy management, as well as about the drivers in the community. This was followed by initial site visits to the top energy consuming sites of Lismore Council. The site visits provided

information about potential energy efficiency and renewable energy deployments, and also allowed engagement with staff at a site level. The following pictures show examples of the site visits.

Figure 3: Pictures of the site visits

2. The '*Energy Situation Assessment and RE / EE Development*' stage commenced with a thorough analysis of electricity use by Lismore City Council and past / current energy saving actions by Council. This process was underpinned by data and information from Council's energy database for FY12/13 and prior years, as well as extensive consultation with Council to gain a comprehensive insight into Council's past performance and efficiency efforts. A first-pass assessment of energy end-use, possible energy reduction opportunities and a high-level financial analysis was also performed.
3. Outputs from this analysis were collated with other information on energy efficiency and renewable energy technologies, regulations, incentives and known or possible changes to Council's operations in future years. This information was used to conduct a workshop with Council's stakeholders to present and prioritise opportunities for renewable energy and energy efficiency development.
4. The outcomes of the workshop were Council's preferred renewable energy technologies and energy efficiency options. The next phase was the '*Renewable Energy and Energy Efficiency Delivery*' stage, in which the current and proposed energy efficiency measures and renewable energy projects were analysed to develop the business cases for each proposed strategy. This phase also incorporated the development of an Action Plan, which is a separable document to be managed and updated yearly by Council staff.
    a. Due to the strong preference for energy efficiency, more site visits to approximately 20 smaller sites were undertaken to verify and develop the case for the energy efficiency potential.
    b. The estimation of on-site RE opportunities focused on solar PV and solar HW where the energy generated could be wholly utilised on-site with no export, as this delivered the biggest benefits to Council.
    c. Additional renewable energy generation via the installation of larger PV systems in conjunction with 'Virtual Net Metering' and community-based retailing, and the installation of larger PV systems than necessary to meet site demand in conjunction with battery storage, were also examined. Beyond energy efficiency and direct on-site use of renewables, these are the measures likely to be deployed to make up the remainder of Council's self-generation target.

5. Following this detailed analysis, another workshop was held at Council premises to discuss the business cases and delivery options for the various energy efficiency and renewable energy projects. The Action Plan for reaching the target was discussed and modified with the input from stakeholders.
6. The project delivery concluded with the finalisation of the Renewable Energy Master and Action Plan and a presentation to Council's administrative staff, as well as to a Councillors' briefing session in December 2014.

Based on this approach, the REMP is set out in four parts as follows:

1. **Baseline** – the situation in FY12/13 when Council established its target in line with the 10-year *Imagine Lismore* process, a forecast of what electricity use would have been without action, and what Council has already done to reduce its target,
2. **Consultation** – the inputs to the initial consultation workshop are summarised, focused mainly on the high-level analysis outputs and the technologies that were presented for consideration,
3. **Business cases** – based on the consultation outputs and further site visits and analysis, seven business cases were developed that inform Council's initial Action Plan, and these are presented here,
4. The **Action Plan** for FY14/15 is presented, and will be updated annually ahead of each budget cycle, so that funding and resources for each financial year are committed and responsibilities for implementation are known

Appendices include additional consultation workshop information, give an overview of solar potential at a range of Council's sites, and present more detailed business case summaries.

3. Baseline: review of Lismore City Council's electricity consumption

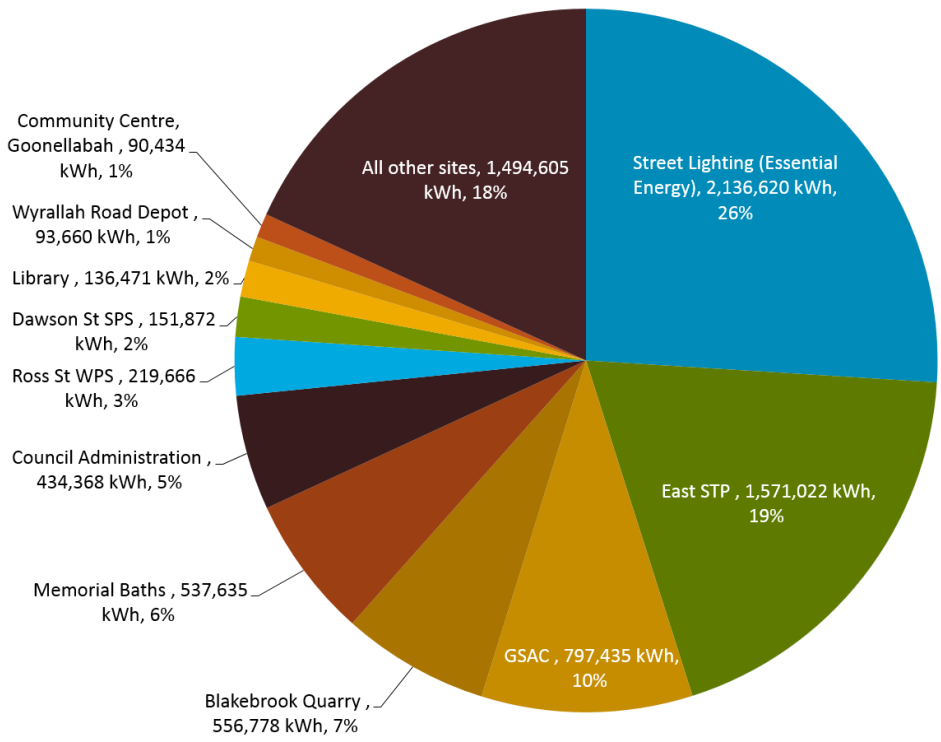
3.1. Electricity use in base year FY12/13

Electricity data were supplied by LCC, via the *Planet Footprint* database that records and reports on energy use by Council's facilities. Total electricity consumed in FY12/13 was 8,220 MWh, with 2,137 MWh consumed by Council's street lights and 6,084 MWh consumed by Council properties.

To put the consumption of 8,220 MWh in perspective, the average household consumes about 8 MWh[4]. This means that Lismore City Council's electricity consumption is equivalent to around 1,000 typical households.

FY12/13 data show that the top 10 properties and street lighting accounted for 82% of all consumption, with just 18% (1,495 MWh) consumed by the other 141 properties. The chart below shows this high-level summary of electricity consumption.

Figure 4: Major LCC electricity users in FY12/13

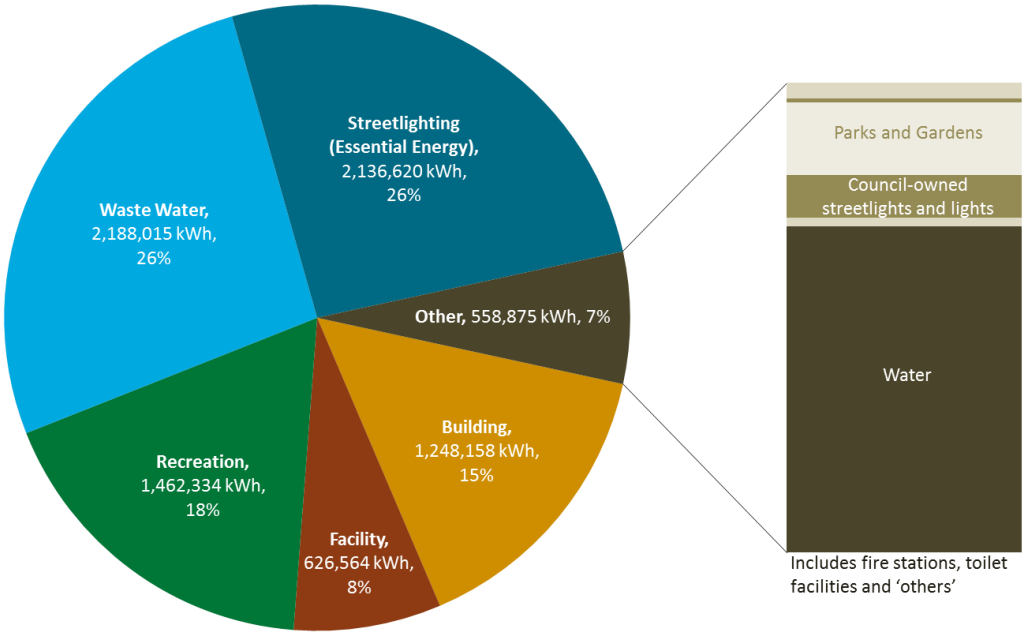


Electricity use can be looked at by asset category as well. This highlights street lighting, wastewater treatment, recreation, buildings and facilities as the major energy using assets, with these five

[4] BREE and Planning NSW figures indicate that NSW houses use, on average, over 8,000 kWh per year, and this figure is used when converting potential savings by LCC into 'number of equivalent households' electricity use.

categories accounting for 93% of all electricity consumed. Smaller asset categories such as parks & gardens, amenities and water supply account for just 7% of electricity used. This is illustrated below.

Figure 5: Electricity use in FY13 by asset category



3.2. Business-as-usual trend in electricity use from FY12/13 to FY22/23

The 8,220 MWh consumed in FY12/13 represents the start of Lismore City Council's 10-year target period to self-generate its own electricity needs from renewables. In the absence of any action to reduce electricity demand, this target would have grown over this period.

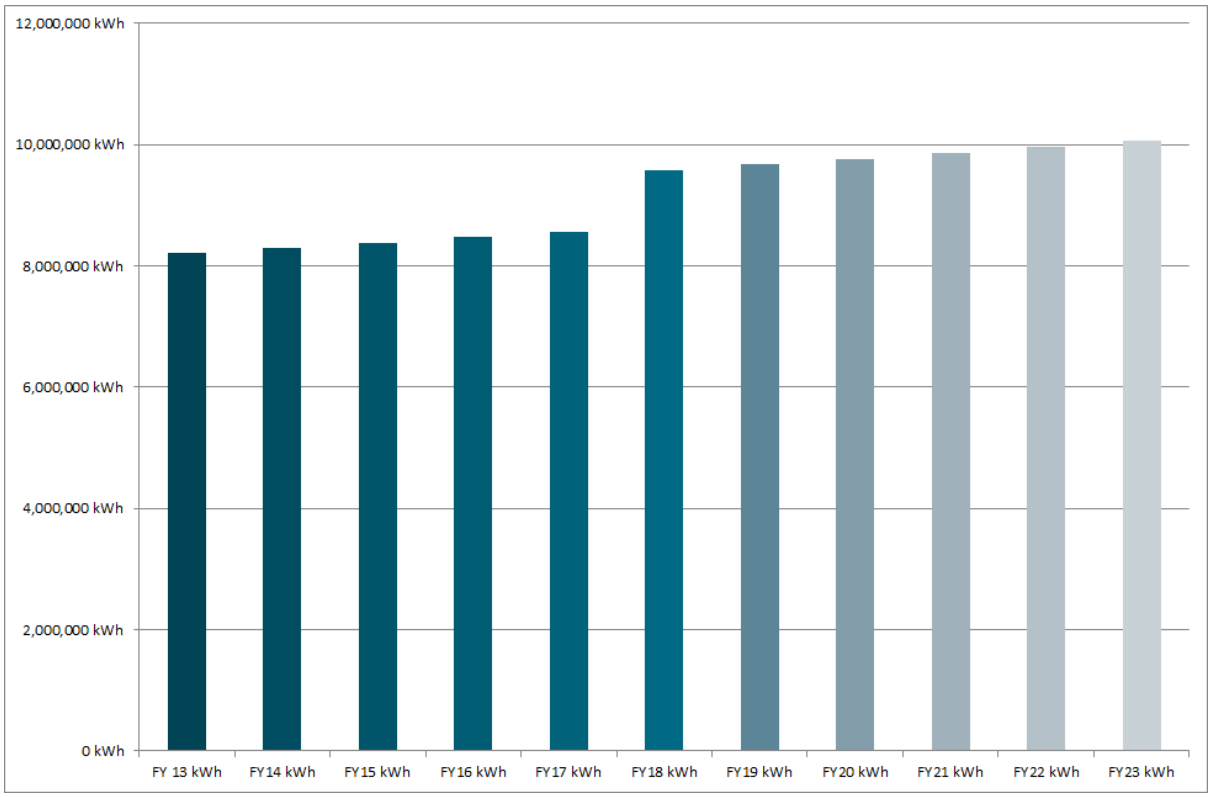
A simplistic approach to estimating future electricity use is to assume that population growth is the major factor driving changes in BAU energy use, and that other factors remain the same (use of properties, operating times, weather, etc.). For the above major asset categories it is reasonable to expect that population growth would affect energy use – i.e. more land sub-divisions for housing means more street lighting, water and waste water services, more Council staff to meet the needs of additional residents, and greater use of recreation facilities. An exception would be the energy consumption at the Blakebrook quarry, which is more likely influenced by road construction and maintenance trends. Also, energy use at the South STP may rise to 1,000 MWh pa when upgraded.

While population growth in Lismore in the 1980s was around 2% per year, subsequent population growth has been less than 1% per year, and in recent times has averaged just 0.4% pa.

Thus, if BAU energy growth was estimated to be 1% per year additional to an increase in South STP electricity use to 1,000 MWh pa (assumed to occur from 2018), it would present a conservative (i.e. higher than expected) estimate of electricity use in 2023 that is to be met from renewable energy sources. The graph below shows FY12/13 electricity use, escalated at 1% per year out to FY22/23, plus

1,000 MWh pa at South STP. This suggests that FY22/23 BAU electricity use would be a little over 10,000 MWh. This is the amount of electricity that would have to be supplied from renewable sources if no action was taken by Council to reduce its energy consumption from FY12/13.

Figure 6: Business-as-usual electricity use by LCC in FY22/23



3.3. Past and current energy efficiency and renewable energy initiatives

Of course, 'doing nothing' to reduce energy consumption has not been an approach taken by Council. In fact, through participation in the *Cities for Climate Protection* (CCP) program, and through Council's own initiative to participate in recent grant and other incentive schemes, energy consumption has been reduced considerably in recent years.

Council's *Planet Footprint* database reports show some 18 initiatives implemented up to and including 2011, with variable speed drives on sewer pumps, solar PV systems on a number of Council properties, solar hot water, LED lighting, as well as other improvements.

Several recent initiatives, part-funded under the *Community Energy Efficiency Program* (CEEP) have also been implemented or are underway. Several solar PV projects have been implemented or have commenced, and Council has also continued to implement saving measures on its own initiative.

A summary of past and recent / current initiatives is shown below. The impact of some of these is yet to be seen in Council's energy consumption and cost data, but will be evident from FY14/15 onwards.

Table 1: Summary of Implemented Energy Efficiency Initiatives at LCC's Sites

Year	External funds	Description
2014	RET (Small scale)	165 kW solar PV implemented at LCC's waste management facility, Brunswick St depot, Crematorium residence and Lismore Airport
2014	CEEP 2 Project	HVAC improvement, lighting retrofit, heat reflective paint Council Administration Centre
2013-14	CEEP 1 Project	Upgrade of pumps, lighting (upgrade to LEDs) and solar heating and installation of variable speed drives on pool circulation pumps Memorial Baths
2013-14	LGEEP Grant Project	Solar hot water upgrades across 10 sites
2013	CEEP 1 Project	Upgrade of pumps, variable speed drives on pool circulation pumps and LED lighting at facility Goonellabah Sports and Aquatic Centre
2012	ESS Certificates (surrendered)	Streetlighting Retrofit from MV to CFL lamps
2011		Hot water heating upgrade at Council Administration Centre
2011	ESS Certificates (surrendered)	Lighting retrofit: all TL136 and TL236 Luminaires to 1 x 28W luminaires Lismore Regional Library
2011-14		Variable speed drive control of aerators and pumps, LED lighting at water & wastewater sites including Wyrallah Road, Dawson Street SPS, South SPS among others
2011		Retrofit all RT418 luminaires to 3 x 14W luminaires Lismore Neighbourhood Centre
2011		Replacement of 2 x 36W luminaires with high efficiency 1 x 58W diffused battens with electronic ballasts CBD Office
2011		Luminaires either be replaced or upgraded to 1 x 28W electronically ballasted luminaires ACE Building
2011	Feed-in-Tariff	3.885 kW PV system Lismore Art Gallery
2011		Solar Hot Water Lismore Neighbourhood Centre
2011	Feed-in-Tariff	3.885 kW PV system CBD Office
2011		Upgraded aircon in IT Server Room = 12 kw Panasonic system (previous two systems have been kept as backup) Council Administration Centre
2010		Change airconditioner set times - temperatures set to the highest levels possible in summer and lowest possible in winter Goonellabah Sports and Aquatic Centre
2010		Lighting upgrade: replacing single fluroescent tube with single high brightness LED and incandescent and CFLs replaced with LEDs Council Administration Centre
2010		VSD installed Sewerage Pump Station 260 Rous Road G'bah

Year	External funds	Description
2010		VSD installed Sewerage Pump Station Habib Drive Sth Lismore
2010	Feed-in-Tariff	9.62 kW PV system Brunswick Street Depot
2010	Feed-in-Tariff	9.62 kW PV system State Emergency Service Building
2009		Variable speed drive installed Sewer Pump Station - Cullen St, Nimbin
2009		Variable speed drive installed Sewer Pump Station - Sibley St, Nimbin
2009		Upgraded Solar Panels from 20 to 50 at GSAC

Some of these initiatives are summarised below as case examples.

Case example #1: street lighting upgrade

Electricity use by Council's Essential Energy-owned street lights was approximately 2,500 MWh. The majority of street lights were of the Mercury Vapour (MV) type, which is an energy inefficient technology. During FY12/13 the majority of Council's street lights were replaced, with 42W compact fluorescent globes (CFL, 46.2W actual demand) and a range of high pressure sodium lamps (HPS from 70W to 400W, mainly 250W) replacing the old technology. The effect of this change was to reduce electricity use to an estimated 1,638 MWh in 2013-14. This is a saving of 38% compared with FY11/12.

Case example #2: Memorial Baths

Memorial Baths implemented a number of initiatives that were identified in an energy audit, and that were subsequently part of a grant application to the Commonwealth Government under the Community Energy Efficiency Program (CEEP). The project included upgrade of pumps, lighting (upgrade to LEDs) and heating (solar hot water using evacuated tube technology) and installation of variable speed drives on pool circulation pumps. The project will produce annual cost savings of over $57,000 and annual energy savings of 290,000 kWh.

Case example #3: wastewater treatment and pumping

The Dawson Street sewer pump station pumps were upgraded, with the new 150 kW pumps equipped with VSD control. LED lighting was also installed. Observed operation showed the pumps running at around 43 Hz. Overall savings of around 30% of pre-installation energy use are expected. The aeration pumps at the East Lismore sewerage treatment plant (Wyrallah Road) are equipped with VSD control. LED lighting and solar hot water have also been implemented, and controls have been optimised to ensure correct run hours of the major plant loads, during offpeak times wherever possible to reduce peak / shoulder period peak demand charges. An estimated 250,000 kWh is expected to be saved compared with FY13 electricity use, with savings of close to 500,000 kWh achieved since FY11.

Case example #4: solar photovoltaic power generation

Lismore Council has availed of incentives to implement renewable energy systems at several sites. During FY09/10 and FY10/11 Council gained access to attractive feed-in-tariffs to implement PV systems at four sites including the SES building and Brunswick Street depot, as well as the Lismore Art Gallery and CBD Office building. The total size of these systems is around 27 kW. A further 165 kW of PV systems were installed on five facilities during FY13/14, with the Renewable Energy Target (RET) for small-scale systems used to reduce the upfront cost of the systems and make them financially viable.

The result of all of these actions is that Council's has reduced its electricity use in the past five years by 22% in total, including by 17% across all owned facilities, and by 38% in street lighting consumption.

However, despite this improvement, costs for electricity have still risen owing to steep rises in electricity rates over this period. The electricity cost for all facilities (excluding street lighting) rose by 21% in this period, the result of an increase in electricity rates from under 19¢/kWh to more than 27¢/kWh.

The following charts tell this story. Hence, rather than a projection of electricity consumption that trends upwards with population growth or other growth factors, Lismore City Council has already taken significant steps towards meeting its FY22/23 target to self-generate from renewables.

Figure 7: Council's overall electricity consumption (kWh) from FY09/10 to FY13/14

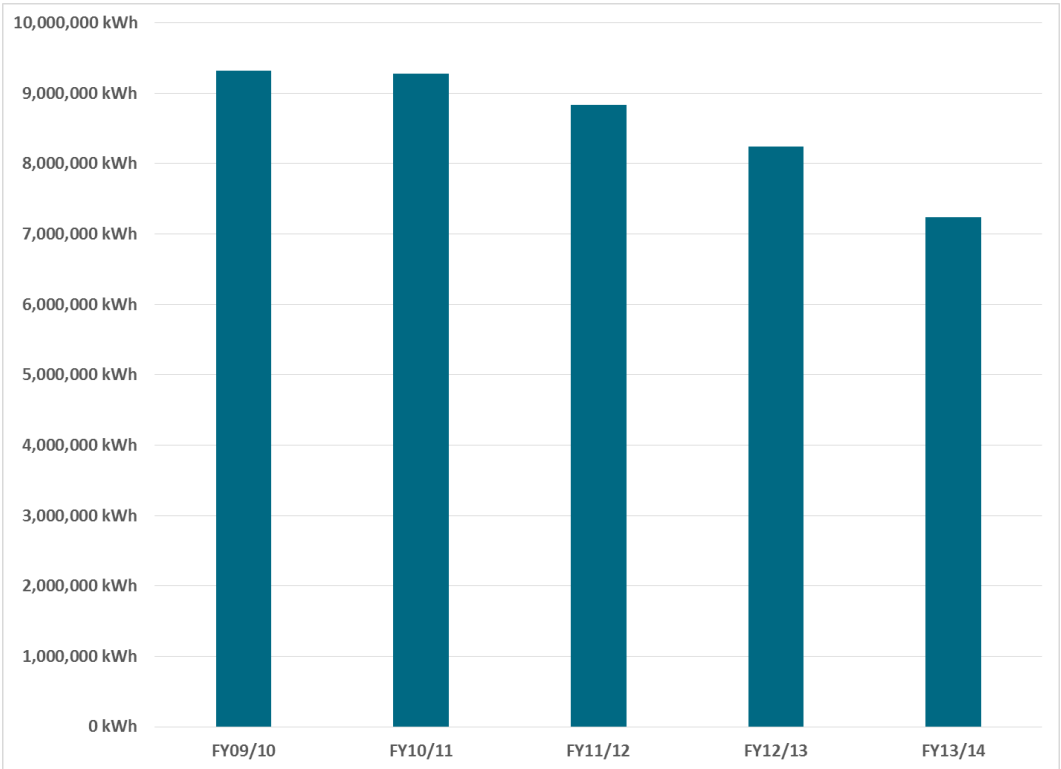
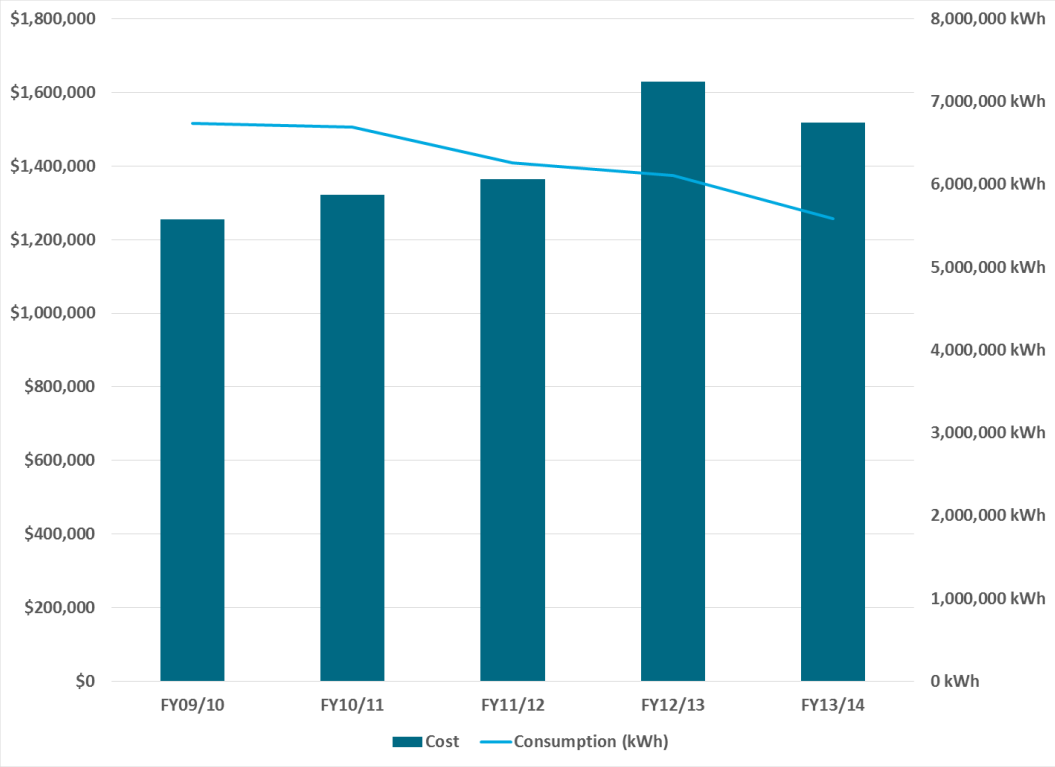


Figure 8: Council's facilities electricity consumption (kWh) and cost ($) from FY09/10 to FY13/14



4. Consultation with Lismore City Council stakeholders

Consultation with Council's stakeholders underpins this REMP. Two consultation workshops were informed by an initial review of sites and energy consumption, and then by a detailed analysis of prioritised saving opportunities.

4.1. Consultation workshop #1

The first workshop was held at Council's Administration Centre in Goonellabah on 21st May 2014, with a wide range of stakeholders. A summary of the attendees and approach followed is included as Appendix A.

Key inputs to the consultation process included an initial assessment of energy efficiency and renewable energy options for Lismore City Council. The primary aim of this assessment was to develop a picture of the options available to Council to meet the target of "*becoming self-sufficient in electricity from renewable sources within the next ten years",* including:

- Identification of the options,
- Initial quantification of the options in terms of the potential contribution they could make towards the target,
- Initial appraisal of the potential costs, savings and regulatory issues associated with achieving the target

With this high level assessment of energy efficiency and renewable energy options it was intended that Council's stakeholders would be in a position to select a more focused package of options that should be formulated into a Renewable Energy Master Plan for Lismore.

Energy efficiency potential

The initial assessment of Council's information (electricity use, audit reports, direct engagement with staff) and sites indicated that energy efficiency could be an integral part of Council's REMP.

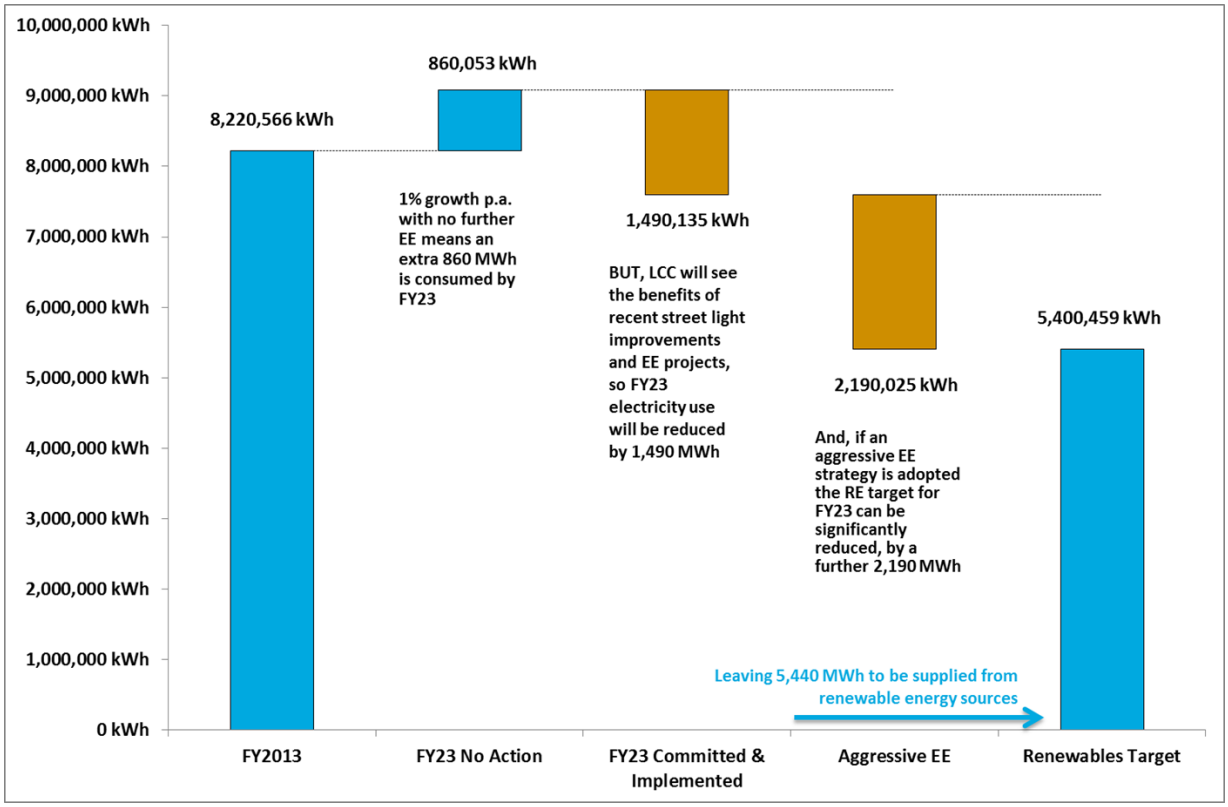
Three energy efficiency options were highlighted to be considered for further development into a fuller business case, as summarised below.

Table 2: Energy efficiency options for consideration in workshop #1

EE Scenario	Aggressive	Moderate	Light
Target(s)	• 40% across properties & street lighting • 30% across water / wastewater	• 40 % across properties • 30% across water / wastewater	• 20% across properties • 15% across water / wastewater
Properties / pumping	Yes	Yes	Yes
Street lighting	Yes	No	No
Potential savings in FY23	2,190 MWh	1,593 MWh	980 MWh
Potential consumption in FY23	5,400 MWh	5,997 MWh	6,610 MWh
Likely payback	8 years	6-8 years	4 years
Potential investment	>$5 million	$3-4 million	$1-2 million
Actions likely to be included	• Active Reactor control &/or LED street lighting • LED lights in properties • VSDs on pumps • Controls – BMS, time scheduling • Passive improvements – shading, insulation • HVAC plant upgrades • Awareness programs • Green IT	• LED lights in properties • VSDs on pumps • Controls – BMS, time scheduling • Passive improvements – shading, insulation • HVAC plant upgrades • Awareness programs • Green IT	• LED lights in properties • VSDs on pumps • Controls – BMS, time scheduling • Awareness programs • Green IT
Excluded sites	Sites where significant EE has already been implemented		
Other issues / barriers	• Engagement with Essential Energy • Heritage issues	• Heritage issues	• Heritage issues

The potential impact of an aggressive energy efficiency target on Council's electricity consumption was graphed as shown below. The purpose of this was to highlight the amount of electricity use that would still remain to be supplied from renewable energy generation sources even under such an approach to energy efficiency.

Figure 9: Waterfall chart showing the effect of energy efficiency measures on the RE target



Renewable energy potential

An initial assessment of possible renewable energy options for LCC was carried out, via both site-specific assessments and desktop research. This led to the identification of options, including;

- On site renewable energy generation,
- Working with local business organisations, and
- Regional renewable energy generation options

The results of these preliminary investigations are shown in greater detail in Appendix A and are summarised below.

Table 3: Renewable energy options for consideration in workshop #1

Site	RE Option	Onsite / VNM / Other	Capacity	Issues / barriers
Street lighting	Solar PV with storage	Onsite	Per-lamp	Untried
City View Drive reservoir	Solar PV	VNM	100-300 kW	VNM, DUOS charges, owned by Rous Water
Nimbin Dam	Solar PV	VNM	TBC	VNM, DUOS charges
GSAC – Farm the Sun	Solar PV	Onsite	99 kW	Ownership model, project establishment
GSAC – additional	Solar PV	Onsite / VNM	50 – 300 kW	VNM, DUOS charges
GSAC – additional	Solar HW expansion	Onsite	Unknown	
Memorial Baths	Solar PV	Onsite	20 kW	Useability of steel shade / awning
Oakes Oval	Solar PV	Onsite / VNM	25 kW	VNM, DUOS charges
Crozier Oval	Solar PV	VNM	45 kW	VNM, DUOS charges
Adam Gilchrist Oval	Solar PV	Onsite / VNM	2 kW	VNM, DUOS charges
South STP	Solar PV	Onsite / VNM	Unknown	Redevelopment
South STP	Micro-hydro	Onsite	Unknown	Redevelopment, net head, inflows
South STP	Biogas generation	Onsite	Unknown	Redevelopment decisions on plant type
East STP – Farm the Sun	Solar PV	Onsite	99 kW	Ownership model, project establishment
East STP – additional	Solar PV	Onsite / VNM	300 kW	VNM, DUOS charges
East STP – additional	Micro-hydro	Onsite	Unknown	Sufficient flow, net head pressure
Nimbin STP	Solar PV	VNM	60 kW	VNM, DUOS charges
Council Administration	Solar PV	Onsite	50 kW	
Library, Magellan	Solar PV	Onsite	10 kW	Heritage
Wyrallah Road Depot	Solar PV	Onsite / VNM	50 kW	VNM, DUOS charges
Brunswick Street Depot	Solar PV	Onsite	10 kW	
Community Centre Goonellabah	Solar PV	Onsite	10 kW	
Lismore Airport	Solar PV	Onsite / VNM	10 kW - > 1 MW	CASA 'approval' re 'bright light' interference (CAR 94)
Library HQ	Solar PV	Onsite	10 kW	Not visited, roof looks like it could accommodate 10 kW+

Site	RE Option	Onsite / VNM / Other	Capacity	Issues / barriers
Lismore Neighbourhood Centre	Solar PV	Onsite	2 kW	Not visited, roof looks like it could take 1-2 kW
Tourist Information Centre	Solar PV	Onsite	2 kW	Roof looks to be shaded from trees on all sides
CBD Centre Depot	Solar PV	Onsite	2 kW	Not visited, roof looks like it could take 1-2 kW
Blakebrook Quarry	Solar PV	Onsite	20 kW	Dust
Wyrallah Road MRF	Solar PV	Onsite	165 kW	Tender in progress
Wyrallah Road MRF	Green waste	Other – e.g. PPA	800 kW (total Ballina)	Green waste to go to Ballina for Biochar plant
Old Quarry, Three Chains Road	Solar PV	VNM	Up to 1 MW	Suitability of the land – water body and extensive tree cover
'Turf Farm' in front of South STP	Solar PV or CSP	VNM	Up to 9 MW	Suitability of the land v other uses, below flood level?
Local non-LCC: Lismore Square	Solar PV	Onsite / VNM	>100 kW	Viability of VNM with non-Council organisation
Local non-LCC: LBH Mental Health	Solar PV	Onsite / VNM	>100 kW	Viability of VNM with non-Council organisation
Local non-LCC: Trinity College	Solar PV	Onsite / VNM	>100 kW	Viability of VNM with non-Council organisation
Local non-LCC: SCU	Solar PV	Onsite / VNM	>100 kW	Viability of VNM with non-Council organisation
Ballina Council Biochar / pyrolysis	Biochar, syngas electricity gen	Onsite / PPA	~800 kW	Too far for VNM to be considered, would have to purchase part-output
Sustain Northern Rivers project	Bioenergy		Unknown	
Regional: Wind	Wind		Unknown	NSW Wind map suggests low potential
Regional: Geothermal	Geothermal		Unknown	Not aware of any Northern NSW potential
Regional: Concentrated Solar Thermal	CST		Unknown	

The workshop discussed and considered information relating to all of the identified energy efficiency and renewable energy opportunities.

Also debated was the wording of the target, with a specific focus on whether renewable energy generation to meet the target should be developed on-site / locally only, or whether generation outside of the LGA or region would suffice.

Stakeholder engagement workshop #1 outcomes

The original target was for "Lismore City Council to become 100% self-sufficient in electricity from renewable energy sources by 2023". Discussions amongst the stakeholders revealed that the target should be made more specific and taken even further. It was agreed that the new target would be to:

"Self-generate all of Lismore City Council's electricity needs from renewable sources by 2023"

The overall outcomes from this workshop were:

- That the renewable energy target should be based around 'self-generation' and should exclude consideration of Green Power, RECs or other forms of offset against electricity supplied from the grid,
- That the target should be applied to Council's electricity and stationary fuel use (i.e. for heating), but should not extend to transport energy,
- That energy efficiency is a central part of the target and should be aggressively pursued,
- That solar technologies are strongly preferred for 'self-generation', with the maximum amount of 'behind-the-meter' opportunities to be developed, augmented by larger-scale solar PV or CST development(s) that will service Council's needs via a delivery model to be determined, but which may include consideration of a community-based retailer, virtual net metering and other options.

It was agreed that the prioritised options identified in the workshop would be developed in more detail. These were:

- **Energy efficiency** – the setting of an aggressive energy efficiency target that seeks to maximise the implementation of cost-effective measures over coming years, so that the target for renewable energy generation is minimised. Included steps:
  - Engagement with asset owners to discuss EE opportunities and plans in greater detail,
  - Discussions to include feasible implementation timelines and approaches / delivery methods, including continued use of current funding and other financing options,
  - Refinement of the high-level target that has asset owner input,
  - Financial analysis of the business case, to be shared with asset owners,
  - Discussion and refinement of the business case for presentation as part of the draft action plan
- **Solar – behind-the-meter (PV and solar hot water)**
  - Engagement with asset owners to refine the list of sites where solar can be installed and utilised on-site, also to refine estimates of capacity that can be installed,
  - Engagement with suppliers of solar as well as battery storage suppliers and industry to get insight to current and future trends in technology development and pricing,
  - Financial analysis of solar at refined list of sites and capacity, shared with asset owners,

- Investigation of financial delivery options including community owned (e.g. Farming the Sun), community retailer, Virtual Net Metering and others as needed, and refinement of the financial analysis,
- Discussion and refinement of the business case for presentation as part of the draft action plan

- **Large scale solar**
  - Engagement with Council to confirm potential for use of identified large areas for solar energy generation, and steps necessary to confirm suitability,
  - Engagement with similar-sized projects in Australia to discuss costs, delivery options, financial viability,
  - Identification of all delivery options and confirm financial analysis parameters,
  - Financial analysis of solar options and share with Council stakeholders / asset owners
  - Discussion and refinement of the business case for presentation as part of the draft action plan

4.2. Consultation workshop #2

Following the development of business cases for the selected priority options, a second workshop was held at Council's Administration Centre in Goonellabah on 24th September 2014, which was preceded by a series of meetings with key senior management to present and discuss individual business cases.

The purpose of the workshop was to discuss and finalise the business cases, talk about enabling actions and potential delivery models, get commitment for the implementation plan for the business cases, determine action items for the completion of the REMP, and to discuss the action plan for the implementation of the REMP.

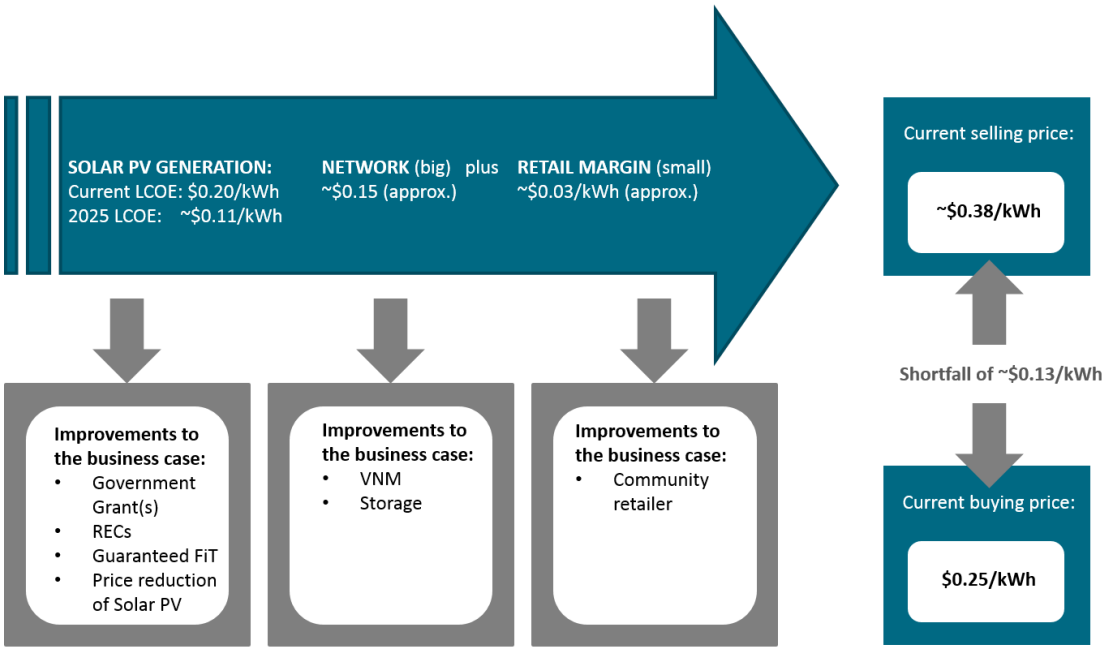
Enabling actions and delivery models workshop #2 outcomes

An important outcome of this workshop was that the energy efficiency measures and behind-the-meter solar PV installations should be completed as a first priority.

In 2014, especially with the political uncertainty around the *Renewable Energy Target*, the business case for a large scale solar PV implementation was not viable, as can be seen in the following graphic. It was agreed to wait a few years before the large scale solar PV project was developed in greater detail. In a few years, the LCoE might have come down sufficiently, more funding/grants might be available and *Virtual Net Metering* might be established.

In terms of delivery models for the business cases it was decided that it would either come off Council's balance sheet, or would be loan financed. In the case of the large scale solar development, Lismore City Council might enter a partnership agreement with an energy company.

Figure 10: Illustration of current break-even point for a large scale solar implementation



5. Energy efficiency and renewable energy master and action plans

The assessments performed to develop the current case for the range of identified energy efficiency and renewable (solar) technologies drew on a range of technology literature, case studies, site equipment and energy use / cost information, and from supplier / manufacturer information. A general overview of the approach taken is given below. Also outlined are some of the concepts – virtual net metering, levelised cost of electricity, and technology options – storage – that are likely to be more relevant when refining the business cases in the future as and when these inputs develop further.

5.1. Introduction to energy efficiency and solar PV installations

There is a broad amount of literature available that relates to the cost-effectiveness of both energy efficiency (EE) and renewable energy (RE). The economics of various approaches are changing all the time, and energy efficiency and renewables, as well as storage technologies, are becoming even more cost effective with a lot of innovation happening in this space.

Energy efficiency is commonly evaluated based on simple paybacks associated with planned investments, owing to the generally small scale of the investments. *Internal rates of return* or *net present value* (IRR, NPV) are also commonly performed on larger projects or portfolios of options. Council's preferred financial metrics are the payback period and the IRR and the following business cases thus focus on these two metrics.

The cost effectiveness of any particular on-site **renewable energy** project is a function of the site operating characteristics, and there can be different paybacks for the same technology deployed at different sites.

Optimal or near-optimal **solar PV** at commercial and residential levels tends to be more cost effective than grid-purchased electricity, where PV output is well matched to demand, and where peak (kW or kVA) demand charges are not applied. If a solar installation provides power to the business on which it is located, it is called a 'behind-the-meter' system. The solar power generation replaces the electricity supplied from the grid.

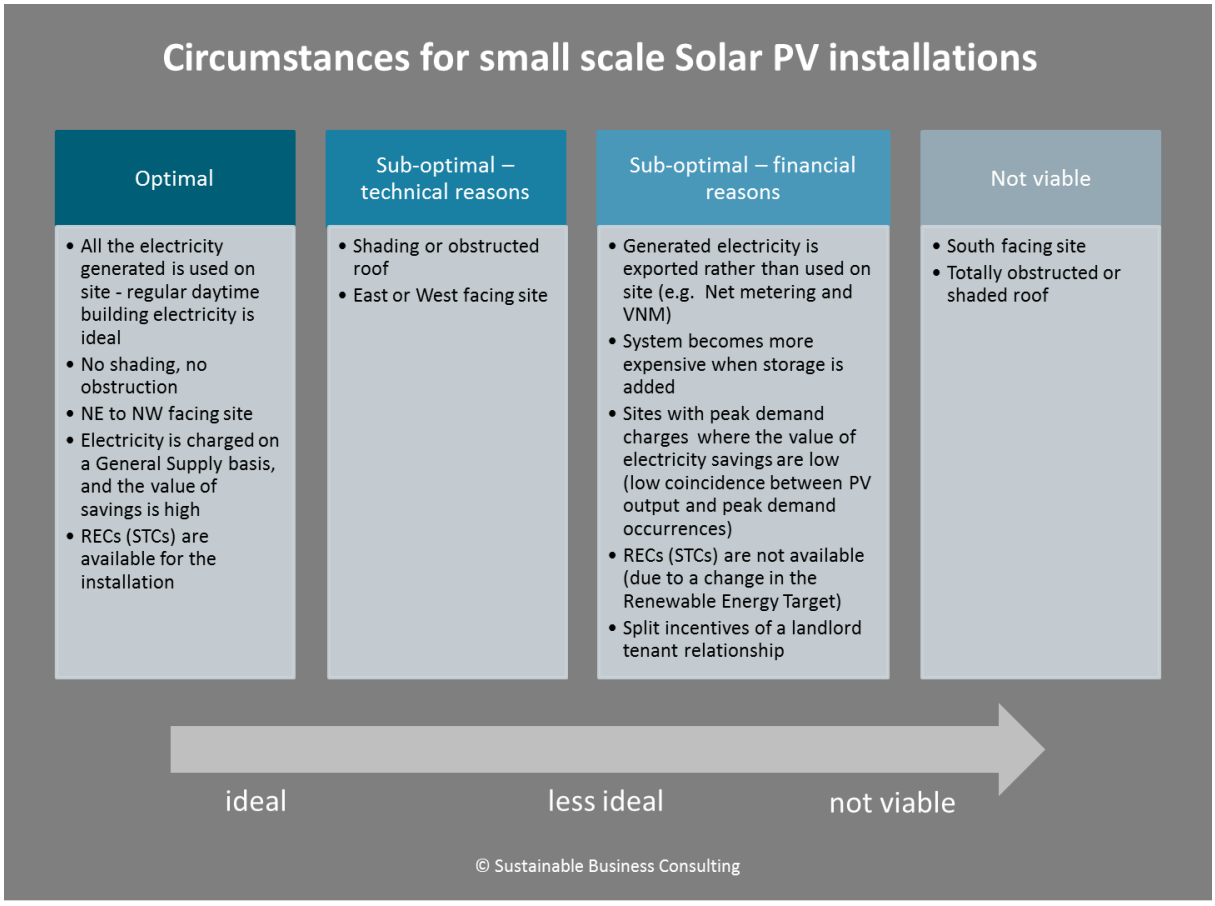
However, 'gap to grid costs' for most solar technologies is thin, and erodes quickly under 'sub-optimal' circumstances. 'Sub-optimal' refers to shading and orientation factors that diminish PV output, but also the following sub-optimal financial situations that would produce the same outcome, including:

- A site that has a **demand-based tariff** is usually charged at a set rate for the highest peak (power draw) that occurs during a calendar month, which will be a function of various factors such as operational characteristics and weather. Peak demand level and timing can be unpredictable, and in Lismore City Council's network area three separate peak demands are charged monthly for large sites, and peak demand can be as much as half of a site's bill. As such the likelihood of high PV output coinciding with building peak demands (36 per year) are slim, and so the value of savings may only be the cost of per-kWh charges.

- Sub-optimal valuation of **exported energy**, as happens under net metering (5-8¢/kWh) and as would also likely occur under a Virtual Net Metering (VNM) situation. In these cases the value of the financial gain is much lower than when reducing one's own grid consumption. This is because the export price for electricity is low (wholesale rates). As a result the financial business case can be quickly eroded, lengthening the return period for Council. It will be important to closely monitor the trial of VNM at Byron Bay Council.
- The capital cost of **energy storage** is additional to PV but produces no additional energy. Storage can be used to meet energy needs when solar output is low, with greater financial benefit than exported energy. It can also increase the value of savings – particularly at sites that have peak demand charges. Cost-effectiveness of energy storage for commercial applications is low at present, however storage technology is developing rapidly, and costs for this, integrated with PV systems, is likely to drop quickly.
- A **removal of the *Renewable Energy Target***, which means a removal of *Renewable Energy Certificates* that help finance a Renewable Energy project

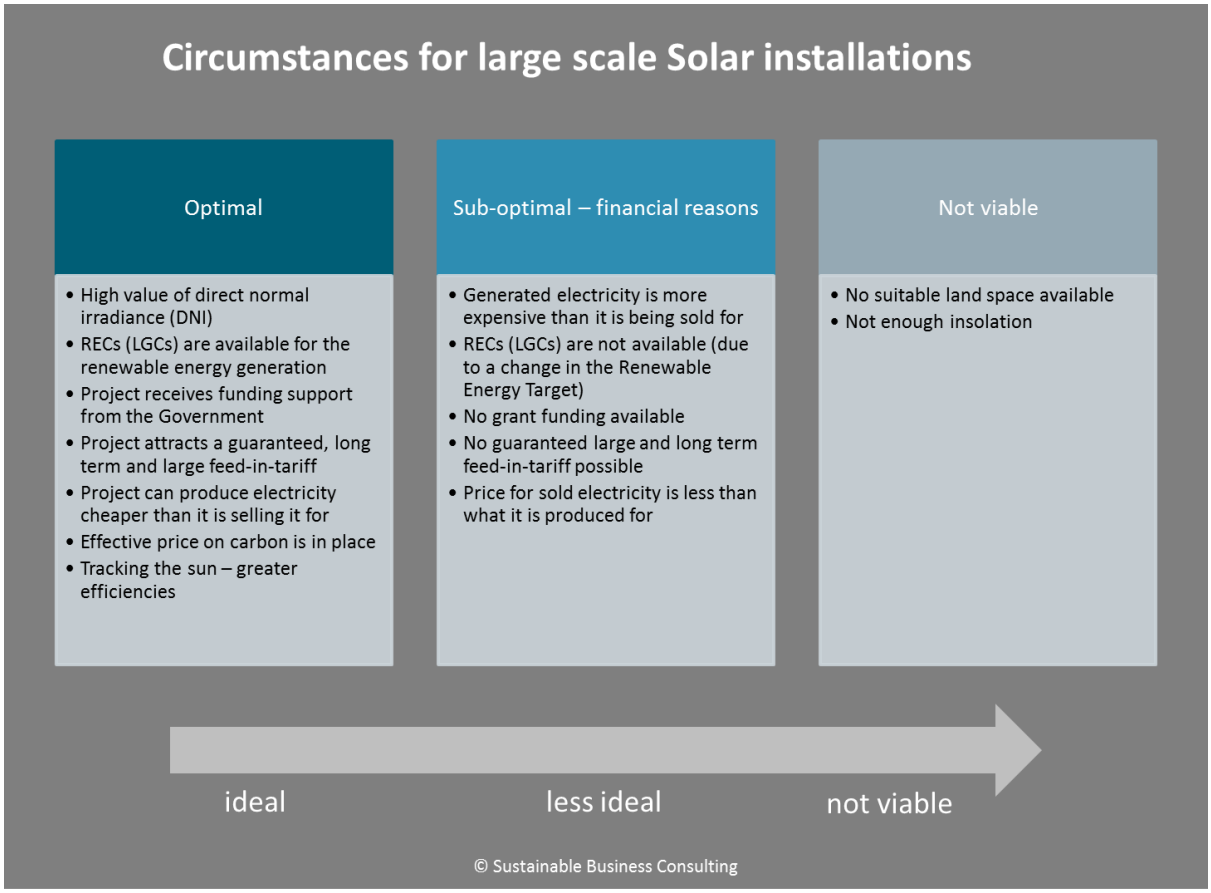
Solar PV is not viable where the site faces South, or where the site is completely shaded. The following graphic summarises the conditions for solar PV installations.

Figure 11: Conditions for small scale solar PV installations



In contrast to the business case for small scale solar PV, the economic viability of large scale solar plants is mostly dependent on financial assistance being available through, for instance, government funding, or guaranteed long term large feed-in-tariffs. The next graphic shows how favourable conditions can make a large scale solar power plant economically viable.

Figure 12: Conditions for large scale solar PV installations



The next paragraphs give insights into technologies and concepts that are important for understanding the business cases that follow.

Virtual Net Metering

"Virtual net metering (VNM) … refers to when an electricity customer with on-site generation is allowed to assign their 'exported' electricity generation to other site/s. The other site/s may be owned by the generator or other electricity customers. The term 'virtual' is used to describe this sort of metering arrangement as the exported electricity generation is not physically transferred to the consumer, but rather transferred for billing reconciliation purposes[5]*".*

At present VNM is not in widespread use in Australia; a small number of projects do 'wheel' power between sites but incur full network costs. In order to be economically viable VNM seeks to wheel power to a site that is close to the generation site and in doing so seeks a reduced fee for the use of only a part of the network.

[5] Langham, E. Cooper, C. and Ison, N. (2013). Virtual net metering in Australia: Opportunities and barriers. Report prepared for Total Environment Centre.

A trial of VNM has recently commenced involving Byron Shire Council[6]. An outcome from this trial could be an added set of network tariff rates that provides a discount compared to standard NUOS rates for power 'wheeled' between eligible sites.

Energy Storage

With energy storage, the solar power can be 'bottled' and saved for later consumption. Energy storage offers the potential to extract additional value from a solar PV system mounted on a facility with peak demand charges by ensuring that solar energy use is maximised during times of peak building demand. This strategy maximises the monetary value of savings. In Lismore City Council's case, for example, it could mean raising the benefits value from 13c/kWh towards the full average cost of about 25c/kWh for several Lismore City Council sites. However, cost for energy storage is still high and the complexity of storage (and control) solutions would require a detailed site analysis in each case. The best strategy currently would be to wait a couple of years and re-evaluate the situation then.

Alternatively, solar PV systems can be oversized to allow for the excess energy to be stored rather than exported. Storage would capture surplus energy generation and deploy this at a time when solar generation is low, rather than export electricity that attracts a low purchase price by energy retailers. This means that the storage solution can fill the gap when the sun does not shine and helps to better align PV and building peak demand.

The cost of energy storage is changing rapidly and it is expected that this will become cost effective at residential level, and potentially for commercial customers, in future years.

Levelised Cost of Electricity (LCoE)

The cost of electricity (typically cents/kWh) generated by different sources is a calculation of the cost of generating electricity at the point of connection to a load or electricity grid. It includes the initial capital, discount rate, as well as the costs of continuous operation, fuel, maintenance and decommissioning. To evaluate the total cost of production of electricity, the streams of costs are converted to a net present value using the time value of money. These costs are all brought together using discounted cash flow.

This type of calculation assists organisations to guide discussions and decision making. Levelised cost of electricity (LCOE) is a metric that indicates the cost at which each unit of electricity needs to be sold at in order to break even. The word 'cost' might not be the actual selling price, since this can be affected by a variety of factors like subsidies and taxes.

[6] http://www.byron.nsw.gov.au/newsletters/2014/03/27/virtual-net-metering

5.2. Identified key initiatives

The energy situation analysis, site visits, discussions with Council staff and the LCC workshop outcomes have led to the identification of seven key initiatives that can help Council achieve its goal of self-generating all of its electricity needs from renewable energy sources by 2023. These seven initiatives are[7]:

1. Major facilities energy efficiency & solar hot water improvement
2. Water and wastewater facilities energy efficiency improvement
3. Other facilities lighting energy efficiency improvement
4. Other facilities energy efficiency improvement
5. Street lighting energy efficiency improvement
6. Solar photovoltaic 'behind-the-meter' implementation
7. Major solar photovoltaic project

For each of the energy efficiency business cases described in the next sections the following seven-step approach is followed.

- Summary
- Potential annual MWh reduction
- Energy use and cost trends to 2013-14
- Potential energy changes due to business priorities
- Completed, in-progress, planned and potential energy efficiency improvements
- Cost-benefit analysis
- Suggested action plan for implementation

For each of the renewable energy business cases described in the next sections the following approach is followed:

- Summary
- Potential annual MWh production
- Potential future MWh production
- Regulatory environment and barriers to renewable energy
- Cost-benefit analysis
- Suggested action plan for implementation

For each business case a possible timeline for implementation is selected based on various discussions with Council. However these timelines are mainly illustrative and serve to highlight the financial viability of each opportunity rather than prescribe implementation timing. It is assumed that Council will review its implementation priorities annually through its Action Plan process, based on available funds, resources or revisions to the original business cases.

[7] Note that for the purpose of LCC's Action Plan, these initiatives are organised into three REMP Strategies, being energy efficiency, on-site or 'behind-the-meter' solar solutions, and offsite solar solutions such as large-scale PV and VNM. For the purpose of the business case development a more granular approach to energy efficiency opportunities in particular was adopted.

5.3. Business case #1: major facilities energy efficiency & solar hot water improvement

Summary

Improving the energy efficiency of Lismore City Council's four major facilities will significantly reduce total electricity consumption. These sites account for about two thirds of LCC's buildings' electricity consumption. Improving the energy efficiency fits well within Lismore City Council's business strategy and has been a strong focus in recent years, primarily at GSAC and the Memorial Baths. Significant savings initiatives have recently been completed at Memorial Baths, and others are in progress at the Administration Centre; savings from these recent initiatives will be reflected in future years' energy consumption data.

Implementation of the most recent initiatives, as well as additional identified energy savings at GSAC and Blakebrook Quarry, can reduce Council's electricity use by 488 MWh per year compared with FY13/14. Costs (some already incurred) to realise these savings are estimated to be $580,000 with an internal rate of return (IRR) of 19%.

Initiatives that have already been implemented, or are planned will achieve 180 MWh savings and cost a little over $500K. To achieve the full 488 MWh savings per year energy audit estimates indicate that a further $78,730 needs to be spent going forward, which will achieve the balance of the savings, being 308 MWh. The payback period for the implementation of these initiatives is 1.2 years.

This business case does not include water and wastewater assets, or street lighting assets owned by Essential Energy. Opportunities for these are dealt with in separate business cases.

Potential annual MWh reduction

By implementing all suggested energy efficiency improvements, the electricity consumption can be reduced by 488 MWh. This is equivalent to the following reductions:

Electricity saved	Equivalent to a reduction in …….			
	Solar PV capacity in kW and number of panels	# Households annual electricity consumption	GHG emissions in t CO_2-e (total lifecycle - S2+S3)	# Cars off the road
488 MWh	348kW 1392 panels that don't have to be installed	61	483	141

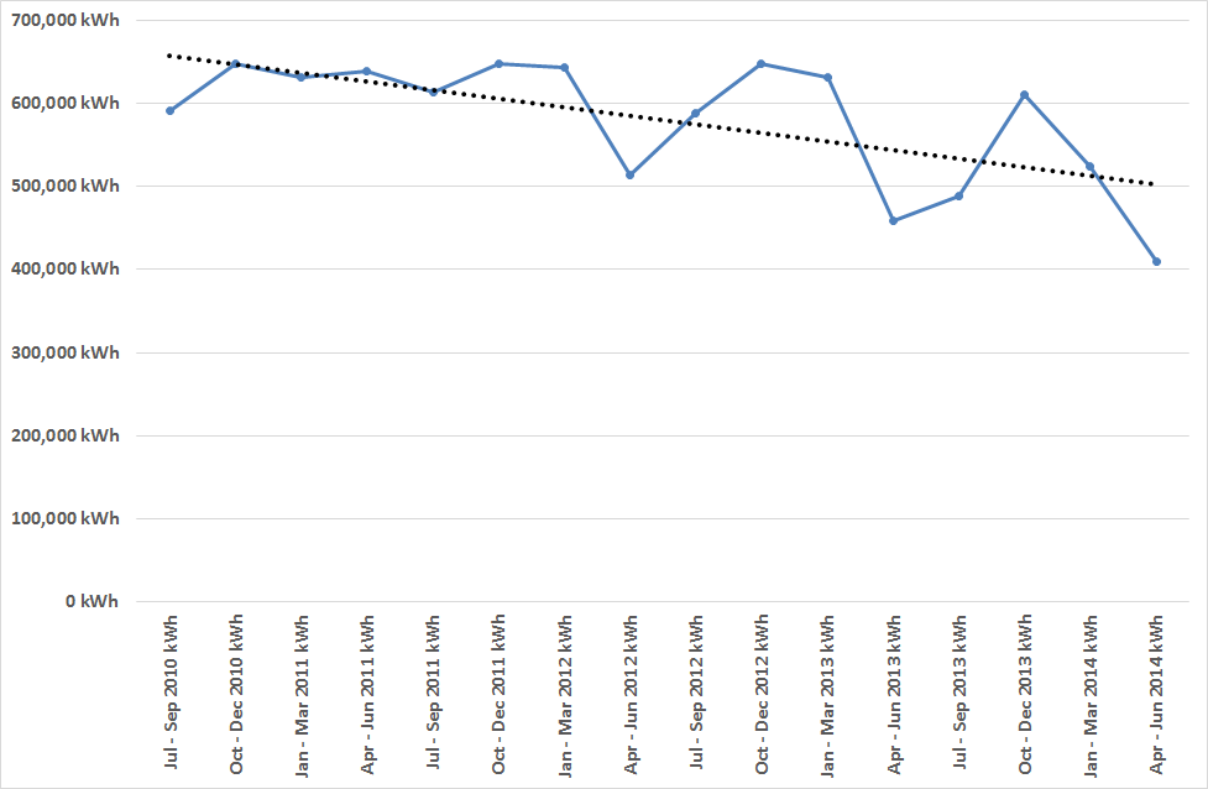
Energy use and cost trends to FY13/14

The four largest energy using facilities owned by Lismore City Council are:

- Goonellabah Sports and Aquatic Centre,
- Blakebrook Quarry,
- Memorial Baths, and
- Council Administration Centre

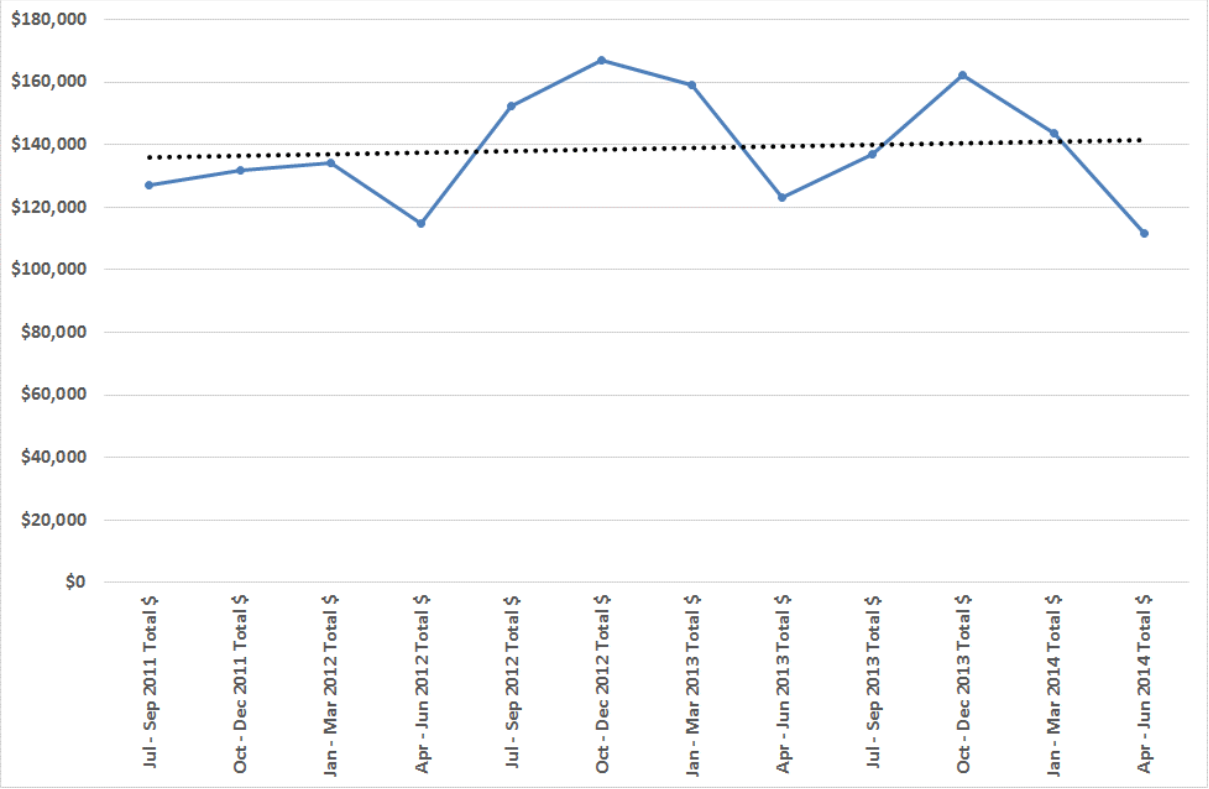
These four sites consumed 65.5% of facilities electricity consumption in FY13/14 (2,032 MWh), compared with 64.4% in FY10/11 (2,508 MWh). The chart below shows the quarterly electricity use trend for these four sites since FY10/11. The downward trend amounts to a 19% reduction in FY13/14 compared with FY10/11, or 475 MWh. Factors giving rise to this trend are discussed below.

Figure 13: Electricity use trend (in kWh) for Lismore City Council's top-4 sites (excl. wastewater)



Conversely, electricity cost trends over the past few years have been slightly upwards, as a result of rising network costs and the carbon price. As such, efforts to reduce electricity use at these sites have been successful at maintaining costs at around the same level. Had electricity use remained the same over this period then electricity costs would have been $125,000 more than they were in FY13/14.

Figure 14: Electricity cost trend for Lismore City Council's top-4 sites (excl. wastewater)



Potential energy changes due to business priorities

Non-energy factors potentially affecting future energy use at these sites include:

1. Re-location of LCC's head office building to another location, possibly Lismore, and
2. Demand for aggregate and asphalt products at the quarry, as well as future potential changes in the site's operating strategy – e.g. changing crushing strategy from mobile in-pit (diesel) to fixed electric crushing

The energy usage impact of any significant future changes such as these would need to be factored in to estimates of renewable energy generation needs to meet all of Council's requirements.

Completed, in-progress, planned and potential energy efficiency improvements

Improvements in energy efficiency at these sites have arisen out of energy audits and subsequent implementation of saving initiatives in recent years. Completed initiatives where savings are already reflected in FY1314 energy use data include:

1. Implementation of LED lighting and VSD control of pool pumps at GSAC,
2. Implementation of LED lighting and VSD control of pool pumps at Memorial Baths,
3. Installation of domestic solar hot water systems at Memorial Baths, Blakebrook Quarry, and LCC's Administration Centre at 43 Oliver Avenue, Goonellabah

Recently completed and in-progress initiatives at these sites, where savings will be seen from FY14/15, include:

1. Evacuated tube solar hot water heating at Memorial Baths swimming pools and showers,
2. Application of reflective paint to the roof of Council's Administration Centre,
3. Implementation of Steril-Aire's UVC Emitter® germicidal lamps at Council's Administration Centre HVAC systems to reduce ventilation and cooling energy demand (and improve air quality),
4. LED lighting at Council's Administration Centre, internal and external

Potential further energy efficiency improvements arising from the energy audits conducted at these sites include:

1. GSAC air conditioning optimisation,
2. Blakebrook Quarry HVAC, lighting, and appliance improvements, and
3. Blakebrook Quarry bitumen tank heating improvements – note that savings estimated by the auditor were adjusted downwards by the change in energy use from FY10/11 to FY13/14, which was deemed to be attributable to the installation of a new upright insulated electric heated bitumen tank

If all of the identified energy efficiency initiatives at these sites are implemented, then the expected future electricity use of these four sites is 1,545 MWh per year, all other factors being equal. Compared with FY10/11 electricity consumption of 2,508 MWh this represents a saving of 38%.

A further potential energy saving initiative is the optimisation of solar hot water heating at the GSAC facility. At present, pool heating demand is met by a 20 x Rinnai Beasley SP200 solar panel system, and an Apricus 10 AP30 evacuated tube solar panel system installed in 2010. These systems augment an LPG heating system that used almost 3,000 GJ in FY13/14. Further study is required to determine if the solar hot water potential at this site is optimal, or whether additional panels can be cost-effectively installed. NSW Office of Environment and Heritage (OEH) may be able to assist with a study to investigate this opportunity.

Cost-benefit analysis

A cost-benefit analysis was carried out on the above initiatives, including those recently completed (where the impact on energy use will be seen from FY14/15, thus lowering future renewable energy requirements), in-progress / planned initiatives, and potential opportunities that have not yet been progressed.

Energy savings and capital cost estimates are drawn from energy audit reports and from subsequent updates supplied by the energy auditor.

Energy savings are taken directly from updated project estimates provided by the energy auditor.

A summary of the initiatives at these four sites is shown below, split into those implemented in FY13/14 and those that could be implemented in future.

Table 4: Summary of recently implemented and in-progress / planned energy efficiency initiatives at LCC's top 4 sites

Site	Initiative	Capital Cost	kWh Saving	Cost Savings pa	Payback in Years
Memorial Baths	Evacuated Tube SHW	$158,000	106,743 kWh	$35,508	9.86
Administration Centre	HVAC - Reflective Paint	$95,400	12,593 kWh	$2,770	34.43
Administration Centre	HVAC - Sterile Air Emitters	$24,869	26,513 kWh	$5,833	4.26
Administration Centre	Lighting upgrade internal	$16,970	27,248 kWh	$5,995	2.83
Administration Centre	Lighting upgrade external	$14,037	6,578 kWh	$1,447	9.70
Total top 4 sites	**All Initiatives**	**$501,276**	**179,675 kWh**	**$51,553**	**9.72**

Table 5: Summary of potential energy efficiency initiatives at LCC's top 4 sites

Site	Initiative	Capital Cost	kWh Saving	Cost Savings pa	Payback in Years
GSAC	Air conditioning optimisation per energy audit recommendations	$0	47,944 kWh	$10,501	0.00
Blakebrook Quarry	HVAC improvements	$10,500	3,051 kWh	$648	16.20
Blakebrook Quarry	Lighting improvements	$2,330	4,268 kWh	$906	2.57
Blakebrook Quarry	Kitchen, food service, Refrig improvements	$100	4,403 kWh	$935	0.11
Blakebrook Quarry	Adjusted Bitumen Heating improvements (reduction from FY11 to FY14 attributed to new insulated tank)	$65,800	248,274 kWh	$52,706	1.25
Total top 4 sites	**All Initiatives**	**$78,730**	**307,940 kWh**	**$65,696**	**1.20**

An internal rate of return (IRR) analysis was performed on these initiatives, with a project life of 15 years, assumed escalation rates for energy of 2.5% per year, and a discount rate of 7%[8].

The outcome from this financial analysis is tabulated below, and a chart showing the cumulative cash flow that should result from the implementation of these initiatives follows.

[8] 7% discount rate with a 2.5% escalation rate for energy is used in the financial evaluation by NSW Government in its retrofit program for Government buildings. These rates are used in all financial analysis of business cases for Lismore City Council's REMP

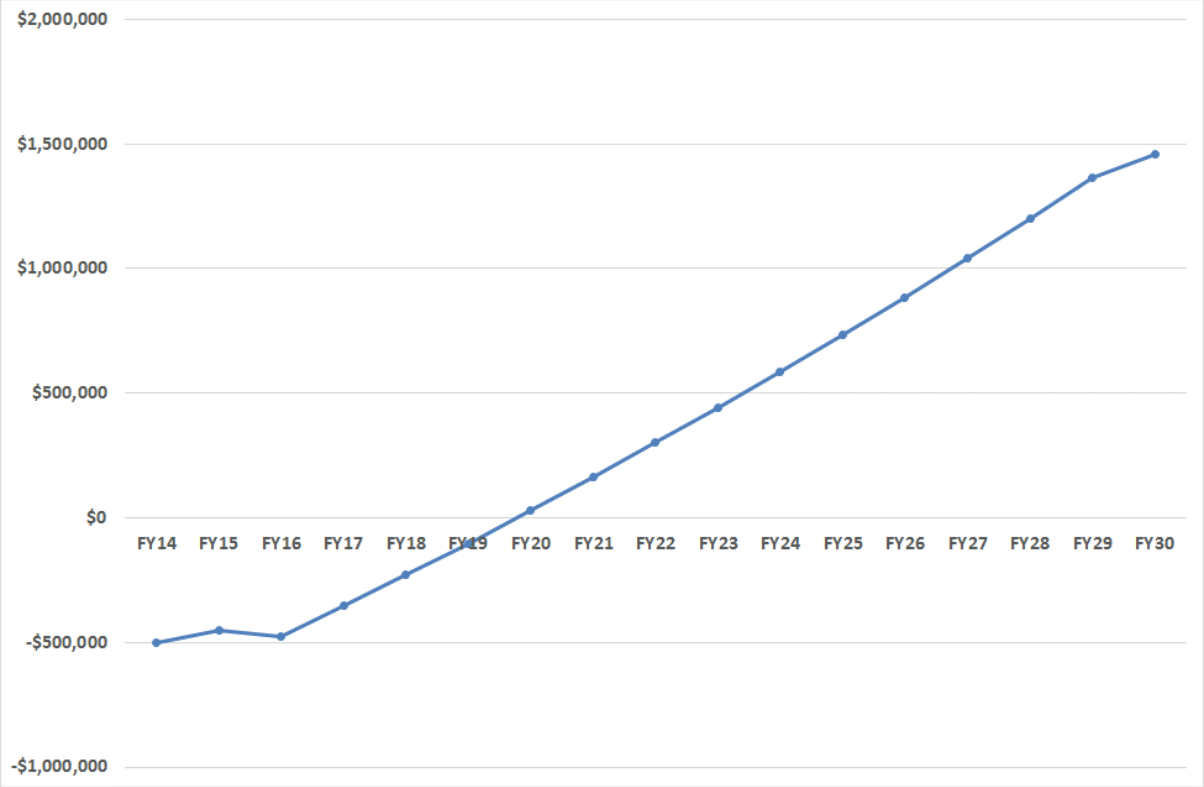
Table 6: Financial analysis summary of recently implemented, in-progress, planned energy efficiency initiatives at LCC's top 4 sites

Year	FY14	FY15	FY16	FY26	FY27	FY28	FY29
Capital cost of EE initiatives at top 4 sites FY14	$501,276						
Annual cost savings for EE initiatives at top 4 sites FY14		$51,553	$52,842	$67,642	$69,333	$71,066	$72,843
Net cash flow	-$501,276	$51,553	$52,842	$67,642	$69,333	$71,066	$72,843
Internal rate of return of top 4 EE investment	**8.2%**						

Table 7: Financial analysis summary of potential energy efficiency initiatives at LCC's top 4 sites

Year	FY16	FY17	FY18	FY28	FY29	FY30	FY31
Capital cost of EE initiatives at top 4 sites FY14	$78,730						
Annual cost savings for EE initiatives at top 4 sites FY14		$67,338	$69,021	$88,353	$90,562	$92,826	$95,147
Net cash flow	-$78,730	$67,338	$69,021	$88,353	$90,562	$92,826	$95,147
Internal rate of return of top 4 EE investment	**88%**						

Figure 15: Cumulative cash flow expected from energy efficiency initiatives recently implemented, in-progress, planned and potential at LCC's top 4 sites



Recommended action plan for implementation

The recommended action plan for the above energy efficiency initiatives at Council's Top 4 energy consuming sites (excluding wastewater) is:

1. Continue to monitor and verify energy savings at all sites, at the total consumption level (i.e. via *Planet Footprint*) and at the project level if/where appropriate,
2. Conduct additional analysis to determine the feasibility of upgrading the heating source for bitumen at the Quarry, both technically and in the context of future plans for the site,
3. Evaluate the merit in seeking OEH support to assess the potential for an additional solar hot water system / panels to augment the systems currently serving the GSAC pool,
4. Continue to identify, evaluate and implement cost-effective energy efficiency improvements at Council's largest sites. As these consume the majority of Council's electricity (excluding street lighting), all efforts to minimise electricity use at these sites will have the greatest impact on reducing the demand that needs to be served by renewable energy generation sources in future.

5.4. Business Case #2: water and wastewater facilities energy efficiency improvement

Summary

Water and wastewater assets' energy efficiency has been improved in recent years with the implementation of VSD controls on most major pumping and aeration systems, together with other efficiency initiatives at the major site, East STP. Ongoing optimisation of energy systems should continue, drawing on benchmarking and best practice Operations and Maintenance (O&M) for energy efficiency as needs.

Limited additional retrofit opportunities for energy efficiency remain, the most significant being the installation of VSD control on the Ross Street WPS pumps. VSD control of upgraded pumping systems at Nimbin Dam (commenced) will deliver energy efficiencies but with a larger pump. VSD control of the Wade Street SPS pumps and the South SPS pumps looks to be economically unviable, and these should be considered for implementation when a major upgrade of these sites occurs.

The implementation of VSD control at Ross Street is expected to cost in the order of $100,000, and savings of 70 MWh and $11,000 per year look to be possible. This would result in a simple payback of nine years, and an internal rate of return (IRR) of 10%.

The finalised plans for upgrading or replacement of the South STP will have a significant bearing on future energy needs of the water and wastewater network. Replacement of South STP with an *Intermittently Decanted Extended Aeration* (IDEA) activated sludge plant could increase electricity use of the plant to 1,000 MWh per year (71 MWh in 2013-14), which would create significant additional requirements for the renewable energy generation by Council.

Potential annual MWh reduction

By implementing all suggested energy efficiency improvements, the electricity consumption can be reduced by 70 MWh. This is equivalent to the following reductions:

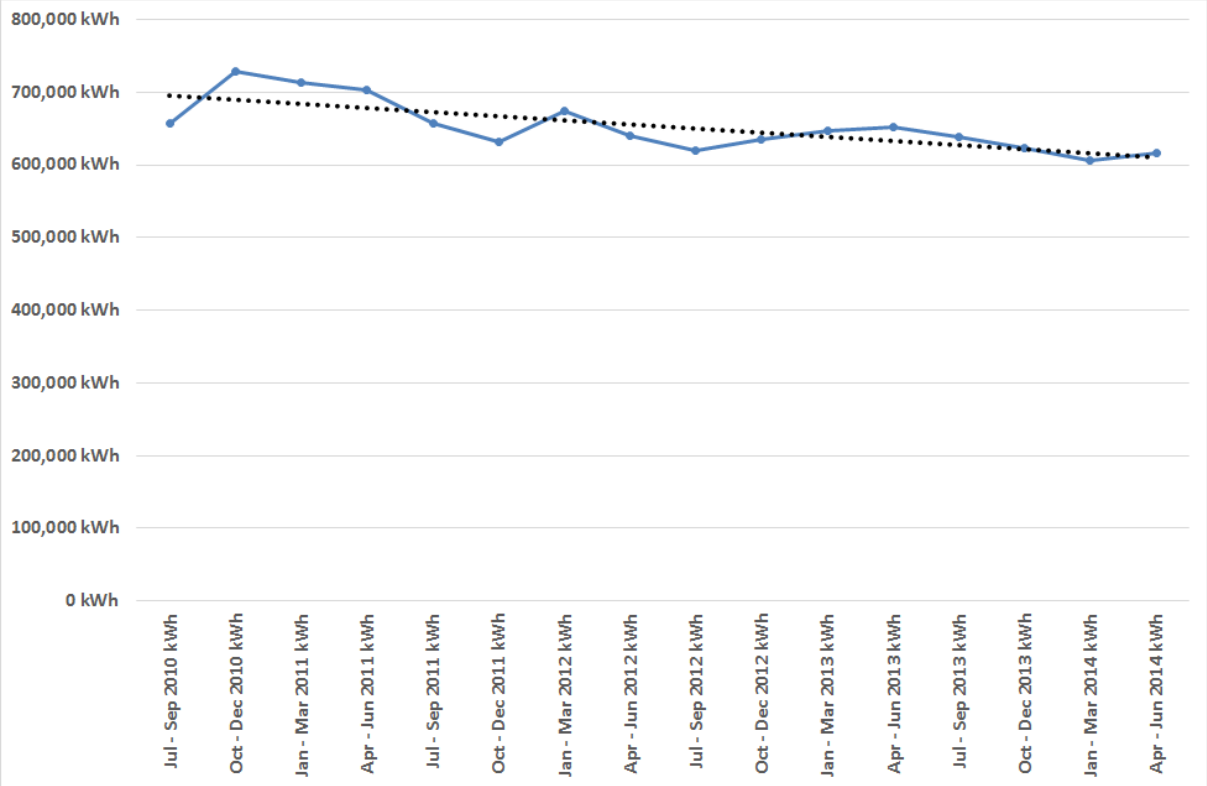
Electricity saved	Equivalent to a reduction in			
	Solar PV capacity in kW and number of panels	# Households annual electricity consumption	GHG emissions in t CO_2-e (total lifecycle - S2+S3)	# Cars off the road
70 MWh	50kW 200 panels that don't have to be installed	9	69	20

Energy use and cost trends to FY13/14

A total of 50 sites consumed 2,484 MWh of electricity in FY13/14, reduced from 2,801 MWh in FY10/11. Just 14 sites consumed 95% of this electricity. Energy efficiency at water and wastewater facilities has been improved in recent years with the upgrade of pumps and speed control at most major locations, and via upgrades to energy systems at the main energy using site at East Lismore Sewerage Treatment Plant (East STP).

In the period FY10/11 to FY13/14 LCC's energy database indicates a reduction in electricity consumption of 11.3%, driven by a reduction of over 15% at the East STP site, which accounts for more than 62% of all electricity used by water and wastewater assets.

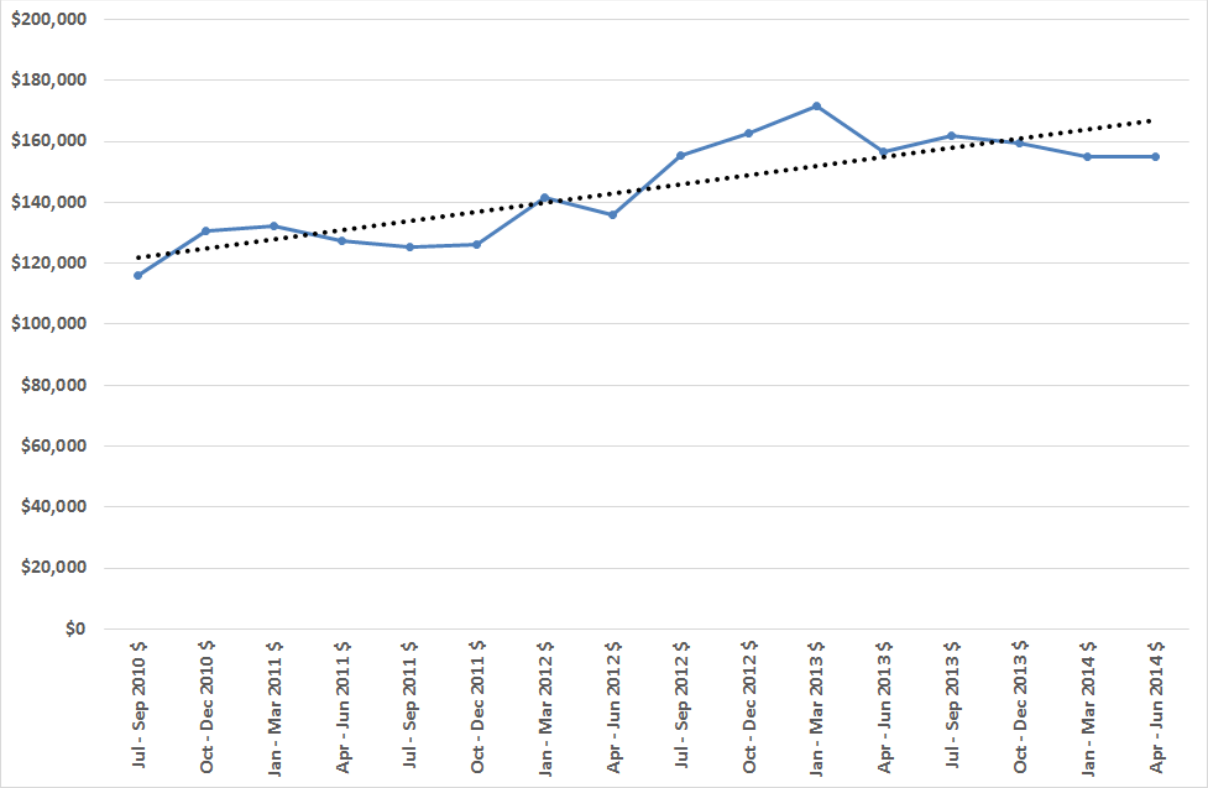
Figure 16: Electricity use trend (in kWh) for Lismore City Council's water & wastewater sites



Electricity unit prices have risen at a greater rate than energy use has been reduced. This caused the total electricity costs for water and wastewater to increase by almost 25% over the same period, or $125,000.

On a simple basis this cost increase is some $80,000 less than would have been the case if energy use had not been reduced.

Figure 17: Electricity cost trend for Lismore City Council's water & wastewater



Potential energy changes due to business priorities

The South Lismore Sewerage Treatment Plant located on Three Chain Road in Lismore is due to be upgraded or replaced. At the moment this is a *Trickling Filter* plant, which has a very low energy intensity. Options under consideration are to retain the current approach, which will maintain a low energy intensity and may allow for biogas recovery for energy generation (subject to gas volumes above what may be needed for digester heating), or – more likely – to replace the plant with an IDEA plant similar to the East STP.

If a new IDEA plant is implemented then electricity use will increase substantially. Energy modelling for this option indicates operational energy demand of 120 kW on average year-round. This would result in electricity consumption of 1,000 MWh per year more than is used at present. The same estimate would be derived by applying the East STP energy intensity (in MWh/ML inflow) to the South inflow of 3 ML/day. In this case additional renewable energy would need to be generated in order to enable Council to meet its goals.

Completed, in-progress, planned and potential energy efficiency improvements

Discussion with key staff has highlighted several major energy efficiency initiatives that have been implemented in the water and wastewater network in recent years. These include:

- East STP: installation of VSD control on the 8 aerators serving the IDEA system, improved control of dissolved oxygen, power factor correction, VSD of dosing system pumps, and solar hot water for domestic use / amenities. This site uses 62.5% of all water & wastewater network electricity, and these initiatives have resulted in a gross reduction in electricity use of 15% since FY10/11,
- Dawson Street SPS (5.44% of water and wastewater electricity use): two 160 kW single speed VSD motors were installed in early 2014, replacing two 2-speed 75/100 kW motors. These are generally run at 45 Hz, and can be adjusted upwards to 47 Hz or 50 Hz in wet weather conditions. Some cavitation was experienced at 40 Hz, indicating that the motor speed cannot be turned down to this level at present. Energy savings can already be seen in energy data, with an estimated 20 MWh (22%) savings seen in the second half of FY13/14. Full year energy savings of 20-25% are expected. Lighting in the SPS was upgraded to LED as part of the upgrade,
- Nimbin STP: VSD control has been implemented on the STP's aerator, which is the major energy using equipment at this site. Full-year savings from this initiative should be seen from FY14/15 onwards,
- VSD control of SPS pumps has been implemented at Allambie Drive (SPS #19), Rous Road, Gallagher Drive (SPS #20) and Kadina Street (SPS #17), which together accounted for 5.6% of water and wastewater electricity use in FY13/14. Also all new switchboards are designed to cater for VSD control of pumps,
- All water pumping stations (WPS) other than Ross Street and Nimbin Dam have been retrofitted with VSD control

There are limited opportunities for further energy savings from capital improvements at water and wastewater treatment sites, including:

- Wade Park SPS (#16): an opportunity exists to implement VSD control at this site, replacing two 2-speed 75/150 kW pumps. However space limitations and current electrical equipment mean that some civil works, main switch and new cabinetry would be required, potentially resulting in a project cost of up to $100,000. Energy spend at the site has ranged from $11- 15,000 per year over the FY10/11 to FY13/14 period, and cost savings of just $3-4,000 per year would be expected. Therefore this opportunity is likely to be uneconomic, and upgrading to VSD controlled pumps should be assessed when major works are planned for the site,
- South SPS (#1): this pumping station has been automated, however VSD control of pumps has not been implemented. As with Wade Park significant civil and main switchboard works would be necessary if this was to occur, incurring high costs for low annual savings. This opportunity is best implemented if/when major works are planned to upgrade the site,

- Nimbin dam site consumed 32 MWh in FY13/14, equal to 1.3% of all water and wastewater electricity use by LCC. An upgrade to this site will occur within the next two years and planning has commenced, and it is expected that this will see efficiencies to pumps including VSD control. However the size of the new pumping equipment is expected to be greater (in kW) compared with the current system, and so no overall reduction in electricity consumption is expected to occur,

- Ross Street water pumping station is the second largest site in the water and wastewater network, consuming 233 MWh in FY13/14, equal to 9.38% of total electricity consumption. Soft start controls are used on the 2 x 220 kW pumps, LED lighting has been implemented, and power factor correction is installed. There is potential for VSD control, with costs expected to be in the order of $100,000 including a new switchboard. Potential energy savings are 70 MWh per year based on a 30% reduction. The value of these savings would be highly dependent on whether peak demand savings result. Average energy charges are more than 30¢/kWh, and if savings are valued at just 50% of this (15¢/kWh) allowing for reduced carbon and network prices and low peak demand savings, then cost savings of around $11,000 per year would result. This suggests that a payback can be achieved in 9 years, and this should be given further consideration. It is noted that other options for this site can also be considered, in the context of the water supply network as a whole, and these could potentially produce higher energy savings than VSD control of the Ross Street pumps. Investigation of VSD control opportunities should also consider this.

Cost-benefit analysis

A financial analysis of the opportunity to upgrade the Ross Street pumps with VSD control is shown below. This assumes:

- Project costs of $100,000,
- Annual savings of 70 MWh, valued at 50% of the FY12/13 average energy cost rate

Table 8: Financial analysis summary of energy efficiency initiatives recently implemented, in-progress, planned and potential at LCC's top 4 sites

Description	FY16	FY17	FY18	FY28	FY29	FY30	FY31
VSDs for Ross Street pumps	$100,000						
Annual savings		$11,619	$11,909	$15,245	$15,626	$16,016	$16,417
Net cash flow	-$100,000	$11,619	$11,909	$15,245	$15,626	$16,016	$16,417
IRR	**10%**						

Recommended action plan for implementation

The recommended actions to be implemented include:

1. Investigation of VSD opportunity at Ross Street, together with other opportunities for reduction in ross Street through re-design of part of the water supply network,
2. Implementation of opportunities at Ross Street that are found to be cost effective,
3. Continued monitoring and verification of energy use and new savings opportunities in the water and wastewater network, including – for example – benchmarking with other IDEA plants of comparable capacity[9] , and ongoing reference to good / best O&M practices for energy efficiency[10]

[9] For example: 2014, Energy Benchmarking at Queensland Urban Utilities Sewage Treatment Plants, Sofia Andriany, Matthew Mulliss, Queensland Urban Utilities, Brisbane, QLD

[10] For example: 2014, O & M Energy Efficiency Checklist for Wastewater Treatment Plants: *o&m-energy-efficiency-checklist-for-wwtp_5-9-12.pdf*, downloaded from www.oracwa.org

5.5. Business case #3: other facilities lighting energy efficiency improvement

Summary

LED lighting technology has developed rapidly in recent years, and offers a potentially significant energy saving opportunity that cuts across multiple types of facility and public space. Procurement simplicity, uniformity and cost efficiencies may be achieved by implementing a bulk lighting retrofit / replacement program across Council's buildings and public spaces.

A high-level assessment of multiple Council sites and public lighting indicates that a project to upgrade about 2,100 lights to LED would cost about $310,000 and save some $44,000 per year. This includes an upgrade to linear fluorescent lights and downlights that is estimated to cost $110,000 and have a payback of 5.15 years, and upgrading of high bay, car park and other public lighting at a cost of $200,000 and a 9-year payback. Energy savings of 178 MWh per year are estimated in total.

In addition to energy savings this initiative would reduce maintenance costs and provide highly visible evidence of Council's implementation of its objectives.

Potential annual MWh reduction

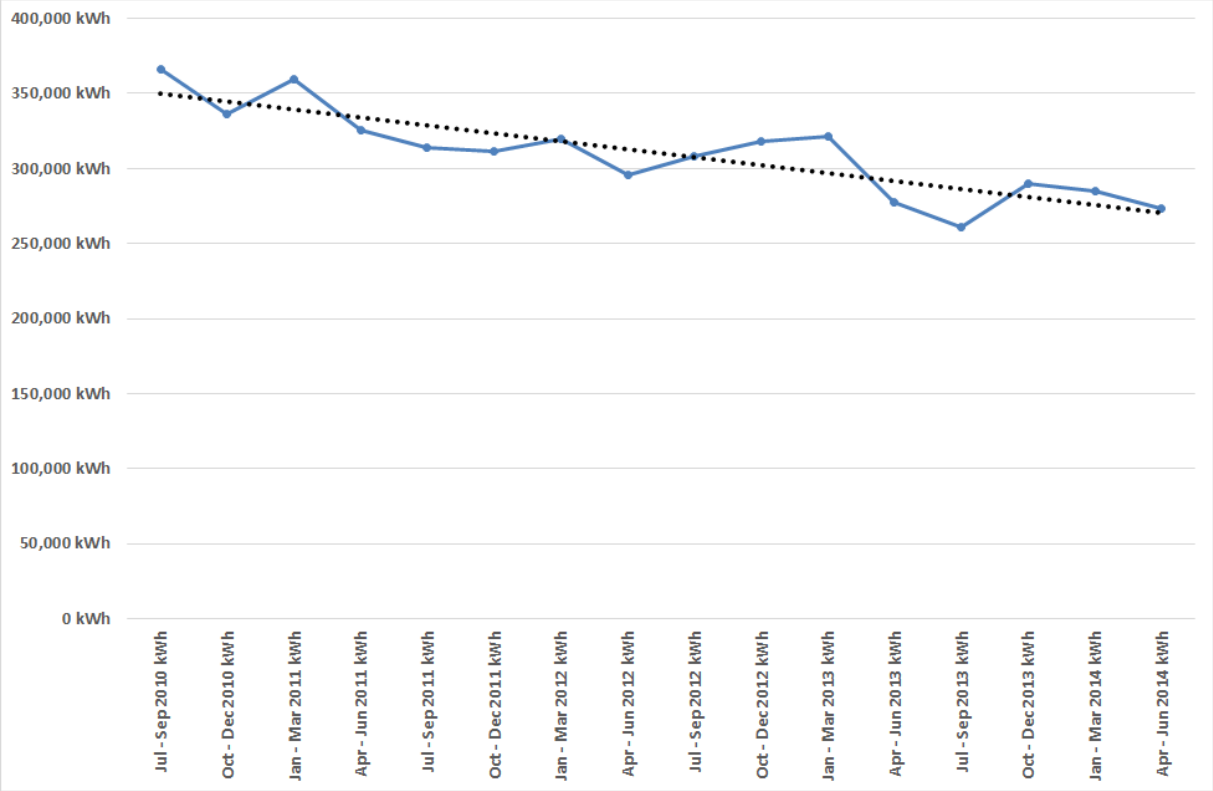
By implementing all suggested energy efficiency improvements, the electricity consumption can be reduced by 178 MWh. This is equivalent to the following reductions:

Electricity saved	Equivalent to a reduction in …….			
	Solar PV capacity in kW and number of panels	# Households annual electricity consumption	GHG emissions in t CO_2-e (total lifecycle - S2+S3)	# Cars off the road
178 MWh	127kW 508 panels that don't have to be installed	22	176	51

Energy use and cost trends to FY13/14

Apart from the top four electricity using sites (excluding water and wastewater assets), all remaining sites consumed 1,110 MWh of electricity in FY13/14, at a cost of some $342,000. This contrasts with electricity consumed by these sites in FY10/11 of 1,387 MWh ($321,000), a reduction of 20% and 277 MWh per year. This electricity use trend over this period is shown below.

Figure 18: Electricity use trend (in kWh) for Lismore City Council's small sites (excl. wastewater)

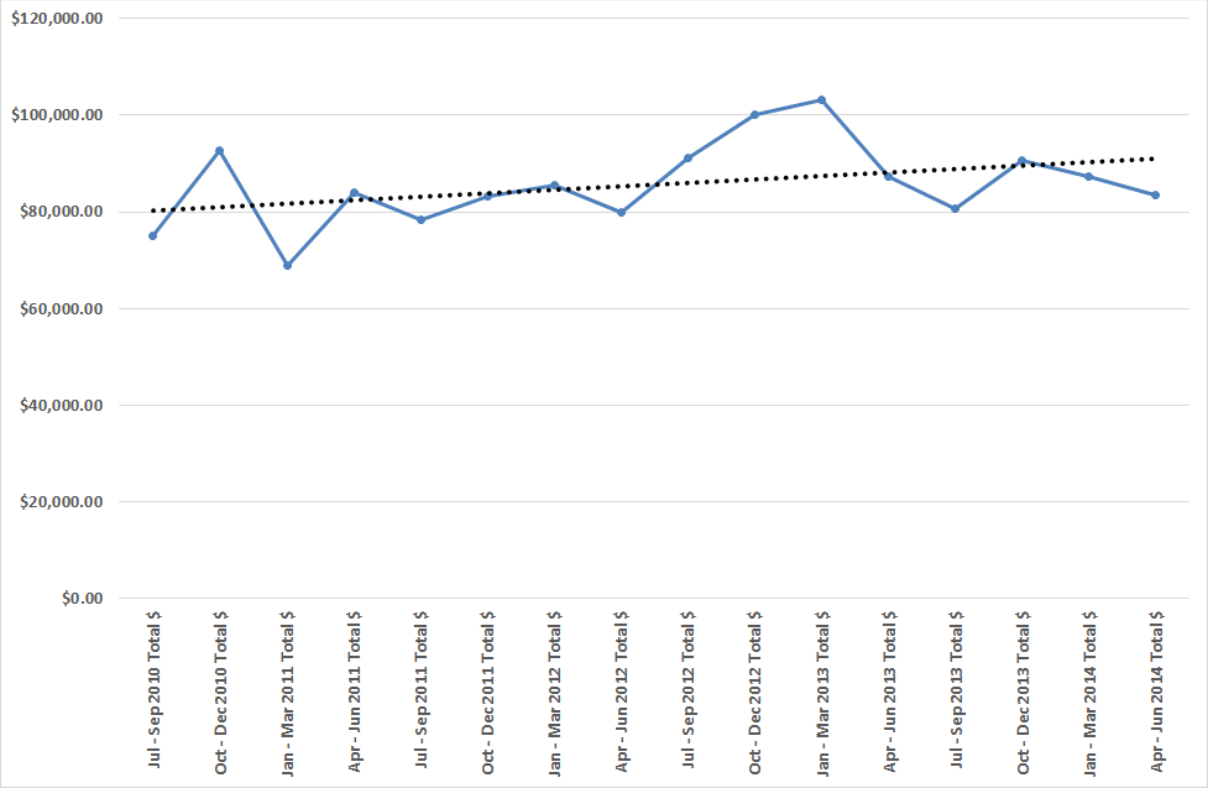


Several non-energy related factors appear to give rise to a significant part of this apparent reduction, with divestment of sites being a contributor to over 50% of the decrease seen. In addition, the Council's energy reporting database is continuously being updated with new billing information as this comes in, and it is likely that some sites showing an apparent decrease in electricity use have simply not shown up yet in the database.

Known initiatives include the installation of solar hot water on several sites, the upgrade to T5 lighting (retrofit kits) and several new air conditioning units at the Lismore Regional Library (improvement from 177 MWh to 114 MWh over four years), and LED lighting upgrade at the Lismore Tourist Information Centre on Molesworth Street.

The cost trend associated with this electricity use trend is shown below, and shows that - as with the Top 4 sites – the effect of the reductions achieved has been to keep energy cost increases under control, rather than to reduce costs.

Figure 19: Electricity cost trend for Lismore City Council's small sites (excl. wastewater)



Potential energy changes due to business priorities

No significant changes to expected future energy use were identified for lighting across Council's facilities.

Completed, in-progress, planned and potential energy efficiency improvements

As part of this plan development a number of sites were visited in order to develop a high level estimate of the energy used by lighting technologies in buildings and for public lighting. The sites visited included:

- Airport Terminal
- Lismore Regional Library
- Wyrallah Road Depot
- Brunswick Street Depot
- Library Headquarters (Goonellabah)
- Oakes Oval Lismore
- Community Centre (Goonellabah)
- Heritage Centre Lismore
- SES Building Brunswick Street
- Lismore Art Gallery
- Lismore Transit Centre
- Crozier Oval
- Lismore & District Sports Association (Depot building between Oakes and Crozier ovals)
- Outdoor Lights City Hall
- Roundabout Cnr Dawson & Uralba Street
- 165 Molesworth Street (Common Area lighting)
- Lismore Water Brigade & Rowing Club (car park lighting)
- Transit Centre Lismore (Wharf Approach)
- 667 Skyline Road Goonellabah Crematorium Residence

- Levee Bank, Market St, Lismore (walkway public lighting)
- Hensleys Car Park (car park lights)
- Victoria Street Lismore Skate Park (public lighting)
- Riverview Park South Lismore (public lighting)
- Fire Station 247 Molesworth Street Lismore (CBD Depot)
- Underpass Hunter Street Lismore (all fluorescent lighting)
- Robinsons Lookout Lismore
- Lismore District Sports Hepburn Park Holland Street

In addition to the development of lighting energy use estimates at these sites, other sites' lighting use was estimated – usually by reference to the type of site / account. That is, accounts clearly labelled as being a carpark, public amenity, public parks or another lighting asset were taken to be mostly or wholly lighting, while others such as flood gates, pumps or accounts labelled as 'unknown' were taken to have no lighting.

Drawing on site visits as well as energy audit reports by others, lighting electricity consumption for these sites is estimated to be 341 MWh per year, equal to 31% of total FY13/14 electricity use. An estimated 2,100 individual lights are estimated to be installed, with about 87% of these being linear fluorescent (36W or 18W), CFLs or downlights (typically 50W halogens).

Upgrading to LED lighting technology is expected to reduce electricity use for lighting by these assets by 55-60%, excepting where T5 lighting has been installed and savings may be limited to 36%. For linear fluorescent T8 lamps this assumes that 18W LEDs can replace 36W ballasted T8 lamps, and similar savings are assumed for other lighting technologies. Total savings potential is estimated to be 178 MWh per year. This would reduce electricity consumption by these sites to 932 MWh per year, a 33% reduction compared with FY10/11.

Cost-benefit analysis

There is a fairly wide range of costs (and quality) for various LED lighting technologies. As such developing a firm cost estimate here is not feasible, however on the basis of quotations received for recent comparable work we have estimated installed costs – before any rebates – based on:

- $60 per lamp for linear fluorescents and downlights, and
- $750 per lamp for all other lamps, including high bays, carpark and other public lights

This gives a total cost estimate for upgrading all lighting of almost $310,000. Annual cost savings would be in the order of $44,000 (7 year simple payback) if implemented now, based on FY13/14 rates discounted by 20% to reflect carbon price and network price reductions, and fixed charges.

However owing to the large number of individual sites involved it is assumed that implementation would occur over a number of financial years. For the purpose of the REMP we present a scenario that

would see buildings lighting upgraded over three years, with public lighting upgraded in the two years following this.

In all cases the financial performance could be further improved by the following factors:

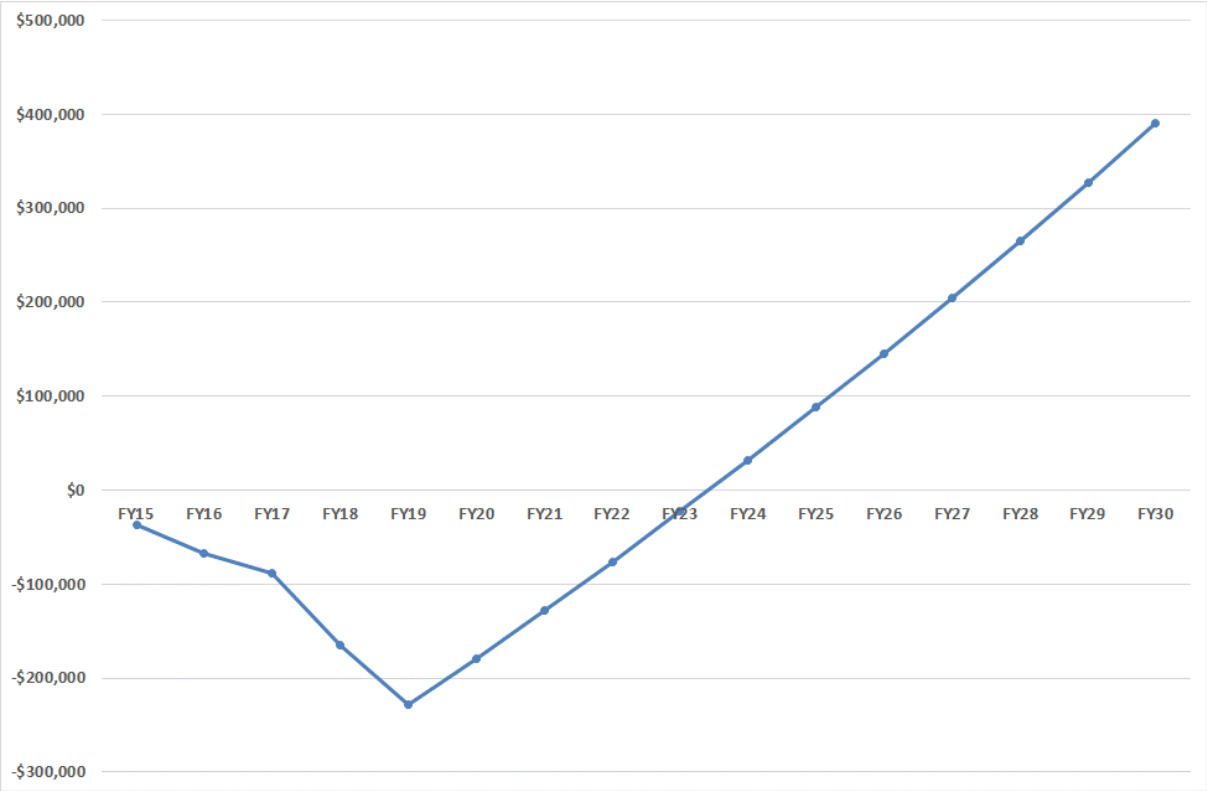
- Maintenance costs will reduce due to the expected longer life of LEDs, and
- LED fittings may be eligible for the NSW Energy Saving Scheme, and as such a credit could be applied against the capital cost of an upgrade, based on the prevailing value of Energy Saving Certificates under the scheme

A co-benefit of upgrading public lighting with LED technology is the high visibility of this to the community.

Table 9: Financial analysis summary of LED lighting upgrade at small sites and public spaces

Year	FY15	FY16	FY17	FY18	FY19	FY34
Capital cost of LED initiatives	$37,120	$37,120	$37,120	$99,750	$99,750	
Annual cost savings for LED initiatives		$7,390	$15,149	$23,292	$36,141	$70,108
Net cash flow	-$37,120	-$29,730	-$21,971	-$76,458	-$63,609	$70,108
Cumulative net cash flow	-$37,120	-$66,850	-$88,821	-$165,279	-$228,889	$660,846
Simple payback	**5 to 9 Years**					
Internal rate of return of top 4 EE investment	**17%**					

Figure 20: Cumulative cash flow expected from LED lighting upgrade at small sites



Recommended action plan for implementation

It is understood that Council has begun to implement LED upgrades at some smaller sites, and this should continue through the remainder of the FY14/15 financial year. The action plan for the above energy efficiency initiative at Council's small sites after this should include:

1. Annual planning to identify and schedule funds and resources to upgrade additional sites,
2. Work with LED suppliers to develop LED public lighting solutions that meet Council's needs,
3. Seek to access incentives such as the NSW Energy Savings Scheme wherever possible,
4. Verify energy savings regularly via reference to Council's energy database

5.6. Business case #4: other facilities energy efficiency improvement

Summary

Energy use at Council's smaller facilities is split between numerous types of end-use equipment. Recent improvements to energy efficiency at several Council sites show that significant cost-effective savings can be achieved when equipment is replaced. Additional savings are possible through regular energy efficiency plans, energy-efficient control, operation and maintenance of equipment, and through staff and contractor awareness. A target saving of 20% of FY13/14 consumption levels for small sites (excluding lighting) is recommended.

Potential annual MWh reduction

A 20% savings target for small sites equates to an energy reduction of about 150 MWh per year. This is equivalent to the following reductions:

Electricity saved	Equivalent to a reduction in …….			
	 Solar PV capacity in kW and number of panels	 # Households annual electricity consumption	 GHG emissions in t CO_2-e (total lifecycle - S2+S3)	 # Cars off the road
150 MWh	107kW 428 panels that don't have to be installed	19	148	43

Energy use and cost trends to FY13/14

Electricity consumption by facilities not in the 'top-4' energy using sites, and excluding lighting (addressed in Business case #3) was 769 MWh in FY13/14, costing Council $231,000. This represents 10.6% of total electricity usage by Council in FY13/14. Over 90% of this electricity was used by 20 sites, with no single site consuming in excess of 100 MWh.

Some of this demand will be met by solar PV systems. For example, electricity consumption by the Materials Recovery Facility (MRF) will be greater in future years than in FY13/14 (~50 MWh), however a 100 kW solar PV system installed at this site will meet a significant proportion of the site's future energy requirements. In addition, solar PV systems that have been installed on a number of sites, and

identified as opportunities at other sites, could supply nearly 160 MWh of the remaining energy demand across these sites (refer to Business Case #6).

Electricity use at these sites comes from a range of end-use equipment in addition to lighting, including air conditioning (split, window units, cassette and packaged systems), exit lighting, appliances, office IT equipment, communications equipment such as radio, AV and phone systems, vending machines, catering equipment, hot water units, fans and heaters. The majority of this electricity is consumed by the following sites:

- *Airport Terminal*: air conditioning of the main terminal building, catering demand including chilling, refrigeration and vending machines, and facility-specific equipment will be the main energy using equipment,
- *Lismore Regional Library*: an energy audit found air conditioning systems to account for 60% of this site's electricity use. Arising from the audit, several air conditioning units were replaced recently, and energy use data from FY12/13 to FY13/14 suggest that significant savings have been made,
- *Wyrallah Road Depot*: around 25 air conditioning units of various types and ages are installed in offices and training / meeting rooms throughout the site. These will account for a sizeable fraction of energy used on the site, together with IT equipment and appliances,
- *Brunswick Street Depot*: a small number of air conditioning units, an air compressor and appliances / IT equipment will account for most of the non-lighting electricity use at this site, with no single end-use system being individually significant,
- *Library Headquarters*: several small air conditioning units, two mid-sized split units mounted on the roof of the building, and numerous computers and other IT equipment in the library will account for most of the non-lighting electricity demand at the site,
- *Oakes & Crozier Ovals and Oakes Depot*: an audit found that, apart from lighting, numerous items of food / catering equipment and air conditioning were the major energy users. The audit found energy use is intermittent, and dependent on sporting events at the two ovals,
- *Swimming Pool Nimbin*: facility-specific equipment such as pumps will be the major energy using equipment at this site,
- *Goonellabah Community Centre*: large refrigeration and freezers serving the meals-on-wheels section of this facility will be a major energy user. The main air conditioning unit is relatively modern. While A/C control for leased meeting rooms is manual, staff operate these units very efficiently and waste is minimised,
- *Heritage Centre Lismore*: an energy audit found that the air conditioning unit serving this facility is inefficient, but would be uneconomic to replace based on energy costs alone. The location of the A/C system is not ideal however, and an upgrade to a more efficient system that better meets the site's needs is proposed,
- *SES Building Brunswick Street*: this building is used infrequently; energy demand will be high for meetings, training or operations, and low at other times. Air conditioning, operational equipment (IT, AV, batteries, etc.) and kitchen appliances will all contribute to non-lighting demand, with no one major end use system,

- *Lismore Art Gallery*: Stored art is maintained at a constant temperature and humidity in an upstairs store, and while this unit is small it is likely to be a sizeable energy user in the context of the Gallery, excluding lighting. Other air conditioning energy use is likely to be small, a small number of appliances and IT equipment are in use, and some exhibitions may see TVs or other electronic devices in use when the Gallery is open,
- *Wyreema Ave Two Way Transformer*: this is equipment load relating to the communications function of the site

Completed, in-progress, planned and potential energy efficiency improvements

A range of efficiency and renewable energy improvements have been made at these sites, including:

- Lighting retrofit and air conditioning upgrade at the Lismore Regional Library,
- Solar PV systems installed at Lismore Art Gallery, Brunswick Street Depot, SES Building, Materials Recovery Facility, Crematorium Residence and the Lismore Regional Airport,
- Solar Hot Water systems installed at Wyrallah Road Depot and several other sites,
- LED lighting installed at the Lismore Tourist Information Centre

As the above sites summary shows, electricity use is split among many end using equipment types. At most sites where air conditioning is the (known or likely) major energy user this is often spread across multiple small units of varying age, condition, controls and usage patterns.

As such the approach that is recommended in relation to energy using equipment at Council's smaller sites is to adopt sound energy management practices in the replacement, operation and maintenance of equipment. This would include:

- Planning – a process of periodic review of energy using equipment (that may also include the major energy-using sites) to assess what equipment or controls require replacement / retrofit, and this feeds into budget processes and resource planning accordingly,
- Procurement – Council regularly reviews its procurement specifications and processes related to equipment purchasing to identify what adjustments need to be made so that up-to-date energy efficient technologies, controls and standards are reflected, and can lead to low life-time use and cost of energy by purchased energy-using equipment,
- Operations & maintenance – Council regularly assesses the practices or controls in relation to operations or maintenance of energy using equipment that need to be changed / adjusted to implement saving opportunities,
- Communication, training and awareness – Council periodically identifies and documents what Council staff and contractors / tenderers need to be aware of in relation to energy management, and solicits input of ideas that can improve energy efficiency

The table below outlines some examples of the actions that regular planning may identify can be undertaken to improve the efficiency of Council's facilities for these end using equipment categories.

Table 10: Example of potential energy efficiency opportunities at small facilities

Equipment	Procurement or retrofit	O&M, control + awareness
Air conditioning	High EER / COP equipment, Inverter technology, Insulation, UV-C kit for A/C units	Removal of redundant equipment, PE control (on/off or setback), 365-day control, Delayed A/C start, Regular cleaning / maintenance
Exit lighting	LED exit lighting - 70-90% energy saving	
Office IT equipment	Specify efficiency of IT at procurement – e.g. Energy Star v6, use of laptops, LCDs, in-built power management	Switch-off campaign, PC management software
Appliances, catering equipment	High efficiency appliances – e.g. Star-rating or label	Removal of redundant equipment, Timers, weekend-off controls, Regular checking / maintenance
Lighting controls	Daylight, occupancy controls, Lighting management system, Voltage control	Switch-off campaign, Regular checking of controls for correct operation
Vending machines	Energy efficient machines – lighting and cooling systems and controls, LED lighting retrofit	PIR sensing to control lighting and/or cooling, Regular maintenance
Hot water	Solar hot water, High efficiency units, Low flow tapware	Repair leaking taps

Cost-benefit analysis

The implementation of energy efficiency initiatives at several of Council's sites shows that significant savings can be achieved through the implementation of efficient technology and through better awareness and energy-efficient practices. A saving of 20% is reasonable to establish as a target in relation to energy use at these sites, from the cost-effective replacement, control and operation of equipment. This equates to a saving of about 150 MWh per year compared with the FY13/14 consumption level of 769 MWh (excluding lighting).

Recommended action plan for implementation

The recommended action plan for the above energy efficiency initiative at Council's small sites is:

1. Annual planning to identify and schedule funds and resources to upgrade additional sites, including engagement with key stakeholders in facilities, IT and procurement,
2. Seek to access incentives such as the NSW Energy Savings Scheme wherever possible,
3. Verify energy savings regularly via reference to Council's energy database

5.7. Business Case #5: street lighting energy efficiency improvement

Summary

Lismore City Council has already achieved significant savings in street lighting by converting most of its lamps to *Compact Fluorescent Lamp* (CFL) and *High Pressure Sodium* (HPS) technologies in the last few years. Street lighting is now moving rapidly towards LED technology for *Category P* (local) roads and LED is expected to become the norm in the near future. LED lighting for *Category V* (main) roads is developing. A full upgrade to LED lighting across the LCC area would save over 750 MWh per year, with this figure likely to rise as LED lamp efficiency (lumens per Watt) improves[11].

A first-stage project to replace CFL 42W lamps with LED would save 192 MWh per year. An initial financial analysis that uses proposed FY15/16 maintenance costs indicates a 6.2 year payback. An upgrade to the remainder of the lighting network (mainly HPS) is modelled from FY19/20, recognising that the development of network-accepted lamps for Category V roads may take time. A better payback of 3.1 years is expected in this case owing to the higher energy cost savings. In all cases the analysis is sensitive to the future costs to maintain the LED lighting network, which are unknown at present, but assumed to be lower due to longer intervals between bulk replacements, and expected lower failure rates.

Potential annual MWh reduction

By implementing all suggested energy efficiency improvements, the electricity consumption can be reduced by 759 MWh. This is equivalent to the following reductions:

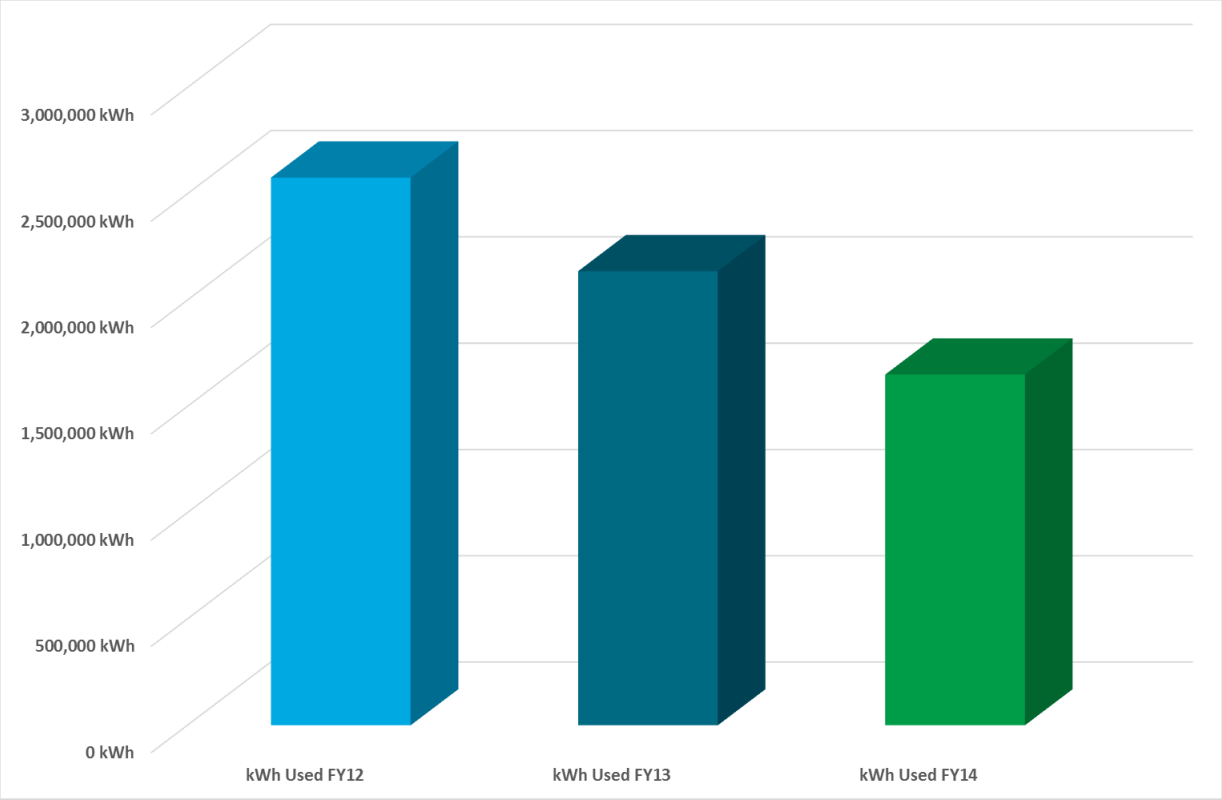
Electricity saved	Equivalent to a reduction in …….			
	Solar PV capacity in kW and number of panels	# Households annual electricity consumption	GHG emissions in t CO_2-e (total lifecycle - S2+S3)	# Cars off the road
759 MWh	542 kW 2168 panels that don't have to be installed	95	751	219

[11] Personal communication with LED street lighting suppliers indicated that, for example, LED replacement option for a 250 W HPS lamp is about 155-160W now, but could be reduced to 130-135W in a few years. This would result in added savings of 80 MWh pa compared with this assessment.

Energy use and cost trends to FY13/14

LCC's street lighting electricity consumption has historically accounted for a significant percentage of all Council's electricity use. In FY11/12 consumption was 2,577 MWh. During FY12/13 LCC and Essential Energy worked to convert the majority of the network over to 42W Compact Fluorescent Lamps (CFL) and High Pressure Sodium (HPS) lamps, resulting in consumption of 2,137 MWh in FY12/13, and consumption of 1,638 MWh in FY13/14 as the full effect of the conversion was seen. The savings achieved as a result of the upgrade are 36%.

Figure 21: Trend in electricity use by LCC street lights



Costs for street lighting include:

- Electricity consumption, including regulated network charges (11.31¢/kWh average in FY13/14), and retail electricity charges. Costs in FY13/14 for electricity were around $295,000,
- Maintenance charges, which are set out annually by Essential for every combination of lamp, pole, capital funding provider and maintenance provider. Maintenance fees include lamp replacement, including spot changes and bulk replacements. It is understood that a bulk lamp upgrade occurs every four years. Essential Energy published network-wide failure rates for

lamps on its network in a recent AER submission[12], which shows failure rates of 13.94% pa for HPS70, 7.7% for CFL42, and 6.01% for HPS250 lamps. In this same submission Essential Energy proposes significant increases to the maintenance charges across its street lighting network, to commence from the financial year FY15/16. In relation to Lismore City Council, Essential Energy's proposal includes:

- FY13/14 Actual income $189,806, from a street lighting inventory count of 3,254 lamps,
- FY14/15 Proposed income (2013/14 plus CPI) of $194,484, for a forecast street lighting inventory count of 3,253 lamps
- FY15/16 Proposed income of $335,993, for a forecast street lighting inventory count of 3,253 lamps. This represents a variance to FY14/15 of 73%, or $141,509

For FY13/14 energy and maintenance charges were about $485,000.

Potential energy changes due to business priorities

No significant changes to expected future energy use were identified for lighting across Council's street lighting network.

Completed, in-progress, planned and potential energy efficiency improvements

Given the steep rises in the cost of street lighting as proposed by Essential Energy it is worthwhile examining the business case for an upgrade to LED technology for street lighting. Progress towards LED street lights as a standard option for Local Governments is being made across several jurisdictions. For example:

1. City of Sydney is well into a program of replacing public lighting with LEDs, with a contract to upgrade nearly 6,500 lamps to LED across public spaces and streets. As at August 2013 some 2,600 street and park lights had been replaced. The $7 million replacement plan is expected to save $331,046 in FY10/11 dollars terms, plus maintenance savings[13],
2. Since August 2013, Victorian based distribution businesses Powercor, CitiPower and SP Ausnet have announced that LED replacement options would be available for residential streets in these areas,
3. Following this approval, Warrnambool City Council is planning to reduce street lighting costs by almost 70% through replacing around 2,000 Mercury Vapour (MV) lamps with LEDs, in a $1.2 million upgrade part-funded by the Clean Energy Finance Corporation (CEFC)[14],

[12] http://www.aer.gov.au/sites/default/files/Essential%20Energy%20-%20Attachment%208.1_Public%20Lighting%20Proposal%20-%202014.pdf, Attachment 8.1 Public Lighting Proposal

[13] 2013, ACIL Allen Consulting Report to Lighting Council Australia, 18 November 2013, Emissions Reduction Fund: Efficient Lighting and Australia's Emissions Reduction Objective

[14] http://www.cleanenergyfinancecorp.com.au/media/releases-and-announcements/files/cefc-and-warrnambool-light-the-savings-way-with-led.aspx

4. Owing to reliability issues, Ausgrid is proceeding to rollout LEDs as the default replacement for 42WCFLs, as per its submission to AER in May 2014[15],
5. The NSW Government is supporting the rollout of LEDs across 41 NSW Councils (in Ausgrid's network) as older lamps fail, following successful trials by Ausgrid of LEDs in several LGAs,
6. It is expected that LEDs will be included within the Australian Standard AS1158(.6) in the near future,
7. The organisation Regional Development Australia - Northern Inland, was successful in securing a Community Energy Efficiency Program (CEEP) grant ($634,005 incl GST) to part-fund the upgrade of some 4,700 streetlights across seven NSW Councils to LEDs. The development of this program is progressing, with Essential Energy's involvement

The weight of evidence therefore - including but not limited to the above examples – is that LED technology will become the norm in Australia in the shorter rather than in the longer term, and this opportunity should therefore be considered by LCC.

Cost-benefit analysis

A two-stage implementation plan is evaluated.

Stage 1: Firstly CFL 42W lamps are upgraded to LED (24W) in FY15/16, by which time it is assumed that Essential Energy will have an approved LED lamp that can meet its requirements. For the purpose of this business case it is assumed that:

- LCC pays the capital cost of all LEDs including the 112 lamps that were funded initially by Essential Energy, assumed to cost $300 installed per lamp for 2,011 lamps, with sensitivity analysis performed at $400/lamp and at $250/lamp,
- LCC pays a small residual capital cost for the 112 CFL lamps that were funded by Essential Energy, taken to be $25,000,
- Maintenance costs for LEDs are unknown at this time. It is reasonable to assume that some activities such as lens cleaning and PE cell maintenance may remain the same. However longer life and expected lower failure rates should mean that bulk and spot replacement costs decline significantly. For the purpose of this analysis it is assumed that LED maintenance costs will be $25/lamp per year under the current maintenance cost model, and $50/lamp per year under Essential Energy's proposed future costs, with sensitivity analysis performed at $37.50/lamp per year and $75/lamp per year respectively. This equates to an approximate 50% base case saving, with sensitivity analysis at 25% saving,
- Maintenance costs for each existing lamp tariff code for FY14/15 are extrapolated on a simple basis to Essential Energy's proposed FY15/16 maintenance costs, as well as on a

[15] 2014, Ausgrid Regulatory Proposal, Attachment 8.11, Public lighting investment plan- Replacement of 42W CFL with LED May 2014

CPI basis. This way the expected maintenance savings for the CFLs can be estimated under current and future proposed maintenance cost models,

- Electricity savings are 192 MWh for the CFL 42W lamps, replaced by 24W LEDs,
- Future spot and bulk lamp replacement costs are reflected in the estimated future maintenance costs

Stage 2: Secondly all other street lights are upgraded to LED in FY19/20, by which time it is expected that Essential Energy will have approved LED lamps that can meet its requirements. For the purpose of this business case it is assumed that:

- LCC pays the capital cost of all LEDs including the 387 lamps that were funded initially by Essential Energy, assumed to cost $500 per lamp for 1,247 lamps, with sensitivity analysis performed at $750/lamp and at $400/lamp,
- LCC pays a small residual capital cost for the 387 lamps that were funded by Essential Energy, taken to be $75,000,
- Maintenance costs for LEDs are unknown at this time. It is reasonable to assume that some activities such as lens cleaning and PE cell maintenance may remain the same. However longer life and expected lower failure rates should mean that bulk and spot replacement costs decline significantly. For the purpose of this analysis it is assumed that LED maintenance costs will be $30/lamp per year under the current maintenance cost model, and $60/lamp per year under Essential Energy's proposed future costs, with sensitivity analysis performed at $45/lamp per year and $90/lamp per year respectively. This equates to an approximate 50% base case saving, with sensitivity analysis at 25% saving,
- Maintenance costs for each existing lamp tariff code for FY14/15 are extrapolated on a simple basis to Essential Energy's proposed FY15/16 maintenance costs, as well as on a CPI basis. This way the expected maintenance savings for the CFLs can be estimated under current and future proposed maintenance cost models
- Electricity savings are 567 MWh for the non-CFL lamps, replaced by LEDs,
- Future spot and bulk lamp replacement costs are reflected in the estimated future maintenance costs

The key scenario outcomes from these business cases are shown below. While 12 scenarios are modelled for each stage, three scenarios are shown, reflecting a base case and low-benefit and high-benefit outcomes in each scenario.

Table 11: Financial analysis summary of LED lighting upgrade of 42W CFL street lights

Stage 1: CFL upgrade to LED	Capital Cost	Cost Saving	Energy Saving	Payback	IRR
Scenario 1: $300/fitting capital cost, maintenance saved at proposed 2015-16 rates, new maintenance costs $50/lamp p.a.	$618,383	$99,446	191,898 kWh	6.22 Years	15.3%
Scenario 7: $400/fitting capital cost, maintenance saved at proposed 2015-16 rates, new maintenance costs $75/lamp p.a.	$824,510	$46,626	191,898 kWh	17.68 Years	-0.2%
Scenario 10: $250/fitting capital cost, maintenance saved at current rates + CPI, new maintenance costs $25/lamp p.a.	$515,319	$88,706	191,898 kWh	5.81 Years	16.5%

To summarise these scenarios, a worst-case outcome would occur if LEDs cost $400 per fitting to upgrade (additional to a normal bulk upgrade), and if maintenance costs were determined by the network operator to be greater than is the case for existing lamps, an unlikely scenario. Best outcomes are seen at lower capital costs and low maintenance costs compared with current costs, however good returns can be achieved even if maintenance costs do not materially change, provided that capital costs are no more than $300/lamp. The analysis finds that while increasing maintenance costs as proposed by Essential Energy has a significant impact on the overall cost of street lighting services, it does not have as great an impact on the business case for LEDs compared with capital costs and energy savings.

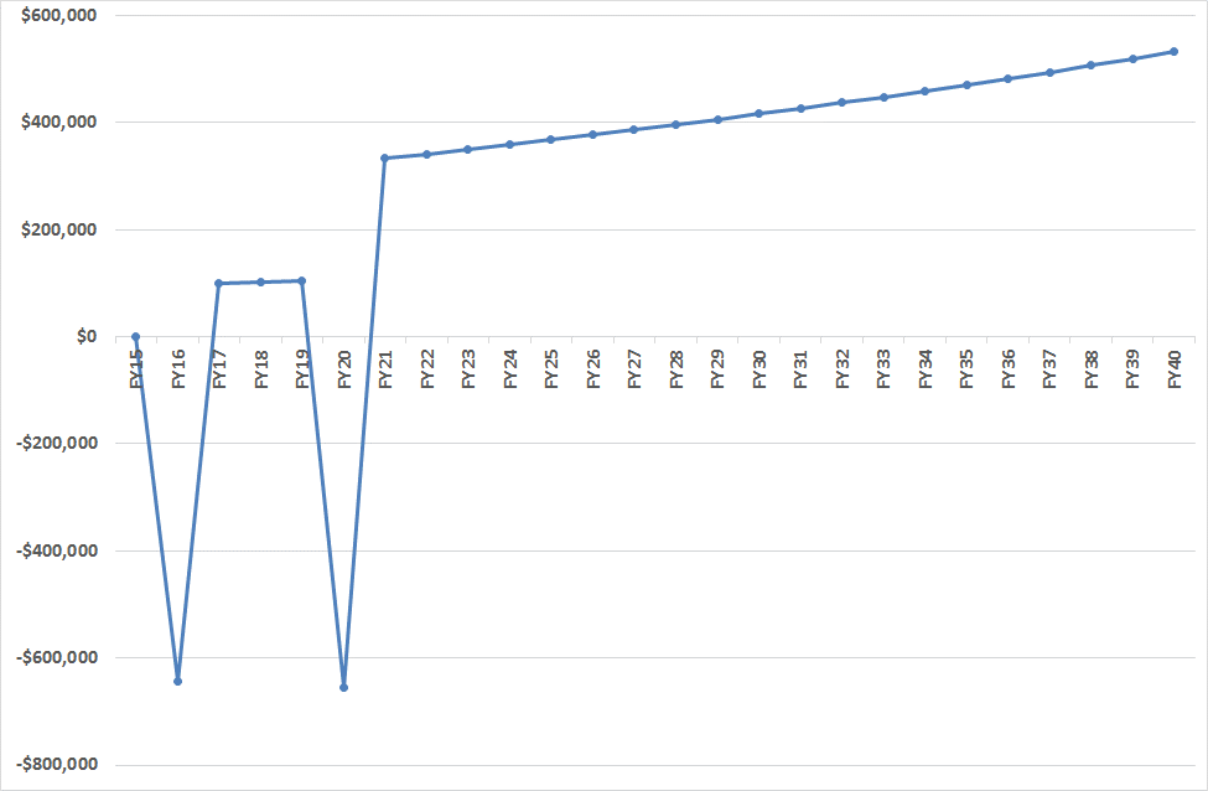
Table 12: Financial analysis summary of LED lighting upgrade of non-CFL street lights

Stage 2: HPS/MV upgrade to LED	Capital Cost	Cost Saving	Energy Saving	Payback	IRR
Scenario 1: $500/fitting capital cost, maintenance saved at proposed 2015-16 rates, new maintenance costs $60/lamp p.a.	$688,227	$223,244	566,929 kWh	3.08 Years	31.0%
Scenario 7: $750/fitting capital cost, maintenance saved at proposed 2015-16 rates, new maintenance costs $90/lamp p.a.	$1,032,341	$179,860	566,929 kWh	5.74 Years	16.3%
Scenario 10: $400/fitting capital cost, maintenance saved at current rates + CPI, new maintenance costs $30/lamp p.a.	$550,582	$184,762	566,929 kWh	2.98 Years	31.3%

The analysis for Stage 2 indicates that the likely energy savings for larger-wattage lamps is likely to outweigh other factors, and that this upgrade is likely to be cost effective. This is premised on the savings being comparable to those indicated for other main road LED lighting upgrades, and future developments in main road LED lighting should be monitored to confirm if this is the case.

An estimated net annual cash flow for LCC's LED street lighting upgrade is shown below, based on capital costs of $300/lamp (CFL) and $500/lamp (other), and maintenance costs and savings evaluated at Essential Energy's proposed rates discounted to $50/lamp per year (CFL) and $60/lamp per year (other) – i.e. Scenario 1 for both upgrade stages.

Figure 22: Annual net cash flow expected from LED upgrade of street lights



Recommended action plan for implementation

The recommended action plan for street lighting LED upgrades includes:

- Discuss LCC's plans with Essential Energy and potential timelines for minor road lighting upgrade to LED, taking into account planned bulk upgrades. Maintain an ongoing dialog relating to an LED upgrade including continued refinement of the business case,
- Engage with relevant regional bodies to evaluate whether an LCC or regional approach should be pursued, and whether ownership and maintenance arrangements should remain as is or if alternate approaches are viable,
- Maintain a watch on developments in major road LED lighting and participate as appropriate in forums to promote trials and uptake of major road LED lighting

5.8. Business case #6: solar photovoltaic 'behind-the-meter' implementation

Summary

This business case is about the installation of solar PV panels behind the meter, which means that the generated electricity will be used in real-time by the host sites.

Depending on the efficiency of the PV panels used, the total electricity generated will be around 1,050 MWh per year (business case '6-a'), and LCC has already taken up a portion of this opportunity with the installation of about 190 kW of solar PV capacity. Implementing PV systems at other sites where the power can be used when generated will lead to further reduced grid purchases of up to 780 MWh per year.

For some sites the potential for electricity generation from solar PV is greater than the amount that can be used immediately, and emerging approaches like storage and 'wheeling' (or Virtual Net Metering, VNM) may be possible at a later stage. By either utilising storage or VNM, the total amount of added potential PV generation is a little over 700 MWh per year. This is being referred to as business case '6-b'.

In total, it is estimated that Solar PV 'behind the meter' could generate up to 1,760 MWh per year.

With the Renewable Energy Target (RET) in place, all potential Solar PV installations are financially viable over a 20 year period. With the removal of the RET, the business case for Solar PV is less beneficial, unless for small sites that are on a General Supply tariff.

Potential annual MWh production

The potential for LCC to produce and use solar PV is estimated to be about 715 kW based on implemented projects, current proposals, energy audit reports, and site visits as part of this work. This is shown below.

Table 13: Estimate 'rooftop' or 'behind-the-meter' PV potential

Site	Source	Estimated PV Potential
East STP	Current proposal	250 kW
Goonellabah Sports and Aquatic Centre	Current proposal	140 kW
Waste Facility Wyrallah Road Lismore + MRF	Implemented	140 kW
Council Administration Centre	Energy audit	50 kW
Wyrallah Road Depot	Site visit	30 kW

Site	Source	Estimated PV Potential
Brunswick Street Depot	Implemented	20 kW
Blakebrook Quarry	Energy audit	20 kW
Airport Terminal	Implemented	15 kW
Oakes Oval Lismore	Site visit	10 kW
Library Headquarters, Goonellabah	Site visit	10 kW
Community Centre	Site visit	10 kW
SES Building Brunswick Street	Implemented	10 kW
CBD Office	Implemented	4 kW
Lismore Art Gallery	Implemented	4 kW
Goonellabah Crematorium Residence	Implemented	2 kW
Estimated total solar PV potential		**715 kW**

Depending on the efficiency of PV panels used to develop this potential, the total electricity generated would be up to 1,050 MWh per year.

This potential can be organised into two main categories:

- **Implemented PV** projects, including:
  - Small scale systems at the Brunswick Street depot, SES building, Art Gallery and CBD office – 27 kW of PV was installed when high feed-in tariffs were available and LCC data show these generated 34.5 MWh in the 2012-13 financial year, and
  - A 165 kW program of PV works recently completed (FY13/14), which will see 240 MWh of electricity produced and used on LCC sites (note this assumes that the 100 kW system installed at the MRF is sized to meet the demand for the new sorting facility)
- **Potential PV** projects, including:
  - Sites where peak demand charges are applied and where the value of electricity savings will be low, in the region of 13¢/kWh, owing to low coincidence between PV output and peak demand occurrences. This includes 440 kW at GSAC, East STP and the Administration Centre, and

- Sites where electricity is charged on a General Supply basis, and where the value of savings will be closer to 25¢/kWh. This includes 80 kW at Wyrallah Road depot, Community Centre Goonellabah, Library HQ, Oakes Oval and Blakebrook Quarry

Potential future MWh production

The potential solar PV capacity noted above would produce electricity that will be used in real-time by the host sites. The potential for electricity generation from solar PV at some sites is greater than the amount that can be used immediately, and emerging approaches including renewable energy storage and 'wheeling' (or Virtual Net Metering, VNM) of electricity to be used at a later time or credited to a nearby site may be possible.

The total amount of added potential PV generation in this way is a little over 700 MWh per year from 505 kW of solar PV capacity (business case '6-b'). This is summarised below.

Table 14: Estimated additional PV potential for storage or VNM

Site	Additional PV Potential	Location	VNM Potential
East STP	200 kW	Trickling tanks	Admin Centre, Quarry
GSAC	150 kW	Roof	Admin Centre, Quarry
Airport Terminal	50 kW	On-ground air-side	Admin Centre, Quarry
Nimbin STP	30 kW	Western side of site	NA
Wyrallah Road Depot	20 kW	Roof	NA
Nimbin Dam	15 kW	North corner	NA
Library HQ	10 kW	Roof	NA
SES Building	10 kW	Roof of rear shed	NA
Crozier Oval	10 kW	Grandstand roof	NA
Oakes Depot	10 kW	Roof	NA
	505 kW		

Regulatory environment and barriers to renewable energy

Incentives have underpinned the growth in solar PV in Australia in recent years, via two principal means:

1. *Feed-in-tariffs* (FiT) that were introduced by several States and Territory governments; LCC's 27 kW of PV installation at the Brunswick Street depot, SES building, Art Gallery and CBD office have benefitted from this type of incentive to be commercially viable,

2. *Renewable Energy Target* incentives, specifically:

    a. Small-scale Technology Certificates (STCs) that can be created upfront by eligible technologies under the Small-scale Renewable Energy Scheme (SRES), and

    b. For larger renewable energy systems (>100kW), Large-scale Generation Certificates (LGCs) can be created annually in proportion to energy generated

Most FiTs are now closed to new projects, and a review of the RET has recommended a range of actions that could affect the future of the scheme.

Owing to the uncertainty created by the RET review, all analyses in this assessment are carried out twice, including and excluding the value of certificates created under the RET.

Cost-benefit analysis

To summarise, there are various factors influencing the economic viability of solar PV, including:

- Value of benefits,
- Uncertainty about the RET, and
- Decisions to create STCs upfront (<100kW) or to create LGCs (>100kW) annually

Given these factors, a range of scenarios are evaluated, summarised below.

Table 15: Modelled Scenarios for Solar PV

Scenario	Scenario	Description	Value of Savings	Notes
1	Current proposals using STC	99.1 kW GSAC 66.4 kW East STP	13.1¢/kWh	Roof-mounted

Scenario	Scenario	Description	Value of Savings	Notes
2	Current proposals LGC	140 kW GSAC 250 kW East STP	13.1¢/kWh	GSAC roof mounted East STP assumes on-ground; added costs if located on trickling tank(s)
3	Current proposals using STC (+ Admin Centre)	99.1 kW GSAC 66.4 kW East STP (+50 kW Admin Centre)	13.1¢/kWh	Noted that solar PV on the Admin Centre may erode some of the savings effect of reflective paint
4	Current proposals using LGC (+ Admin Centre)	140 kW GSAC 250 kW East STP (+50 kW Admin Centre)	13.1¢/kWh	
5	Non-demand sites STC	30 kW Wyrallah Rd depot 20 kW Blakebrook Quarry 10 kW Oakes Oval 10 kW Library HQ 10 kW Community Centre	25 ¢/kWh	All sites would be subject to engineering verification
6	All sites STC-scale	Current proposals STC (+ Admin Centre), and Non-demand sites STC	16.3¢/kWh blend rate	Blend rate estimated based on % contribution to total generation at each savings rate
7	All sites STC + LGC scale	Current proposals LGC (+ Admin Centre), and Non-demand sites STC	14.7¢/kWh blend rate	Blend rate estimated based on % contribution to total generation at each savings rate

For each evaluation a number of assumptions were made. These include:

- Energy generation and capital cost estimates are taken from current proposals' modelled figures, noting that these are for high-efficiency and high-cost panels,
- STCs and LGCs are assumed to have a value of $35/certificate, with a net value of $30/LGC,
- Inverters are assumed to have the same capacity as panels and are replaced every 10 years, with costs taken to decline to $0.20 / Watt by FY20/21 and to $0.15 / Watt after FY26/27,
- Maintenance costs are taken to be $25/kW per year,
- A degradation rate of 0.5% per year is assumed for PV output after Year 1,
- Financial analysis for 20 years is evaluated

For each scenario the results of this initial financial analysis are shown below, with and without the value of RET certificates.

Table 16: Financial analysis summary for solar PV, 20-year evaluation period

Scenario	Payback period in years with RET	IRR with RET	Payback period in years with no RET	IRR no RET
1	9.42	9.50%	13.51	5.00%
2	10.75	7.20%	13.51	5.00%
3	9.42	9.50%	13.51	5.00%
4	10.63	7.61%	13.51	5.00%
5	4.61	22.70%	6.62	15.50%
6	7.36	13.40%	10.55	8.20%
7	9.37	9.80%	11.85	6.70%

From the analyses carried out we can say:

- Over a 20-year period and with the RET in place (as an upfront STC incentive or LGCs to 2030), all of the options analysed look to be viable, noting in particular the high cost of the modelled panels relative to others that are available at lower cost,
- Small sites where electricity is charged on a non-demand basis (i.e. General Supply with or without a time-of-use component) will benefit with or without the RET,
- The RET has a material impact on the economic viability of rooftop PV at LCC's sites, which is most pronounced at sites where peak demand charges represent a significant percentage of total electricity costs, although declining solar technology costs and the conservative approach to the valuation of energy savings suggest that the above outputs are highly conservative

Virtual Net Metering

Depending on the requirements in terms of proximity of sites to each other (e.g. by same postcode, same electricity feeder or sub-station, etc.), LCC may have sites that could avail of VNM tariffs in future. These include:

- Host sites – maximising generation at the GSAC and East STP sites, and using the south-east corner of the Lismore airport site to generate electricity for export,
- Recipient sites – the Administration Centre and the Blakebrook Quarry are two large sites that will have a sizeable time-of-use energy demand profile going forward are the most obvious beneficiaries, with neither likely to be able to self-generate most of their own energy

At this time the financial viability of VNM is not modelled. In simple terms the expected value of savings to a recipient site should be less than the case where renewable energy is generated and used at the same site, and so a VNM project would be expected to show an inferior return to the cases summarised above.

The approach by LCC to VNM at this time could include:

- Joining or establishing a parallel trial, potentially using output from GSAC to be credited to the Administration Centre across the road, or
- Maintain a watching brief on the VNM trial process at Byron

Energy Storage

GSAC, Lismore Airport and East STP appear to be the sites with the greatest potential for storage to augment solar PV systems or for additional capacity with storage to be installed. At these sites, reducing peak demand, supplementing grid electricity when solar production is low, and meeting offpeak energy demand could both be considered. Other sites that may have the space to install solar PV that can be stored and used to meet site electricity demand include Nimbin STP, Wyrallah Road Depot, Nimbin Dam, Library HQ, SES Building, Crozier Oval and Oakes Depot. An estimated 105 kW of solar PV with storage could meet the energy needs of these sites.

This work has not sought to determine the optimum sizing of storage systems that could be implemented at these sites to meet local demand. Site-specific studies of energy use patterns and solar PV production would be needed to optimise a solution for each site.

At this time the main recommendation is to maintain a watching brief on developments in solar storage technologies and costs.

Recommended action plan for implementation

The recommended actions for Council in relation to small-scale solar PV systems, or 'behind-the-meter' solar is:

- Council should take a decision on whether to progress current proposals and identified opportunities – in particular where RET incentives can be accessed – or to await further developments in the regulatory environment,
- Continued refinement of financial analysis models to reflect changing solar technology costs and electricity pricing,
- A watching brief should be maintained on storage technology development, and a business case for solar + storage developed at an appropriate future time,
- Council should take a decision on whether to maintain a watch on VNM developments, or whether to take a more active role via efforts to establish a parallel trial

5.9. Business case #7: large-scale solar photovoltaic generation

Summary

At this stage it appears that a 3.8MW-4.7MW solar PV plant to enable LCC to self-generate its electricity needs would lead to Council paying up to $900,000 per year additional to what it currently pays for electricity. However, developments across a range of areas are driving improvements in the business case for large-scale PV, and the project is likely to viable within or close to Council's timeframe of 2023.

Council should focus in the first instance on the enabling actions that will drive the changes making PV at scale viable.

- Determine additional funding / income sources
- Community retailer establishment – LCC is an active member of the consortium investigating this and should remain involved in the development of the business plan in 2015,
- Virtual net metering – maintain watch on developments in Byron Shire Council, and by others such as TEC, and use resources to advocate for the adoption of VNM. Council could consider the implementation of a VNM trial using GSAC and the Administration Centre,
- Technology costs – maintain watch on developments via BREE and other sources to track improvements in the LCOE of large scale PV,
- Grants and other incentives – maintain watch on developments and use resources to seek to influence support for renewables at Commonwealth and State levels,
- Sunshine Coast Regional Council – Council should remain abreast of the progress of the SCRC Valdora PV project given the apparent parallels with Council's potential PV project,
- Feasibility study – timing for the conduct of a pre-feasibility study for a large-scale

Potential annual MWh production

The requirement for energy generation to meet Lismore City Council's electricity needs is dependent on the reduction in grid electricity purchases resulting from energy efficiency and 'behind-the-meter' PV, offset by increases or changes in Council's energy use profile over time.

To summarise all other business cases, Lismore City Council could reduce its electricity demand by almost 3,400 MWh per year through on-site measures as described. This is summarised below.

Table 17: Summary of LCC's potential savings in purchased electricity from FY13/14

Bus Case #	Description	Electricity saved p.a.
1	Major sites EE	488 MWh
2	Ross St pump VSD	70 MWh
3	Facilities lighting EE	178 MWh
4	Other facilities EE	150 MWh
5	Street lighting	759 MWh
6-a	Solar PV 'Behind-the-meter'	1,053 MWh
6-b	Solar PV from storage and VNM	707 MWh
Total	**All business cases**	**3,404 MWh**
FY13/14	FY13/14 electricity consumption	7,277 MWh
Remaining MWh to be met by business case 7	**after business cases 1-6 (including '6-a' and '6-b') have been implemented:**	**3,873 MWh**

Countering these potential savings, electricity demand will grow in a few areas:

- The South STP upgrade, if an IDEA plant, will add 1,000 MWh per year to LCC's demand,
- The added load on the Materials Recovery Facility, together with a 1% p.a. growth in underlying demand (e.g. new street lights and water / wastewater services in new land sub-divisions), would add a further 500 MWh (approx.) in the next 10 years

These added demands would raise Council's expected electricity consumption in FY22/23 to a little under 5,400 MWh. At solar PV production of 1,400 MWh/MW per year this would call for the development of a 3.8 MW generation plant.

We must also consider the case where savings in energy use are not fully implemented due to financial, technical or regulatory reasons, or where predicted savings fall short of expectations. If we assume that up to one third of potential savings cannot be realised then Council's expected electricity use in FY22/23 would be closer to 6,600 MWh. This would necessitate a solar PV plant 4.7 MW in scale.

So, for the purpose of Council's plans to 'self-generate' to meet its electricity needs by 2023 from renewable energy sources, a solar PV plant of 3.8 MW to 4.7 MW is required.

Cost-benefit evaluation

Solar PV at small-scale in Australia

The advancement of solar PV at small scale in Australia in recent years has been significant. Driven by feed-in-tariffs, the Renewable Energy Target, rising electricity prices and falling PV technology costs, more than 2 million small-scale renewable energy installations have now been completed in Australia. As of 04 November 2014, installations include:

- 1,320,423 solar PV panel systems, and
- 891,118 solar water heaters (including air source heat pumps)[16]

As reported in April 2014[17], the Lismore LGA had 9,161 total solar installations, a penetration rate of 47% compared with a State penetration level of 17%. This places Lismore as the leading LGA in NSW for the total number of solar installations, in the top 10 LGAs nationally for the number of installations, and with the highest penetration rate for solar installations of the top 10 LGAs nationally.

Solar PV at large-scale in Australia

Despite the success of roof-mounted small-scale systems solar PV has been implemented at large or utility scale to a lesser extent. As the table below shows, large-scale PV projects that have been implemented or are in development rely on capital incentives or feed-in-tariffs (FiT), together with Renewable Energy Certificates under the RET scheme in order to break even financially.

Table 18: Summary of recent large-scale solar PV projects in Australia

Name	Location	Scale in MW	Incentive: RET and…	Status
Royalla	ACT	20	$186/MWh FiT	Operating
Mugga Lane	ACT	13	$178/MWh FiT	Planning Approval
Uriarra	ACT	7	$186/MWh FiT	Construction mid-2014
Moree	NSW	56	Commonwealth grant	Committed to Construction
Nyngan	NSW	102	ARENA & NSW Grants	Construction Commenced
Broken Hill	NSW	53	ARENA & NSW Grants	Construction Commenced
Geraldton	WA	10	Unknown	Operating
Valdora	QLD	15	Unknown	Development Application

Upfront financial incentives and long-term feed-in-tariff guarantees for these projects serve to help the projects 'Levelised Cost of Electricity' and the projects revenue streams from the sale of electricity and RECs come together, potentially making these projects financially viable.

[16] Source: http://ret.cleanenergyregulator.gov.au/REC-Registry/Data-reports#Latest-data
[17] Source: http://www.recagents.asn.au/wp-content/uploads/2014/04/GET-Postcode-report-for-RAA-April-2014.pdf

Sunshine Coast Regional Council's Valdora Solar Project[18]

The Sunshine Coast Regional Council is planning to develop a 15 MW solar PV plant to be located on a part of a former sugar cane plantation in Valdora. In terms of scale and purpose (to offset all of Council's electricity needs), this plant appears to be similar in many respects to a solar PV plant at Lismore City Council's that will serve a comparable purpose.

Details of the planned project are confidential, and the following details are taken from SCRC's website.

Table 19: Summary of planned Valdora solar PV project

Project scope

The project will see a 15 megawatt (MW) solar farm installed at 909 Yandina-Coolum Road in Valdora. It will be installed on 24 hectares of a 49 hectare site.

The solar farm is estimated to save Sunshine Coast Council millions of dollars over a 30-year period, based on today's electricity costs, which are anticipated to increase substantially in the future.

Project update

Council has lodged a development application to build a 15 MW solar farm.

The development application takes into account significant changes in the solar industry over the past three years. It includes much greater detail than the previous Material Change of Use (MCU) application prepared in 2010 and lodged and assessed in 2011.

The new MCU application benefited from a body of work completed since 2013, including:

- *independent business case reviews by an investment bank and business advisory firm with experience in commercialisation of renewable energy technology*
- *an Energex feasibility study which indicated grid connection could occur and that the generating capacity of the solar farm could be increased up to 15 MW*
- *significant additional information about the project's financial feasibility generated through the Expression of Interest process undertaken by council in 2013 and which assisted in shortlisting potential partners to build the solar farm*
- *more detailed and up to date geotech and flood study information as well as reviews of the traffic,* ecological, visual and reflectivity impacts.

The development progress of this project would be useful to track and should provide helpful input to Lismore City Council.

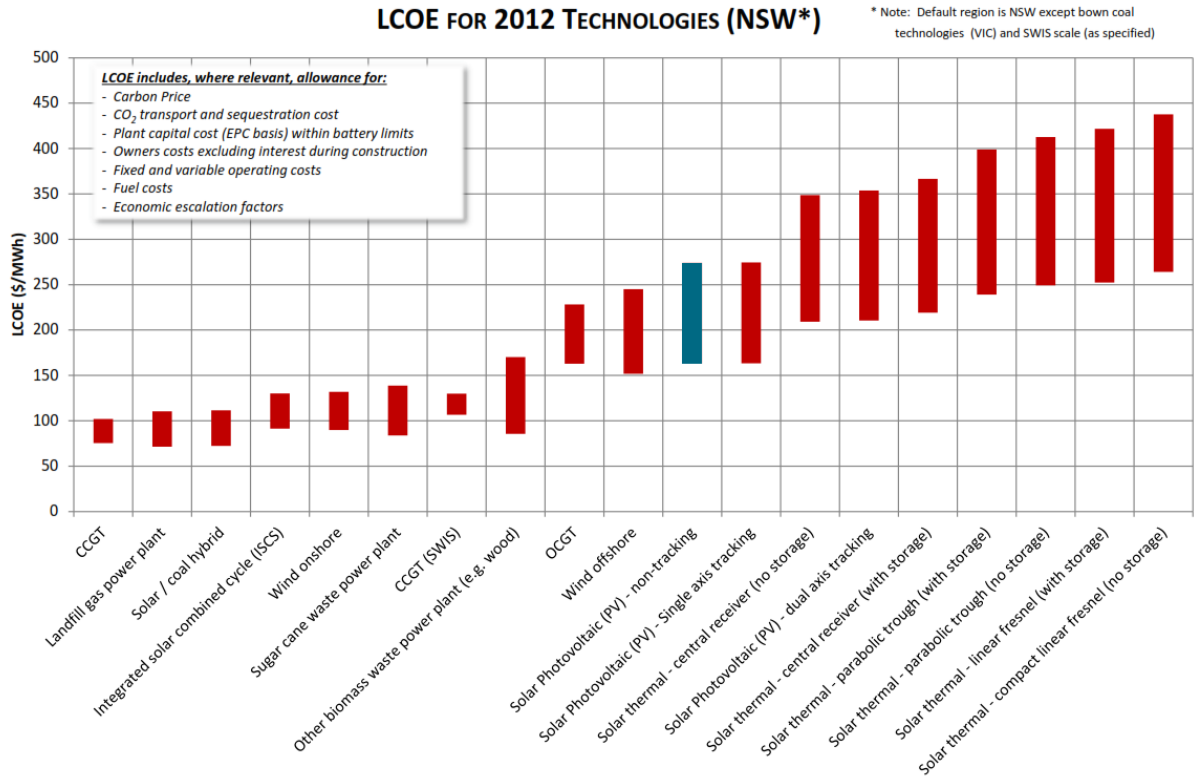
[18] Source: http://www.sunshinecoast.qld.gov.au/sitePage.cfm?code=solar-farm on 18th Nov 2014

Large Scale Solar PV Costs in Australia, and estimated for LCC

According to the Government's "Australian Energy Technology Assessment 2013 model update" (*Bureau of Resource and Energy Economics* (BREE))[19], the LCOE from solar PV at utility scale (without incentives) is currently in the range of over $150/MWh to more than $250/MWh (say $200/MWh). The capital cost of solar PV systems is the single largest input to the LCOE.

Drawing on the large-scale project examples tabulated above we would estimate a 3.8 MW to 4.7 MW PV plant for Lismore to cost in the order of $10-13m today.

Figure 23: AETA Estimates for LCOE of Solar PV and other technologies at 2012 (BLUE column – colour added by SBC)



Opportunities to make large-scale solar PV financially viable

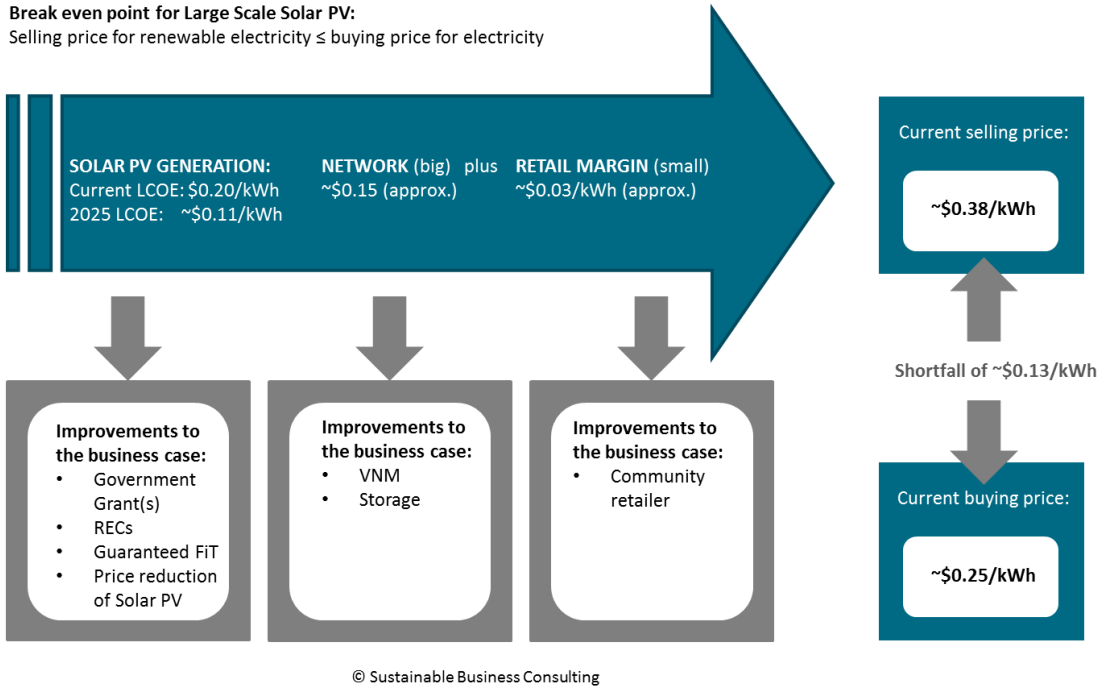
If solar energy is produced (and hypothetically sold) at $200/MWh, and Council then purchased this electricity to meet its commitment to self-generate all of its electricity from renewables, it would then incur network charges and retailer margins of, say, $0.15/kWh and $0.03/kWh respectively.

In simple terms, the final purchase price for electricity would be $0.38/kWh, compared with an average price now of around $0.25/kWh.

[19] Arif Syed (BREE) 2013, The Australian Energy Assessment (AETA) 2013 Model update, Canberra, December 2013

Hence this situation is not financially viable, so options to reduce the cost of solar power generation, network costs, retailer margins, or all of these variables need to be examined.

Figure 24: Illustration of the 'gap' between LCC large-scale PV self-generation and retail purchase



Reducing the capital cost of solar PV generation

Incentives in recent years in the form of grants (e.g. ARENA, States, prior Commonwealth funding schemes), feed-in-tariffs (e.g. ACT solar reverse auction), and the Renewable Energy Target (RET) have helped PV plants become viable. To the extent that these, or new incentive schemes at State or Commonwealth level continue or are established, Lismore City Council could look to access these to help reduce the cost of PV and/or increase the value of generated output.

By 2025 BREE estimates that the cost (LCOE) of solar PV (non-tracking) will have fallen to a range of around $50/MWh to well under $200/MWh (say $110/MWh). At 2050 the AETA report estimates an LCOE for solar PV (non-tracking) of $73/MWh.

The figures below from BREE illustrate the forecast decline in costs. These figures will be updated twice annually to reflect new modelling of costs. Of note is the expectation that solar PV (non-tracking) is expected to be the lowest cost form of renewable energy generation among BREE's selected technologies, by 2050. Also of note is that the report's 2013 revisions to LCOE estimates find that they are lower (i.e. better) than their 2012 figures. This could hint at cost reductions in solar and other renewable energy technologies that are faster than modelled figures show.

For Lismore City Council, the forecast improvements could lead to a plant costing $6-8m in 2025.

Figure 25: AETA Estimates for LCOE of Solar PV and other technologies at 2025 (BLUE column – colour added by SBC)

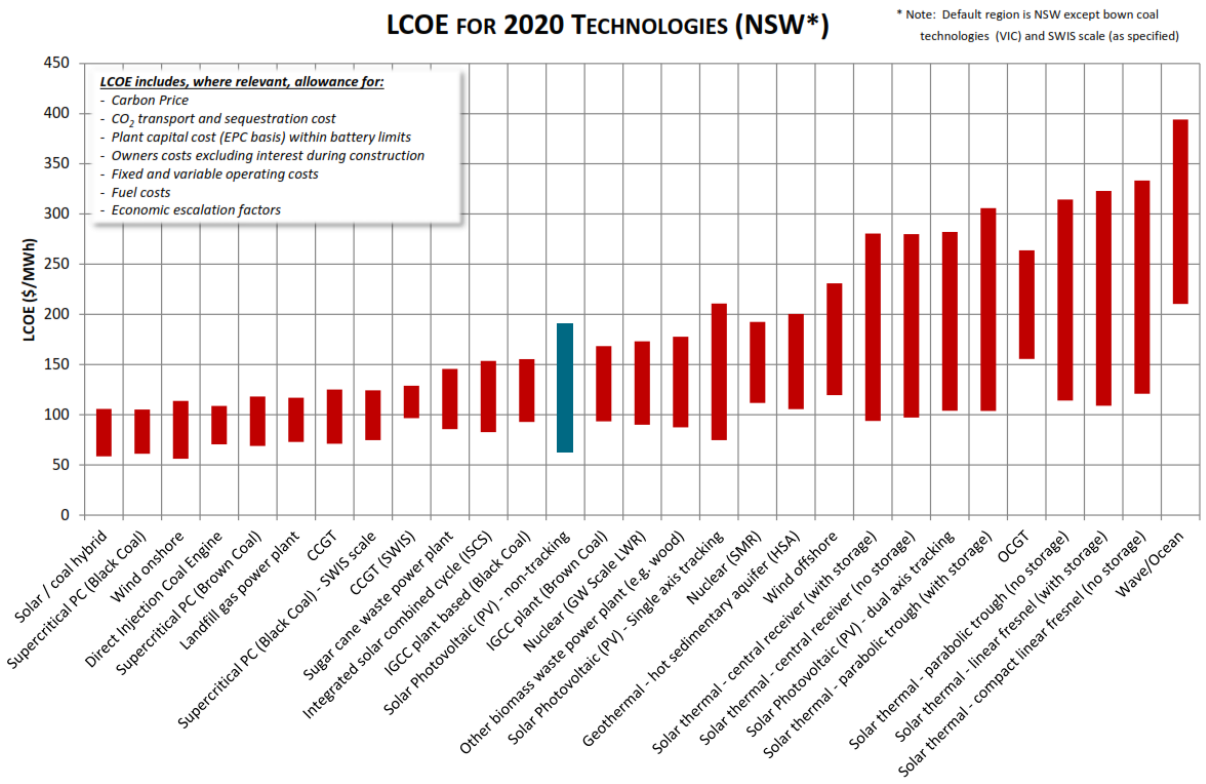
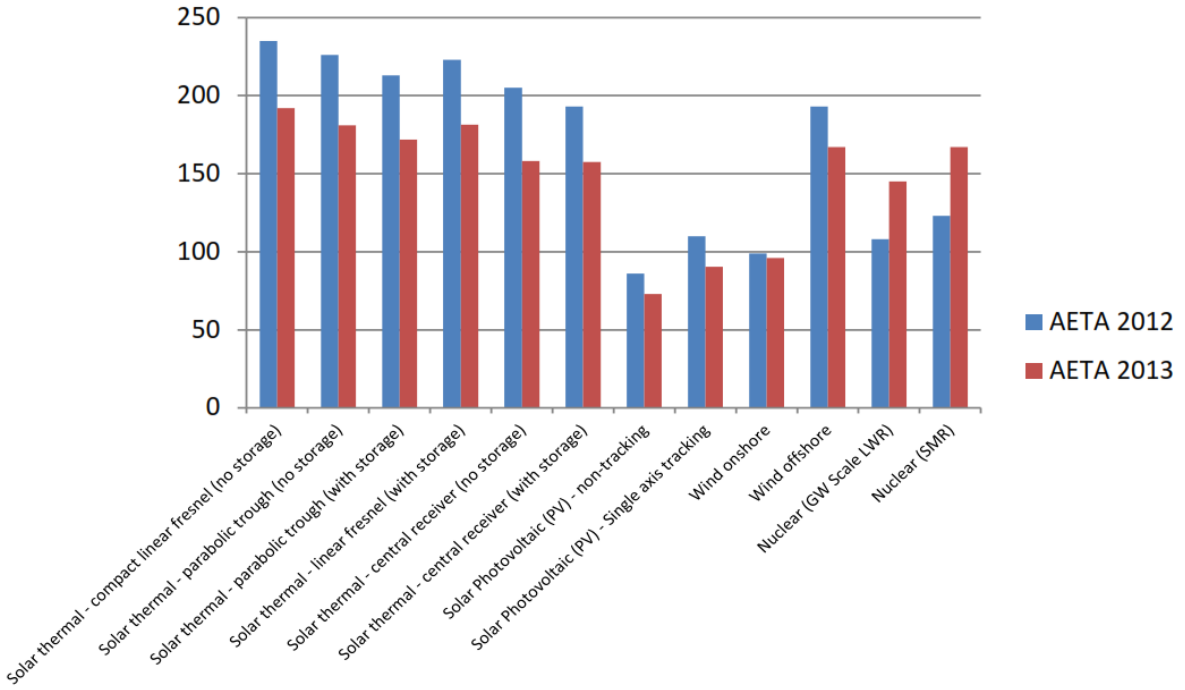


Figure 26: AETA Estimates for the expected cost of some RE technologies in 2050, plus comparisons to prior estimates



Reducing network costs and retailer margins

Network costs make up the majority of delivered electricity costs not including wholesale costs, while retailer margins are somewhat smaller.

In addition to forecast cost reductions to develop solar PV projects, some initiatives are underway that could help to improve the business case for a solar PV project of this nature:

- **Community electricity retailer**: a major incentive for community-based retailers to participate in renewable energy generation is the ability for a community-motivated rather than profit-motivated organisation to support local generation and sell electricity at rates to local customers that are better than what can be achieved now. A large-scale solar PV project supplying directly into the grid may not fit with this business model as a stand-alone activity at this time, owing to the high cost of generation relative to other sources. However it is likely that such projects would be excellent candidates as costs to develop PV projects of this nature fall, or such a project could fit within a portfolio of generation activities that make up the retailer's purchases. A project has been let to develop a viable business model for a community electricity retailer to operate in the Northern Rivers region[20], led by a consortium that includes Lismore City Council. A business plan is expected to be developed by mid-2015.
- **Virtual Net Metering**: linked to the development of a community retailer is the possibility of output from a large-scale PV plant being wheeled to LCC sites via such a retailer. The benefit of lower network prices could be significant, given the significance of network costs. Trials of VNM will help to establish its viability and the extent of any unit price reduction for use of part of the network.
- **Storage**: together with plant design storage could help to optimise the dispatch of electricity so that peak demand coincidence with PV output is enhanced, and/or to meet demand at times when solar output is small or nil.

Where could Lismore site a solar PV plant?

An assessment of numerous sites within the Lismore LGA highlighted several sites that could potentially host solar PV plants. These include:

- 'Turf farm' site located due north of the South STP – a multi-MW scale project would ideally be considered at this site, and if viable could generate all of the required electricity,
- Lismore airport, in particular the land in the south-east corner of the site near the Bruxner Highway,
- Old quarry site across from South STP on three chains road

No formal evaluation of these sites has been carried out, and this should be done when a project feasibility study is conducted.

[20] Source: http://www.tec.org.au/images/CER%20Tender%2018.8.14%205-1.pdf

Recommended action plan for implementation

At this stage it appears that a 3.8MW-4.7MW solar PV plant to enable LCC to self-generate its electricity needs would lead to Council paying up to $900,000 per year additional to what it currently pays for electricity. However, developments across a range of areas are driving improvements in the business case for large-scale PV, and the project is likely to be viable within or close to Council's timeframe of 2023.

Council should focus in the first instance on the enabling actions that will drive the changes making PV at scale viable.

- Determine additional funding / income sources
- Community retailer establishment – LCC is an active member of the consortium investigating this and should remain involved in the development of the business plan in 2015,
- Virtual net metering – maintain watch on developments in Byron Shire Council, and by others such as TEC, and use resources to advocate for the adoption of VNM. Council could consider the implementation of a VNM trial using GSAC and the Administration Centre,
- Technology costs – maintain watch on developments via BREE and other sources to track improvements in the LCOE of large scale PV,
- Grants and other incentives – maintain watch on developments and use resources to seek to influence support for renewables at Commonwealth and State levels,
- Sunshine Coast Regional Council – Council should remain abreast of the progress of the SCRC Valdora PV project given the apparent parallels with Council's potential PV project,
- Feasibility study – timing for the conduct of a pre-feasibility study for a large-scale

5.10. Business cases: summary of required investments

The total amount of investment required to deliver the Council's target of 100% self-generation from renewables is not known at this time, owing principally to unknown future costs associated with large-scale solar and storage technologies that are likely to underpin the implementation of a large part of the target achievement.

The business cases highlight that there are two 'stages' of implementation:

- In the **first stage**, a range of energy efficiency and 'behind-the-meter' solar PV systems can be implemented to deliver a significant part of the target, up to 2,697 MWh per year in reduced grid electricity consumption (business cases 1 to 6-a). The initiatives underpinning the achievement of this saving are commercially available and viable now, or will be within the next few years (e.g. main road LEDs), and are therefore taken to be capable of implementation now,
- For the **second stage**, large-scale solar and storage technologies are expected to deliver the remaining savings, of at least 6,107 MWh per year. These savings are not expected to be capable of implementation until the later part of the target period, to FY22/23.

Taking the business cases included in the first stage above, the high-level modelling here includes the following implementation timing:

- Business case #1, Major facilities – several measures implemented in FY13/14 will realise savings from FY1415, and additional measures at large sites can be implemented in FY15/16,
- Business case #2, water supply – improvements to the Ross Street pumping system are assumed to be implemented in FY15/16,
- Business case #3, facility and public lighting outside of the largest sites – implementation is taken to occur over a 5-year period, with facilities upgraded in thirds from FY14/15 to FY16/17, and public lighting upgraded in the two following years,
- Business case #4, small sites energy efficiency (non-lighting) – a 20% improvement is taken to be achievable based on audits and other data. For analysis purposes it is assumed that this can be achieved over five years from FY14/15, with a simple payback of five years taken to apply,
- Business case #5, street lighting – local roads are taken to be able to be upgraded in bulk in FY15/16, with major roads assumed to be upgraded in FY19-20,
- Business case #6, solar PV behind the meter – scenario 7 is assumed to be implemented with the RET in place, with implementation taken to occur in FY15/16

Based on these assumptions of annual investments, net and cumulative cash flow for these investments could look like the chart and tables below. Continuing refinement of business cases and

capital availability or other priorities may alter the timing and amount of investments, and the annual Action Plan development process is the mechanism via which this would be done.

Table 20: Summary of possible investment profile for implementation of 'stage 1' EE and RE actions by Lismore City Council

Investment	FY14	FY15	FY16	FY17	FY18	FY19	FY20
Bus Case 1	$501,276	$0	$78,730	$0	$0	$0	$0
Bus Case 2	$0	$0	$100,000	$0	$0	$0	$0
Bus Case 3	$0	$37,120	$37,120	$37,120	$99,750	$99,750	$0
Bus Case 4	$0	$36,963	$37,887	$38,834	$39,805	$40,800	$0
Bus Case 5	$0	$0	$643,383	$0	$0	$0	$763,227
Bus Case 6	$0	$0	$1,138,642	$0	$0	$0	$0
Annual Investment	$501,276	$74,083	$2,035,762	$75,954	$139,555	$140,550	$763,227
Cumulative Investment	$501,276	$575,359	$2,611,121	$2,687,075	$2,826,631	$2,967,181	$3,730,408

Figure 27: Possible cumulative cash flow for implementation of 'stage 1' EE and RE actions by Lismore City Council

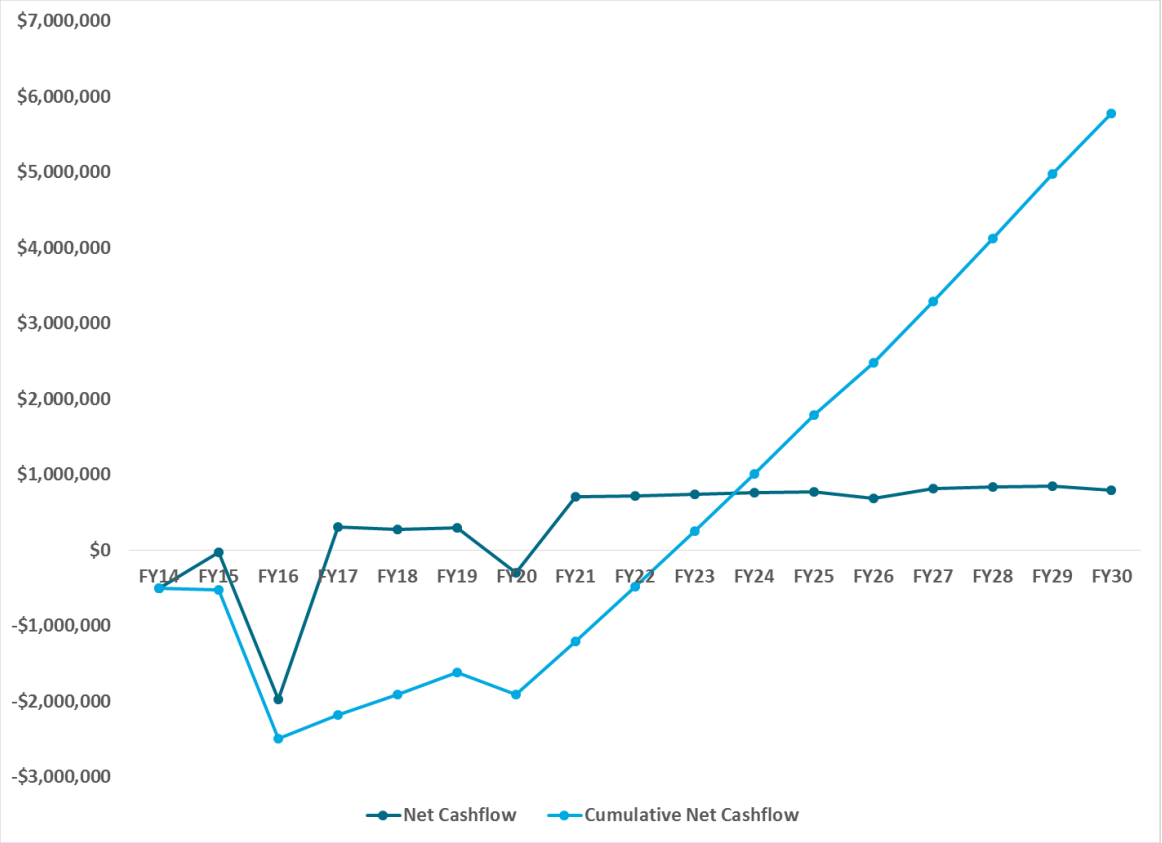


Table 21: Summary of net and cumulative net cash flow to FY29/30 for implementation of 'stage 1' EE and RE actions by Lismore City Council

	FY14	FY15	FY16	FY17	FY18	FY30
Business Case 1	-$501,276	$51,553	-$25,888	$121,501	$124,538	$92,826
Business Case 2	$	$	-$100,000	$11,619	$11,909	$16,016
Business Case 3	$	-$37,120	-$29,730	-$21,971	-$76,458	$63,514
Business Case 4	$	-$36,963	-$30,310	-$23,301	-$15,922	$53,534
Business Case 5	$	$	-$643,383	$99,446	$101,933	$415,889
Business Case 6	$	$	-$1,138,642	$121,481	$123,827	$155,740
Net Cash flow	-$501,276	-$22,530	-$1,967,953	$308,776	$269,827	$797,520
Cumulative Net Cash flow	-$501,276	-$523,806	-$2,491,759	-$2,182,983	-$1,913,156	$5,772,698
IRR	15%					

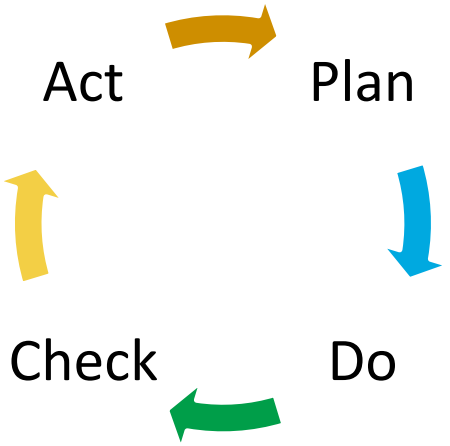
6. Action plan for Lismore City Council's REMP

A separable Action Plan document and related spreadsheets form part of this REMP. The Action Plan summarised here is an outline plan for the remainder of FY14/15 and FY15/16, however this will be revised as part of the budget planning cycle for FY15/16, and annually thereafter. A major review of this Action Plan will be undertaken periodically over the period to 2023, when Council expects to achieve its overall self-generation target.

Responsibility for the implementation of Council's Action Plan sits with the General Manager (GM) and the Executive Committee (EC). Coordination, management and maintenance of the Action Plan will be undertaken by the appointed lead of a Sustainability Team with representatives from each of Council's functional areas.

The Action Plan follows the 'plan-do-check-act' philosophy that underpins best practice in energy and resource management, and while only energy efficiency and renewable energy resources are included at this time, Council could elect to include additional sources of energy use, waste, emissions and the like at a future time.

Figure 28: REMP Action Plan approach



- **Plan** Develop or update the Action Plan drawing on business contextual information (e.g. *Imagine Lismore*, REMP, State and Commonwealth policy or legislation), collaboration with stakeholders, energy use and cost data, performance indicators / metrics, and other relevant inputs. Resources, budgets and timelines should be established for all approved actions, and a monitoring framework established or updated. Meeting / review schedules will be established.
- **Do** Implement the plan through the deployment of resources and budgets, updating progress, and implementing the communication strategy. Plans may relate to many aspects of energy management including communication, training & awareness, procurement, operations & maintenance, design processes, technology and control.

- **Check** Monthly or quarterly (as appropriate), and annually ahead of budget planning, the Action Plan will be reviewed to monitor the progress and performance of projects against expected results, and reported to management. Recommendations for new and corrective action will be made as applicable.
- **Act** Implement approved new and corrective actions in to the Action Plan.

6.1. Action plans for the delivery of 100% self-generated RE

The target of self-generation from renewables for 100% of LCC's electricity use will be delivered via three discrete strategies.

1. **Strategy 1**: Management actions, including planning, measurement and verification, financial planning, resourcing and communication.
2. **Strategy 2**: Energy efficiency – the reduction in absolute electricity consumed by Council's operations and street lighting.
3. **Strategy 3**: Solar energy installed 'behind-the-meter' and used on-site, to be delivered via solar photovoltaic systems, solar hot water systems and, at a later time to include energy storage.
4. **Strategy 4**: Solar energy installed (ideally) on Council-owned land and 'consumed' at other Council sites via an energy retailer and to include, if possible, Virtual Net Metering (VNM).

Other factors may play a role in achieving Council's objectives, including divestments for example, or outsourcing of services and facilities to third parties who assume responsibility for management of energy at these facilities. These factors will be tracked and reported as they occur, so that the factors underpinning the achievement of the target are fully understood.

Each of these strategies has a number of discrete actions associated with them, and these are outlined below. Further to these actions, an accompanying workbook includes project tracking and Action Plan reporting spreadsheets.

STRATEGY 1: MANAGEMENT ACTIONS

PLANNING PROCESS

ACTION MN1: Energy Management Action Plan Development

- LCC to create a process for developing energy efficiency projects to be included in the Action Plan and budget for FY15/16 and subsequent years.
- An Action Plan and budget for FY15/16 will be developed in early 2015 and endorsed by Council's Executive.

MEASUREMENT AND VERIFICATION

The primary tools to be used for verification of overall and project performance are:

- Planet Footprint, and
- Utility billing data for renewable energy credits

These tools are effective at monitoring the step changes that have occurred as a result of major EE and RE projects at LCC sites.

ACTION MN2: Overall Performance M&V

- Council will seek to improve the rate and accuracy of energy use and cost data entry into Planet Footprint. Council will also seek to have MWh of electricity generated from renewable energy sources entered into Planet Footprint in a timely manner.

ACTION MN3: Project Performance M&V

- At this stage the employment of more complex analytical tools is not planned, such as those based on the International Performance Monitoring and Verification Protocol (IPMVP), e.g. M&V resources developed by OEH. The need for project-level M&V will be evaluated on a case-by-case basis by Council.

ACTION MN4: Project Tracking

- An excel spreadsheet will be the main tool used to collate and record project ideas and committed actions. This will also be used to track progress on a 'day-to-day' basis. Periodically project data (descriptions, dates, costs and benefits) will be uploaded from Excel to Planet Footprint, so that implementation and planned project information is accessible to users with the requisite access, and so that professional reports can be created easily.

COMMUNICATION PLAN

Council employs a range of tools at present to communicate its actions on energy efficiency and renewable energy. These cover external and internal communication needs.

Public Communication: Lismore City Council already employs a range of effective tools to communicate its efforts to manage energy use and implement renewable energy on its facilities. For example:

1. Council's State of the Environment (SoE) Report Card 2012 includes reporting of Council's GHG emissions from facilities, vehicles and street lighting over two years,
2. A comprehensive report on Council's energy use and GHG emissions is available on the Council website under "Ten Years of Greenhouse Gas Emissions Monitoring and Reporting 2002-2012",
3. Details of Council's grants under the Community Energy Efficiency Program are readily accessible, including details on Council's website and an effective program to communicate EE and RE initiatives implemented at key public facilities such as the GSAC and the Memorial Baths

Internal Communication: The Sustainability Team will streamline communications to ensure a consistent understanding of actions and progress towards Council's targets is achieved. Existing communications include, for example:

1. Proposals to and decisions by Executive Committee on EE / RE initiatives,
2. Planet Footprint reporting
3. Energy audit reports, project analysis, RFQ / tender specifications, responses and project documentation may be held in multiple locations,
4. Applications for grant funding, re-work of applications, and responses from granting agencies

Council will continue to report and promote its efforts to reduce energy and implement renewables in a manner similar to ongoing communication methods. This will include periodic reporting of Council's progress towards its 100% self-generation target. A key purpose of this Action Plan, and of progress reporting, will be to collate accurate internal information on the progress of committed actions. It is anticipated that this will overcome barriers to information accessibility, and will help to streamline internal communications and improve the accuracy of information communicated to external audiences.

In the first instance, Council will conduct a communication needs assessment in FY14/15, so that sensible and cost-effective decisions can be taken that will meet the needs of all stakeholders.

ACTION MN5: Communication planning

- Council will conduct a communication assessment that examines the needs of a range of internal and external stakeholders, current communication methods relating to Council's energy efficiency and renewable energy actions and objectives, and identifies actions that will help to make communication as effective as possible. This will consider the type and frequency of communications, and in particular how the Sustainability Team can meet these needs via the Action Plan management process.

RESOURCING REQUIREMENTS

ACTION MN6: Resourcing

- Annually, concurrent with the Action Plan review and renewal process, Council will incorporate estimates of resourcing requirements. This will include estimated time and cost for internal and external resources to manage and implement the Action Plan.

FINANCIAL PLANNING AND ANALYSIS

ACTION MN7: Financial planning and analysis

- All business cases developed to support energy efficiency and renewable energy initiatives / projects will use a level of analysis appropriate to the proposed activity. As part of the Action Plan approval / endorsement process the estimated costs (capital and resourcing) will be summarised and presented, based on known costs (e.g. from audits or quotes) or past experience (e.g. where an opportunity has yet to be assessed). Where approved, Council will budget for these funds to be available to implement the Action Plan.

In general energy audits, or the level of analysis performed within this type of study (usually Level 2 per the AS/NZS 3598 standard), is appropriate for most projects involving moderate level of capital expenditure. The Business Cases prepared for the REMP are an example of the level of analysis performed across the key energy saving areas. However minor projects or operational changes may require much less evidence or analysis, while large-scale projects – such as a 4 MW PV system – should require a much more rigorous financial analysis at the detailed feasibility stage.

STRATEGY 2: ENERGY EFFICIENCY

ACTION EE1: Energy Audits, Assessments, Project Evaluations (Energy Audits)

- Energy audits of sites or specific opportunities are to be performed on an as-needs basis, to inform investment decisions. No audits are planned for FY14/15. Planned audits for FY15/16 (if any) are to be determined in the Action Plan development process.

ACTION EE2: Staff Engagement & Operational Savings

- The Sustainability Group will determine the most appropriate way for staff engagement in LCC's energy efficiency efforts. No staff engagement actions are planned for FY14/15. Planned staff engagement actions (if any) are to be determined in the Action Plan development for FY15/16.

ACTION EE3: Large Sites – Blakebrook Quarry

- The energy audit of the Blakebrook Quarry suggests that cost-effective energy savings of close to 60% are possible, principally by augmenting the insulation levels on tanks used for bitumen heating and changing the primary fuel source.

  The feasibility of this project will be investigated further in FY14/15 and into FY15/16, with a view to implementation in the FY15/16 or FY16/17 financial year if proven to be technically and economically viable. Context for this review will include future development work planned for the site.

ACTION EE4: Large Sites – Goonellabah Sports and Aquatic Centre

- Once the CEEP initiatives are implemented and operating it is likely that further energy reduction potential at these sites will be limited. Optimisation of the pump VSD controls (e.g. run pumps at lower frequency / speed after hours), and implementation of HVAC improvements as indicated in the GSAC audit report are to be assessed.

ACTION EE5: Large Sites – Council Administration Building

- A range of energy saving measures have been implemented at Council's head office recently, including UV-C lighting systems for ventilation, roof reflective paint, and LED lighting internally and externally. An audit found that the main cooling plant for the site was energy efficient. No further actions are identified at this time.

ACTION EE6: Large Sites – Memorial Baths

- Substantial energy saving measures have recently been implemented at the Memorial Baths, including solar hot water, LED lighting and VSD control of pool pumps. No further actions are identified at this time.

ACTION EE7: Large Sites – East STP

- Substantial energy efficiency improvements have been made at this site in recent years, including VSD control of the site's aerators, the largest energy using equipment, control of the dissolved oxygen process, LED lighting, solar hot water and the like. No new large-scale savings initiatives are currently planned. Opportunities for further optimization of energy use at the East STP will continue to be identified by staff based on relevant site and industry information.

ACTION EE8: Water & Wastewater

- The 2 x 220 kW water pumps at Ross Street use soft starters but not VSD control. Based on experience using VSDs on other water and sewer pumps it is likely that VSD control could deliver savings of 30% or more beyond the reduction in energy use already seen from FY12 to FY13.

  Other options may also exist to reduce energy use for this site, including – potentially – network optimisation that could see energy use reduced to zero at this site.

  Water network optimisation opportunities are to be investigated, and VSD control assessed if the site is to remain in use as a major WPS.

  Opportunities for further optimisation of energy use by water and wastewater services will continue to be identified by staff based on relevant site and industry information.

ACTION EE9: Street Lighting

- Upgrading street lighting to LED technology represents the single largest energy saving measure available to Council at this time. LED technology for local road lighting is approved for use in many Australian networks, and Essential Energy are expected to have an LED product that meets their requirements in FY14/15.

  Council will accordingly look to set in place a process to upgrade local road lighting to LED, timed to coincide with planned bulk lamp replacement timing. Initial action will focus on discussion with Essential Energy relating to potential timing, technology, costs and the like. A specific focus is continuing in relation to maintenance costs for LEDs and outcomes from this process, together with future maintenance costs for LEDs may influence the final business case. Council will also work with other stakeholders – Councils and/or a region of Councils – to examine relevant issues such as LED technology, rollout scale, ownership and future maintenance options.

  LED lighting for major roads is not approved at this time by energy networks or other major road lighting providers such as RMS. Council will maintain a watching brief on developments in this area. In examining future potential ownership and maintenance options Council will take into account experience of main road LED lighting elsewhere, such as City of Sydney.

ACTION EE10: LED Lighting

- LED lighting will be progressively rolled out to all of Council's facilities and public lighting. More cost-effective opportunities will be implemented first, which will include facilities such as depots, libraries, community centres and public buildings. LED lighting in public spaces such as the bus depot, car parks / underpasses, parks and walkways will be upgraded to LED over the next few years. Exit signage will also be upgraded to LED over time. A plan for sites to have their lighting upgraded to LED will be prepared annually.

ACTION EE11: Air Conditioning

- Air conditioning is a relatively large energy user at many of Council's smaller sites, and most HVAC services are provided by small packaged systems (air cooled), split systems and window-mounted units. Age, usage patterns and condition vary widely. Annually Council's Action Plan development will assess the potential to upgrade the oldest and poorest-performing systems with more modern units and controls.

ACTION EE12: PC Power Management Project

- Many PC management trials claim significant energy savings, through energy savings when desks are unattended and when computers are in use. Council will investigate solutions that could help to reduce PC power consumption without interfering with personal use or system needs.

ACTION EE13: Sustainable Procurement Policy

- Council will investigate the potential to augment and strengthen procurement policies in relation to equipment, specifically setting out guidance for minimum energy standards for stationary energy-using equipment where feasible.

ACTION EE14: Staff Training

- Council will review the skills needs in relation to energy efficiency / management of key stakeholders, and will identify training / skills development opportunities. Initial training opportunities will be identified for funding in 2015-16.

STRATEGY 3: ON-SITE SOLAR ENERGY SOLUTIONS

ACTION SS1: Solar Energy Assessments

- A number of sites have been identified to have potential for solar PV (new or augmenting an existing system), additional to systems that Council has installed. If and as required Council will verify the solar PV potential via further site assessments.

  No PV assessments are planned for the remainder of FY14/15. Action Plan development for FY15/16 will consider whether any new assessments are required.

ACTION SS2: Energy Storage

- At this time energy storage technologies are not cost effective, however costs are expected to come down rapidly in coming years. Council will maintain a watching brief on developments in this area and, at the appropriate time, will evaluate the business case for augmenting PV systems with storage, or for installing PV + storage at suitable sites.

ACTION SS3: Solar Hot Water Systems

- Most of Council's solar hot water potential has been realised, with large systems installed at the two aquatic centre and more than 10 small systems installed at high-use facilities in the LGA.

  There may be potential to expand the SHW system on the GSAC roof, and Council will seek OEH support to investigate whether there is a cost-effective opportunity to augment this system and reduce the LPG usage at the site, currently 120 kL per year. As input to this Council will determine historical gas use at the pool, prior to the SHW systems installation.

ACTION SS4: GSAC + East STP

- Implementation of solar PV at these two sites is critical to Council's ability to achieve the target of self-generation from renewables, as these are the two sites with the greatest potential. Council will take a decision in FY14/15 on the 'Farming the Sun' proposal, which could see up to 390 kW of PV installed (250 kW at East STP, 140 kW at GSAC), which would all be used internally.

  There is ample space at either site to install larger PV systems which, with energy storage, could meet a greater percent of each site's energy needs. A further 350 kW could possibly be implemented subject to assessment. In addition to PV systems and storage, covers over the East STP's decommissioned trickling tanks would be needed, increasing costs.

  This opportunity will be assessed at a later time, and would be considered together with opportunities for Virtual Net Metering (VNM).

ACTION SS5: Waste Services Facility

- Two PV systems have already been installed at this facility, including a large (<100kW) system on the roof of the new Materials Recovery Facility (MRF) and a 30 kW system on an adjacent shed roof. Subject to a further expansion of the site proceeding, a third system of 70 kW may be installed.

ACTION SS6: Council Administration Centre

- It is estimated that a 50 kW PV system can be installed on the roof of the Council admin building. Utilisation during working weekdays would be high, and a 20 kW base demand means that utilisation on weekends should also be good. Adequate N-E and N-W facing space is available to host a system of this size.

  Given the recent application of reflective paint on the building it is probable that some of the savings from this would be eroded by the implementation of PV. This will be considered when assessing this opportunity. Council will investigate the implementation of PV at this site in FY15/16.

ACTION SS7: Blakebook Quarry

- An energy audit identified an opportunity for a 20 kW solar PV system on the roof of the shed next to the asphalt plant. A review of this opportunity will be undertaken concurrent with a review of the bitumen heating system, and will take into account future plans for the site as a whole.

ACTION SS8: Lismore Airport

- A 15 kW PV system was installed at the Airport in 2014, which will serve internal demand within the terminal building.

  As energy storage becomes cheaper and more reliable in the future Council will investigate the potential for additional PV to be installed at the site to supply additional demand at the site during the main usage periods. No assessment is planned for FY14/15.

ACTION SS9: Wyrallah Rd Depot

- Several buildings at the Wyrallah Road depot may offer potential for solar PV implementation and these will be evaluated in FY15/16. Implementation in FY15/16 or FY16/17 will be considered for cost effective solutions.

  Energy storage may also be viable at a later time and will be evaluated in due course.

ACTION SS10: Community Centre, Goonellbah

- The Community Centre roof could potentially host a small PV system (est 10 kW), and with the library in use on weekdays and 'meals-on-wheels' refrigeration systems in use all of the time, utilisation of the generated electricity on-site should be high. This opportunity will be evaluated in FY15/16 with implementation considered for FY15/16 or FY16/17.

ACTION SS11: South STP

- The South Lismore STP will undergo redevelopment. Within this development Council will consider the potential for renewable energy generation to meet part of the site's energy demand. If an IDAL / IDEA plant is developed it is likely that solar PV offers the most suitable RE opportunity; if an anaerobic system is installed the potential for biogas capture and generation will be evaluated.

ACTION SS12: Library Headquarters, Goonellabah

- There is potential for a small PV system (est 10 kW) to be installed at this site, subject to assessment of the roof space. The viability of this project will be investigated in FY15/16 with implementation to be in FY15/16 or FY16/17 depending on the assessment findings.

  Storage of energy at this site may also be feasible, subject to an assessment when technology costs for storage come down. This opportunity will be investigated at a later date.

ACTION SS13: Oakes Oval & Depot Lismore

- A small PV system may be feasible on the roof of the main stand at Oakes Oval, and/or on the depot roof, to meet internal needs. On non-event days main stand demand is for lights, some air conditioning and office equipment, while on event days added load for catering, oval lighting and additional air conditioning will need to be met. Depot demand will be mainly lighting and equipment during daytimes. The roof space on the main stand is relatively small given access needs for camera equipment. The viability of this project will be investigated in FY15/16 with implementation to be in FY15/16 or FY16/17 depending on the assessment findings.

ACTION SS14: Nimbin STP

- The intermittent demand at the Nimbin STP means that an energy storage system would need to be integrated with a PV system to be useful at the site. Space on the western side of the site appears to be suitable for a solar PV system subject to assessment. As storage costs come down this opportunity will be evaluated.

ACTION SS15: Nimbin Dam

- The intermittent demand at the Nimbin Dam means that an energy storage system would need to be integrated with a PV system to be useful at the site. Space on the north-eastern corner of the site appears to be suitable for a solar PV system subject to assessment. As storage costs come down this opportunity will be evaluated.

ACTION SS16: SES Building Brunswick Street

- There is already a PV system on the SES building, and owing to the intermittent nature of use/demand at the site additional PV panels would likely only be useful if accompanied by energy storage. Stored energy could meet night lighting demand, base demand at the site or peak demand during operational periods. This opportunity will be evaluated at a later time when storage costs are much lower.

ACTION SS17: Crozier Oval

- Daytime demand at the oval is minimal or intermittent, and solar PV with storage to meet field lighting or grandstand energy demand may be viable. This opportunity will be evaluated at a later time when storage costs are much lower.

STRATEGY 4: OFF-SITE SOLAR ENERGY SOLUTIONS

ACTION LS1: Large-Scale Solar Energy Plant

- A large-scale solar PV plant would not be economically viable in its own right at this time, and all recent large PV plants have benefitted from substantial upfront or feed-in-tariff incentives. It is noted that Sunshine Coast Council is at EOI stage for a 10MW PV plant at Valdora near Coolum, which will supply 50% of Council's electricity needs.

  An indicative 3.8-4.7 MW plant for LCC would supply a similar % of Council's electricity needs.

  At this early stage the site ('turf farm') in front of the South Lismore STP appears to be a potential site, being large enough, Council-owned, close to the electricity network, north-facing. Similar to the proposed Valdora project the land is subject to flooding and this is a factor that will have to be factored into decisions and planning.

  At this stage the main actions are to, annually:

  - Community retailer establishment – LCC is an active member of the consortium putting this together and should remain involved in the development of the business plan in 2015,
  - Virtual net metering – maintain watch on developments in Byron Shire Council, and by others such as TEC, and use resources to advocate for the adoption of VNM. Council could consider the implementation of a VNM trial using GSAC and the Administration Centre,
  - Technology costs – maintain watch on developments via BREE and other sources to track improvements in the LCOE of large scale PV,
  - Grants and other incentives – maintain watch on developments and use resources to seek to influence support for renewables at Commonwealth and State levels,
  - Sunshine Coast Regional Council – Council should remain abreast of the progress of the SCRC Valdora PV project given the apparent parallels with Council's potential PV project

  At a future time, when technologies, costs, regulatory and other relevant aspects of a large-scale PV plant are resolved to a point where the business case merits review:

  - Determine additional funding / income sources
  - Conduct of a pre-feasibility study for a large-scale PV plant

ACTION LS2: Virtual Net Metering

- The approach by LCC to VNM at this time could include:
  - Maintain a watching brief on the VNM trial process at Byron, and/or
  - Joining or establishing a parallel trial, potentially using output from GSAC to be credited to the Administration Centre across the road, and
  - Maintain a watching brief on VNM developments elsewhere, such as efforts led by UTS and the *Total Environment Centre* to progress acceptance of VNM in Australia

ACTION LS3: Community Electricity Retailer

- An Expression of Interest was let to develop a viable business model for a community electricity retailer to operate in the Northern Rivers region, led by a consortium that includes Lismore City Council. A business plan is expected to be developed by mid-2015 by the successful proponent, a local organisation.

  The main action for Council at this time is to remain involved in this regional initiative, and examine the viability of locally-built renewables to use this channel to supply renewable energy to Council facilities.

ACTION LS4: GSAC + East STP

- These two sites are the most likely host sites for VNM aside from a large-scale plant.

  No action is required at this time, until issues such as VNM, community retailer, technology costs and the like have changed substantially in favour of PV developments.

ACTION LS5: Lismore Airport

- Land on the south-eastern end of the airport could possibly host a solar PV system that could meet part of the site's needs and also export – ideally under VNM arrangements – to other Council facilities. There are precedents for mid-sized PV systems on airports, including a 120 kW system at Newman Airport in WA.

  No action is required at this time, until issues such as VNM, community retailer, technology costs and the like have changed substantially in favour of PV developments.

ACTION LS6: South STP

- South STP land may also be a viable site for a PV system that is larger than is needed to meet local demand but close to most of Council's facilities such that VNM is viable.

  No action is required at this time, until issues such as VNM, community retailer, technology costs and the like have changed substantially in favour of PV developments.

6.2. Tracking and reporting on action plan progress

For reporting and tracking purposes, the sustainability team leader will liaise regularly with persons responsible for progressing and implementing actions.

For the overall action plan progress will be tracked via regular meetings or discussions with responsible persons or groups. This is illustrated below for Strategy 1: Management Actions.

Table 22: Example of action planning reporting template

Strategy	Action	Tasks for 2015-16, including 2014-15 tasks	Responsibility (individual or Group)	Target Date
Strategy 1: MANAGEMENT ACTIONS	**ACTION MN1: Energy Management Action Plan Development**	LCC to create a process for developing energy efficiency projects to be included in the Action Plan and budget for FY15/16 and subsequent years.	TBC	28/02/2015
		An Action Plan and budget for FY15/16 will be developed in early 2015 and endorsed by Council's Executive.	TBC	30/04/2015
	ACTION MN2: Overall Performance M&V	Council will seek to improve the rate and accuracy of energy use and cost data entry into Planet Footprint. Council will also seek to have MWh of electricity generated from renewable energy sources entered into Planet Footprint in a timely manner.	TBC	30/06/2015
	ACTION MN3: Project Performance M&V	At this stage the employment of more complex analytical tools is not planned, such as those based on the International Performance Monitoring and Verification Protocol (IPMVP), e.g. M&V resources developed by OEH. The need for project-level M&V will be evaluated on a case-by-case basis by Council.	TBC	30/06/2015
	ACTION MN4: Project Tracking	An excel spreadsheet will be the main tool used to collate and record project ideas and committed actions. This will also be used to track progress on a 'day-to-day' basis. Periodically project data (descriptions, dates, costs and benefits) will be uploaded from Excel to Planet Footprint, so that implementation and planned project information is accessible to users with the requisite access, and so that	TBC	30/06/2015

		professional reports can be created easily.		
	ACTION MN5: Communication planning	Council will conduct a communication assessment that examines the needs of a range of internal and external stakeholders, current communication methods relating to Council's energy efficiency and renewable energy actions and objectives, and identifies actions that will help to make communication as effective as possible. This will consider the type and frequency of communications, and in particular how the Sustainability Team can meet these needs via the Action Plan management process.	TBC	30/04/2015
	ACTION MN6: Resourcing	Annually, concurrent with the Action Plan review and renewal process, Council will incorporate estimates of resourcing requirements. This will include estimated time and cost for internal and external resources to manage and implement the Action Plan.	TBC	30/04/2015
	ACTION MN7: Financial planning and analysis	All business cases developed to support energy efficiency and renewable energy initiatives / projects will use a level of analysis appropriate to the proposed activity. As part of the Action Plan approval / endorsement process the estimated costs (capital and resourcing) will be summarised and presented, based on known costs (e.g. from audits or quotes) or past experience (e.g. where an opportunity has yet to be assessed). Where approved, Council will budget for these funds to be available to implement the Action Plan.		30/04/2015

In addition to these fields, the sustainability team leader will track additional metrics, including:

- Performance measures
- Progress updates (arising from routine meetings), and
- Corrective actions

There may also be a need for a more granular task or project tracking tool that augments the higher-level action plan. For example, energy assessments may be scheduled for several sites, and LED lighting upgrades may be planned for several sites. Tracking these via a project register that records additional details such as specific timing, delegated responsibility, budgets and expected savings per site, may be helpful from a monitoring perspective, and will allow information uploaded into Planet Footprint to be as detailed as possible. An example of how this might look is shown below.

Table 23: Example of project tracking template[21]

EE AND RE PROJECT TRACKING

Action ID	Description	Responsibility	Planned start date	Planned completion date	Electricity Savings - MWh p.a.	Gas Savings - GJ p.a.	Energy cost Savings $ p.a.	Other cost savings (eg. Maintenance) $ p.a.	Total savings $ p.a.	Capital cost of opportunity	Payback period (years) or IRR%	GHG savings tonnes CO2 p.a.	Energy Saving Certificates Generated	STATUS (Implemented, Planned, or Not to proceed)
ACTION EE1: Energy Audits, Assessments, Project Evaluations (Energy Audits)	Audit of GSAC solar HW	X.Y	30/01/2015	30/06/2015	0	0	$ -	$ -	$ -	$ 2,500.00	0%			
	Audit light count at Site 1 for LED upgrade	A.B	21/02/2015	30/06/2015	0	0	$ -	$ -	$ -	$ 1,000.00	0%			
	Audit light count at Site 2 for LED upgrade	A.B	21/02/2015	30/06/2015	0	0	$ -	$ -	$ -	$ 1,000.00	0%			
ACTION EE10: LED Lighting	Implement LED at site 3	C.D	25/05/2015	30/06/2015	22	0	$ 5,500.00	$ 850.00	$ 6,350.00	$ 18,000.00	2.83 Years			
	Implement LED at site 4	C.D	25/05/2015	30/06/2015	12	0	$ 3,000.00	$ 600.00	$ 3,600.00	$ 14,000.00	3.89 Years			
	Implement LED at site 5	C.D	25/05/2015	30/06/2015	16	0	$ 4,000.00	$ 650.00	$ 4,650.00	$ 16,000.00	3.44 Years			

[21] Note that this template is adapted from the NSW Office of Environment and Heritage's Energy Saver project tracking template

APPENDICES

Appendix A: summary of RE technologies considered and Council sites evaluated

Solar technologies

At the outset of the work it was evident that solar technologies were likely to be to the fore when considering options available to meet Council's 100% self-generation target from renewables.

Solar PV

Even though Lismore receives less insolation than central and northern Australia the sun is still a significant resource for energy generation. The following table shows the applicability of solar PV to Lismore City Council:

Table 24: The suitability of solar PV

Site requirements	• Ideally shade free • North facing (optimal: NE to NW aspect) • Ideal for rooftop and flat land • Generation typically requires regular daytime building electricity use on site to be economically viable.
Challenges	• Some properties are not suitable for solar PV (suboptimal installations would be sloping roofs with a W to NW and E to NE aspect) • Uncertainty about the Renewable Energy Target and associated RECs • Exporting to the grid only attracts a ~ 6¢ feed-in tariff • Virtual Net Metering currently not possible • Getting a discounted DUOS charge
Opportunities	• Solar PV on roofs represents the biggest single renewable energy opportunity for LCC. Solar PV is viable on a number of Council properties. • Solar PV can also be undertaken at a larger scale, incl. ground-mounted solar farms
Cost of RE versus grid	• On par / comparable already, costs still decreasing
Peak demand reduction	• Yes

Solar hot water

Even though Lismore receives less insolation than central and northern Australia the sun is still a significant resource for heating applications. The following table shows the applicability of solar hot water to Lismore City Council:

Table 25: The suitability of solar hot water

Site requirements	• Ideally shade free • North facing • Ideal for rooftop
Challenges	• Some properties are not suitable for solar hot water
Opportunities	• Viable with appropriate site (e.g. aquatic centres) • Council has already implemented most of its major solar HW opportunities • Potential to expand the GSAC system?
Cost of RE versus grid	• On par / comparable
Peak demand reduction	• Yes

These technologies were examined at all sites that were visited and/or reviewed as a matter of course. The summary below gives an insight into the types of sites/assets owned by Council and the initial solar assessments made to inform the first consultation workshop.

Water supply

Sites associated with the supply of water to the Council's residents and businesses are typically either dams lying outside built-up areas or reservoirs located within built-up areas. A key strategy adopted by Council, and other water authorities to manage energy costs, is to run their large time-of-use pumping systems and stirrer motors during offpeak times, typically at night. A natural consequence of this is that energy use during daytime hours, when solar energy can be generated and used, tends to be low and/or intermittent.

As such, the assessment of solar PV opportunities in the water supply network are mainly related to the amount of physical space that is available to host PV arrays that would be used to meet the electricity needs of other Council sites using a VNM model.

Based on the initial desktop and site assessments the following are possible opportunities for PV on water supply sites:

Figure 29: City View Drive Lismore – aerial view

This reservoir appears to be sited on a substantial block of land that is owned by Rous Water. The reservoir itself appears to be sizeable and has a flat lid, though advice is that this could not currently hold a PV system. The tank appears to be comparable in size to the decommissioned drip filter tanks at the Wyrallah road STP. This would mean the top surface could be 700-1200m^2 (30-40m diameter), and subject to use of the roof may be suited to a north-facing PV array up to 100 kW capacity[22].

Land of similar size appears to be available in front and at the rear of the reservoir, potentially tripling the installable capacity to 300 kW. The land at the front of the site is shown below.

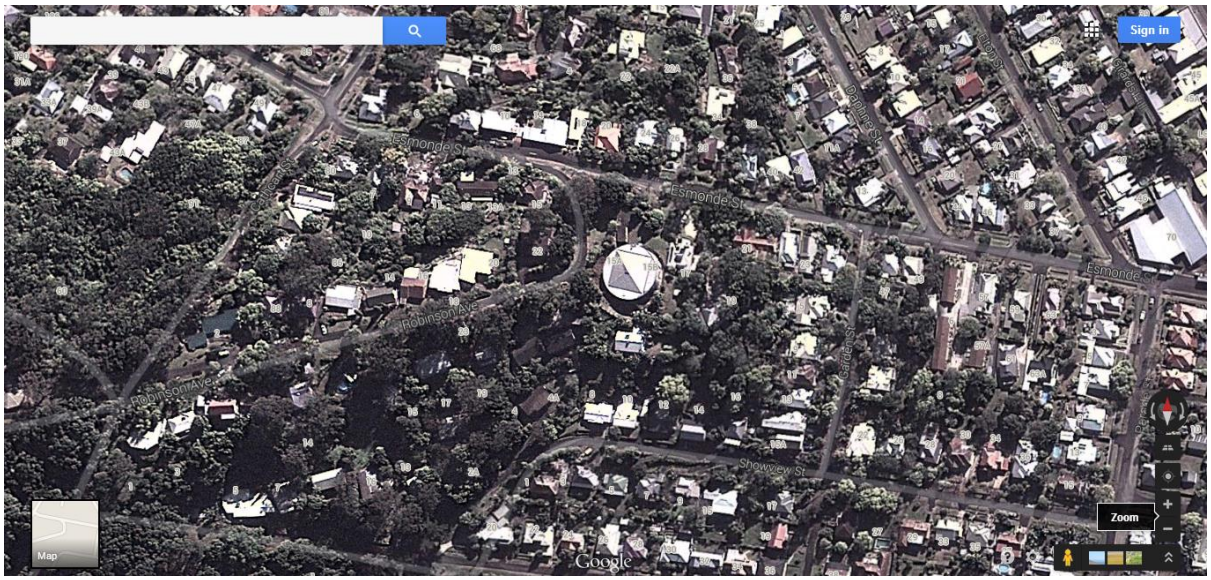
[22] http://www.pv-tech.org/news/qatar_to_use_water_reservoir_rooftops_for_solar

Figure 30: City View Drive Lismore – front view

Figure 31: Nimbin Dam site, Cecil Street Nimbin

Discussions with LCC staff indicate that the Nimbin dam site would be suited to solar PV, with space available in the northern corner dam that is north-facing and unshaded.

Figure 32: Esmonde Street Reservoir, Lismore



This reservoir is in a residential area and on a small block of land, with no ground area appearing to be available to site a PV array. The shape of the roof appears to limit the potential for PV excepting the north facing slope. Any PV system would be very small and assuming night operation of the main equipment, is unlikely to meet onsite energy demand. The size and use of the roof (for access) and the utilisation of energy at the site would need to be confirmed.

Figure 33: Ross Street Water Pumping Station, Lismore

This reservoir is in a residential area and on a small block of land. The land slopes quite steeply, and the land area around the reservoir is used for vehicle access. As such it did not appear that the land

was a suitable place to site a PV array. The shape of the roof appears to limit the potential for PV excepting the north facing slope. Any PV system would be very small and as the main 220 kW pumps are known to operate in offpeak times, will not meet onsite energy demand. The size and use of the roof (for access) at the site would need to be confirmed.

Recreation, parks & gardens, ovals, amenities

Around 45 of Council's electricity-using sites fall into these asset categories. Electricity use in FY13 was 1,727 MWh, of which 85% or 1,475 MWh was consumed by just two sites, being the Goonellabah Sports and Aquatic Centre (GSAC) and the Lismore Memorial Baths. Both of these sites have undergone significant energy efficiency improvements. Other sizeable energy using sites include Oakes Oval and the Nimbin swimming pool. Electricity use by most other sites is very small.

Solar potential includes:

- Onsite generation and use at large sites including GSAC and Baths (incl. PV and hot water)
- Generation and export, mainly at GSAC but looking at potential space at smaller sites, and
- Onsite generation and use at small sites

Figure 34: Goonellabah Sports and Aquatic Centre

The sloped curved roof faces N-N-W, excellent for solar PV. Some solar hot water panels are already located at the northern end of the roof. GSAC is one of the sites proposed for installation of a 99 kW solar PV array, with the project's site assessment suggesting that up to 200 kW could sit 'behind-the-meter'. Load profile curves for the site show that 100 kW can easily be used on site. While peak demand can 'spike' to over 200 kW, typical daytime demand is around 70-150 kW.

The maximum capacity that could potentially be installed is greater than this. Initial estimates suggest the roof could host up to 500 kW, though with the solar hot water system currently installed at the front of the building this could be reduced, say to 400 kW. An engineering report would be needed to determine what the Centre's roof can hold.

Figure 35: GSAC Electrical load profile across four seasonal periods

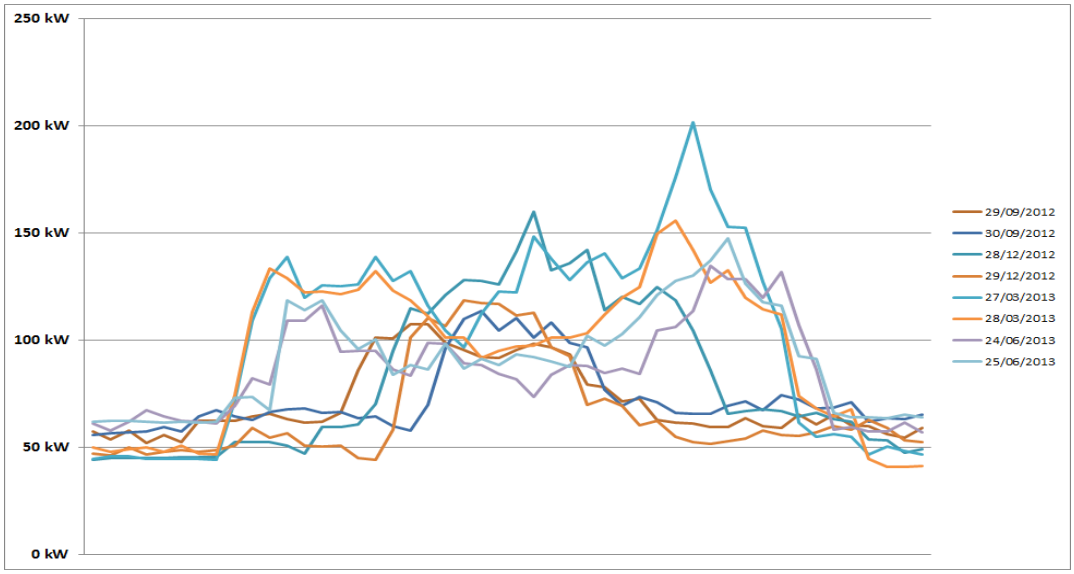
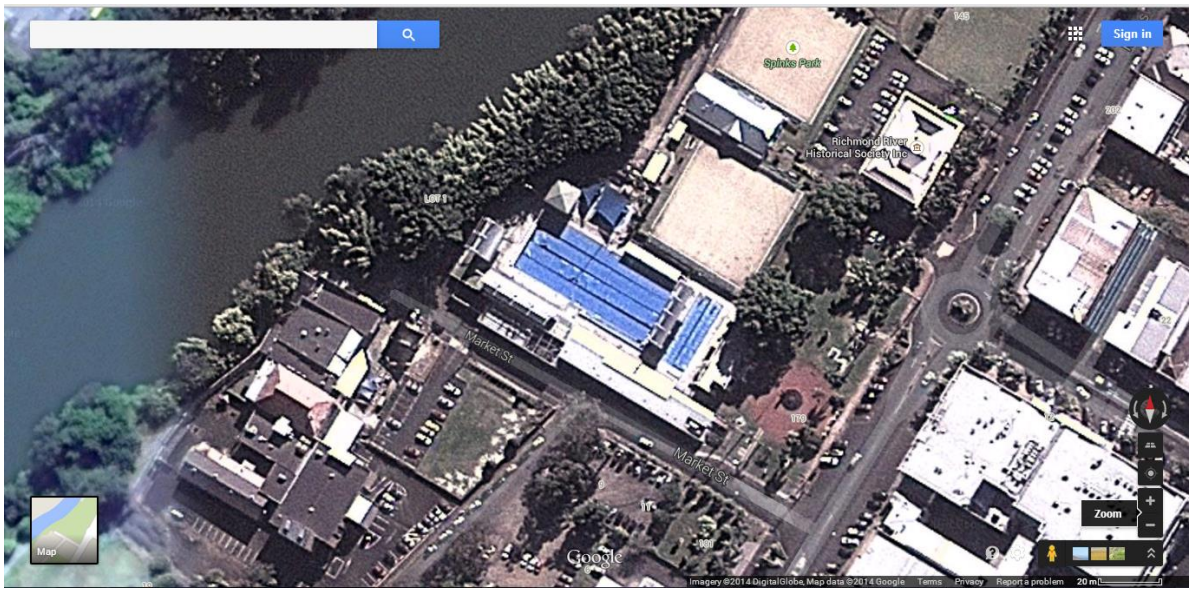


Figure 36: Memorial Baths, Lismore



A solar hot water system, using evacuated tube technology, was recently installed on the roof of the timber frame on the S-E corner of the facility. This will supply much of the pool heating needs of the facility. This system will extend to half-way along the 50m pool.

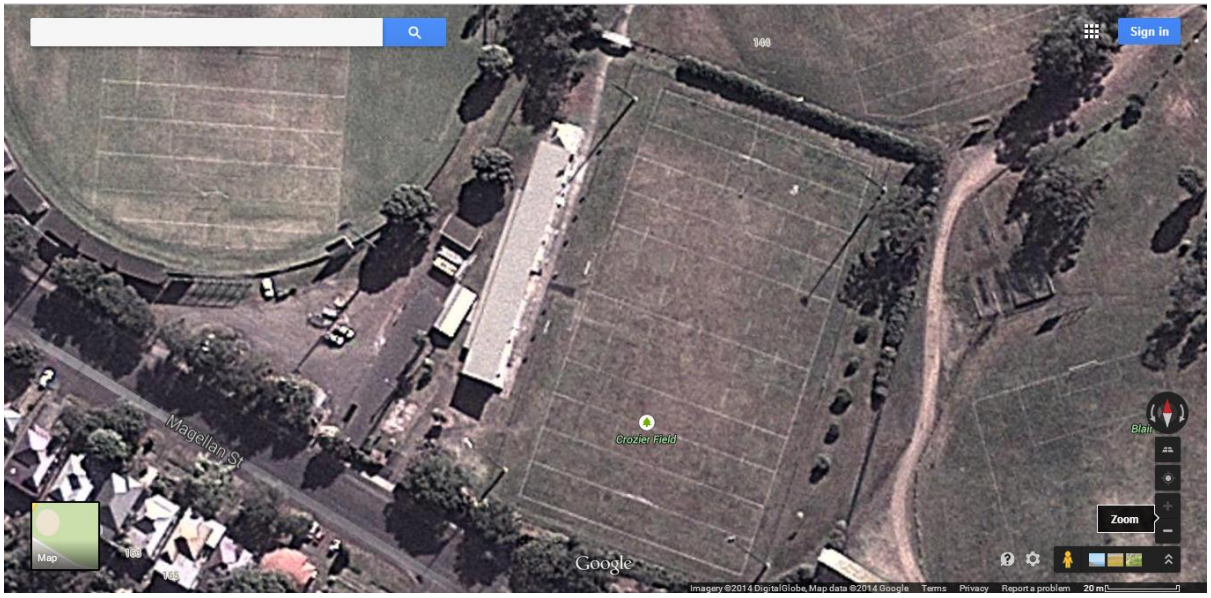
At the S-W end of the pool a large steel structure holds an awning and provides a limited amount of shade over concrete steps. The N-E end of the pool has a 20-25m covered area. If solar PV is to be viable at the Memorial Baths then it is likely that these two locations need to be considered. An array may be able to be mounted on the N-E covered area subject to assessment of roofing. A more detailed assessment of the larger shade on the S-W side would be required, to examine if solar can be integrated within the existing steel structure, or if an extension of the structure to hold the solar hot water system is possible so that PV can be accommodated (flat or sloped). The heritage status of the current shading is unknown.

It is likely that the maximum solar PV capacity that could be installed at the Baths is 17-20 kW. The main potential issue here is the ability to mount PV on the S-W awning, or to modify this so that PV can be accommodated. Apart from heritage, structural or other issues, the added cost to modify the existing structure or integrate PV with it would not be trivial and would affect the economic viability of the project.

Figure 37: Oakes Oval, Lismore

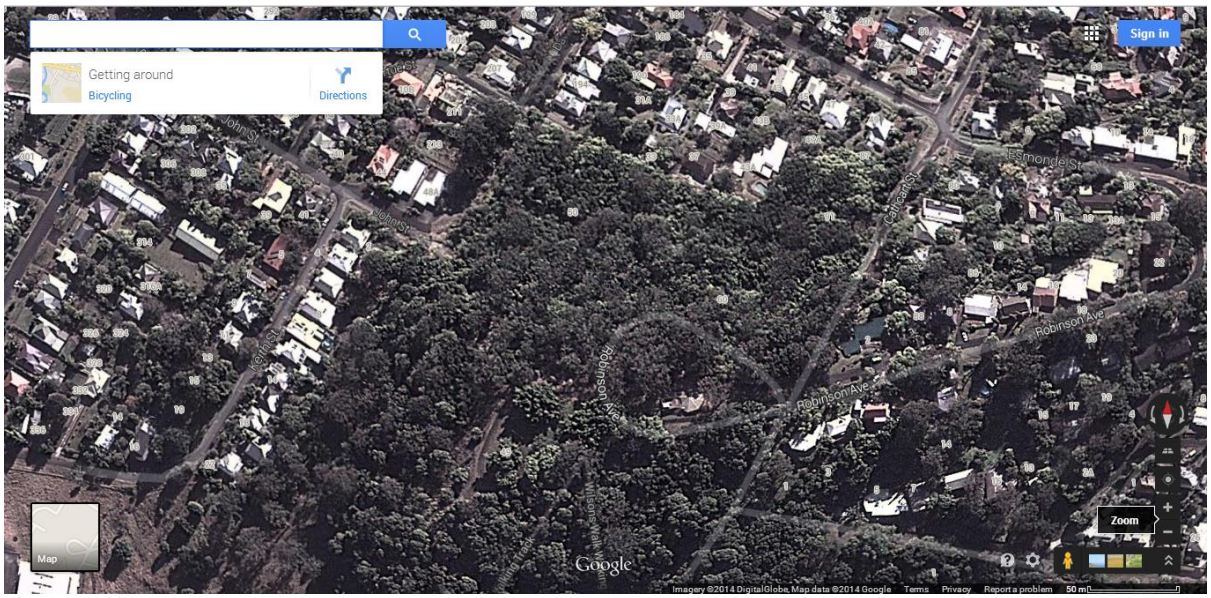
Oakes Oval energy use includes some daytime use for lights and air conditioning, though the majority of the energy used is for floodlighting (night) and catering equipment for events. The bulk of energy use is therefore intermittent, and a small amount is likely to be drawn on working weekdays and weekend daytime. As such a small PV system – e.g. 10 kW – on the North facing roof of the main grandstand could potentially supply some of the daily onsite demand.

Figure 38: Crozier Field, Magellan Street Lismore



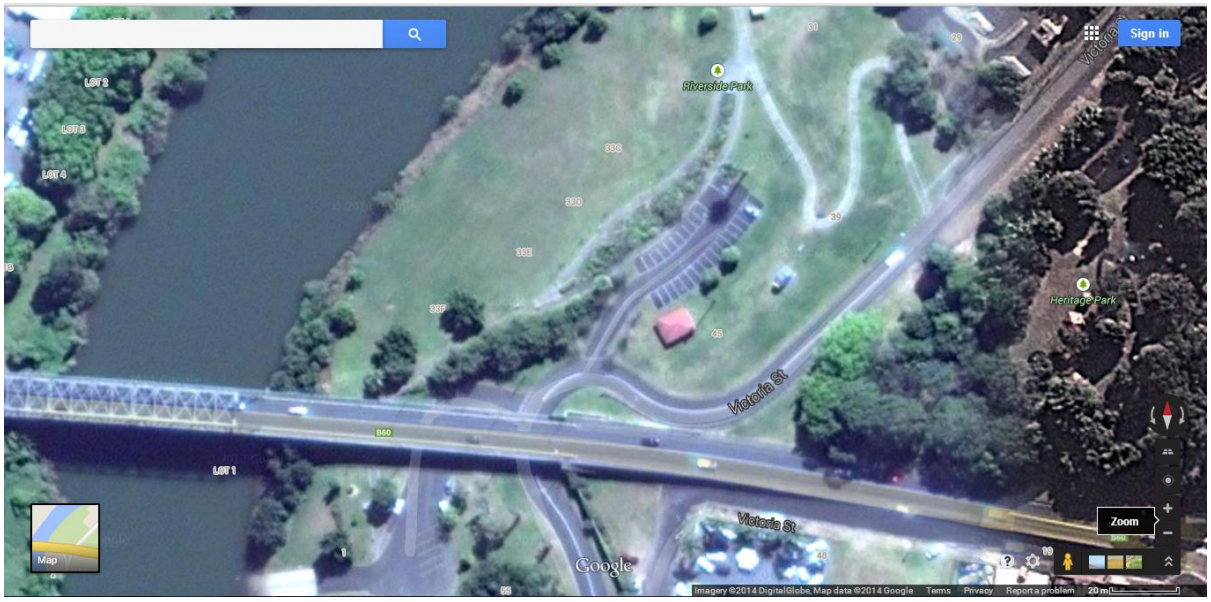
Crozier Field appears to be among the most promising sites for PV at local sporting fields. The grandstand faces N-N-E and has a flat roof. It appears to be around 70m long by say 6-8m deep, giving an area of 400-500m^2. It is likely that most electricity use is for lighting that would operate at night. As such we would consider the site to have negligible potential for PV to supply site-only demand without storage (or VNM).

Figure 39: Robinsons Lookout, Girards Hill



This site appears to be surrounded by trees and it is unlikely that solar PV would be viable.

Figure 40: Victoria Street (Riverside Park?) (including amenities block?)



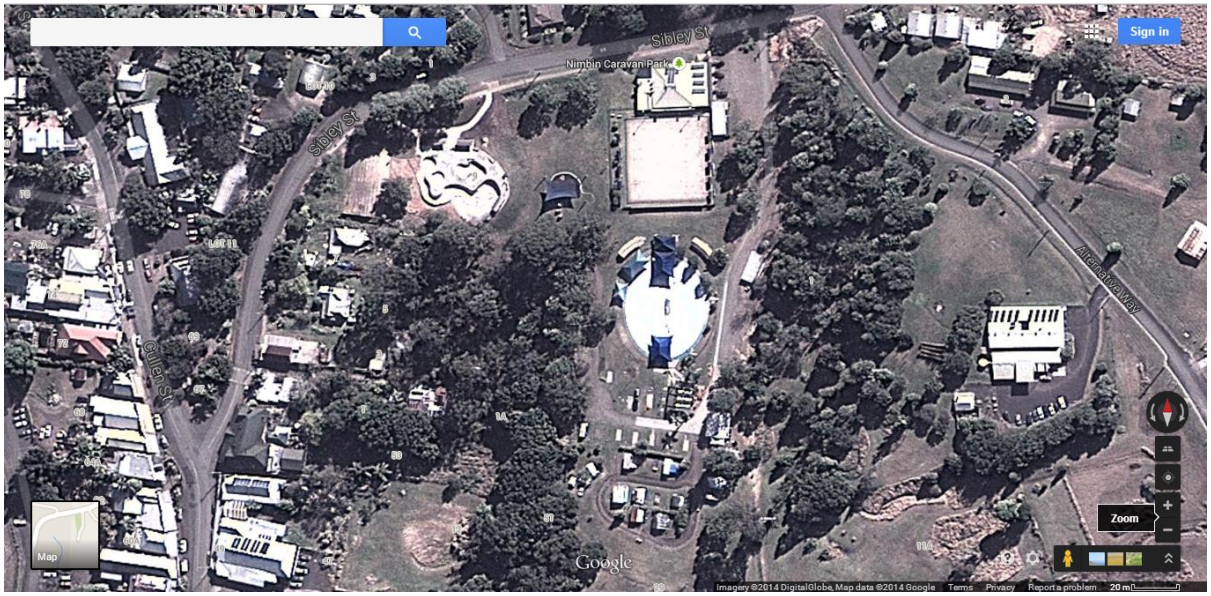
There appears to be few built facilities on this park, with the exception of a small amenities block next to the carpark. Electricity use may be mainly related to public lighting. There appears to be limited or no potential for solar PV.

Figure 41: Hepburn Park Holland St Goonellabah

This park is located next to the Lismore Workers Sports Club. A number of lighting poles surround the sporting fields, and a small clubhouse is located in the grounds. These are presumably the main consumer of electricity. Given energy use is low, and that field and clubhouse energy use (evenings,

night, weekend) will account for most of the energy use, it may be that there is insufficient working weekday consumption to make this viable.

Figure 42: Nimbin Swimming Pool, Sibley Street Nimbin



This site does not appear to have suitable sites for hosting PV systems. A small array appears to be located on the roof of the Caravan Park building fronting Sibley Street.

The last few examples above illustrate that, apart from the major recreation sites and ovals with grandstands, the potential for solar PV at other sites within these asset classes appears to be small.

Wastewater treatment

Management of wastewater involves two main types of facility. Sewer pumping stations (SPS) are usually located within populated areas, and these pump waste to sewerage treatment plants (STPs) located outside of built-up areas. Data show 35 electricity accounts, which together consumed 2,228 MWh in FY13. Of this 71% was used at the Council's major STP at Wyrallah Road (East STP). The top six energy using sites consumed 88% of all wastewater treatment electricity use. These six sites include three WTPs and three SPS located within Lismore.

SPS sites' energy use is mainly from pumps, with lesser amounts of energy used by lights and air conditioners, usually in switchboards. Energy use is on-demand, but is likely to be highly intermittent. Pumps tend to have 'typical' flow energy use as well as 'peak flow' operation, meaning demand can

'spike' from time to time. The pattern of energy use is such that solar PV is unlikely to be a viable solution to meet onsite demand. In addition, the small footprint of the sites means that there is little land that could be used to install an array that could export energy.

WTPs on the other hand are likely to have a more continuous operation of energy systems with higher daytime demand than night time. They also tend to be situated on large land areas. These factors make PV a more attractive proposition for supplying site electrical demand, although the 24-hour operation of the sites means that only a small fraction of total demand can be met by a PV system without storage of energy. These sites may also be more attractive as host sites for larger systems if energy could be exported to other sites. An outline of the desktop and site-based initial assessment of PV potential is given below.

Figure 43: South Lismore Sewerage Treatment Plant (South STP)

The South STP uses a trickling filter process to treat waste. 'Solid' waste is collected in two digesters and anaerobically treated, while treated water goes to the settling ponds on the northern side of the plant before re-entering the water system.

Plans are in development to upgrade the plant, which may result in a completely new aerobic plant build, or could involve an upgrade to the existing process, although a trickling plant has not been approved in NSW for several years.

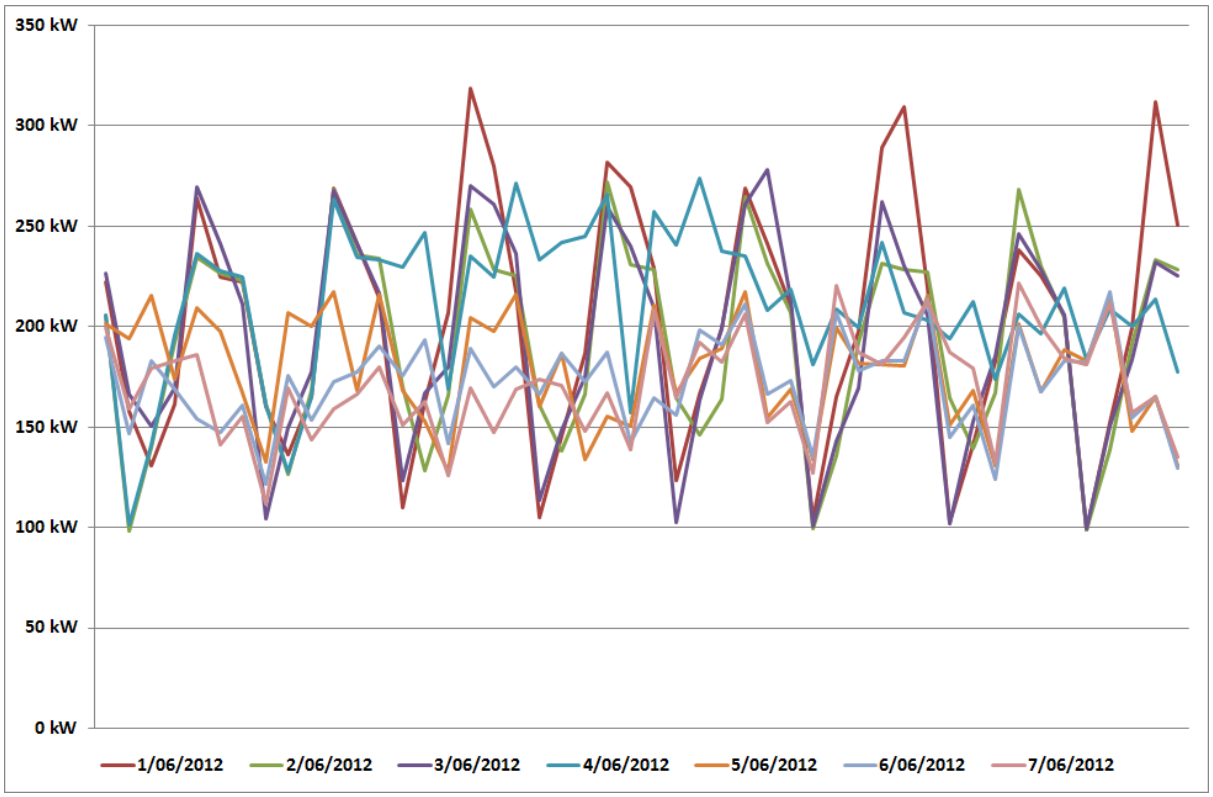
Given near-term uncertainty about what work will be done on the site it is not feasible to suggest a location or scale for any solar PV system. Given the size of the land and the RE target however, it would be reasonable to think that planning for the site should include PV development, whether to serve site needs only or to be large enough to allow export to other Council sites.

Figure 44: Wyrallah Road Sewerage Treatment Plant (East STP)

The East STP is one of two sites earmarked for a solar PV system as part of a current proposal to Council. It is proposed that two arrays will be installed, both on the east side of the land. This will include an array mounted on the north-facing roof of a newly-constructed shed at the N-E corner, on-ground and/or other roof spaces. It is proposed that the PV system will be up to 100 kW, but could be 150 kW or more.

Load profile data for the site in FY13 show that a 100 kW system will have its full output utilised by the site. Peak demand infrequently drops below 100 kW; there were just 125 hours during which this occurred during the whole of FY13.

Figure 45: East STP Electrical load profiles from June-2012



Based on both the size of the land area and the load profile for the site, there is potential for more than 100 kW of PV to be installed. Load profile data suggest that a 150-200 kW system could be expected to be near fully utilised within the site – i.e. installed 'behind-the-meter'. A system with greater capacity would need to be able to export power to other Council sites using a VNM model.

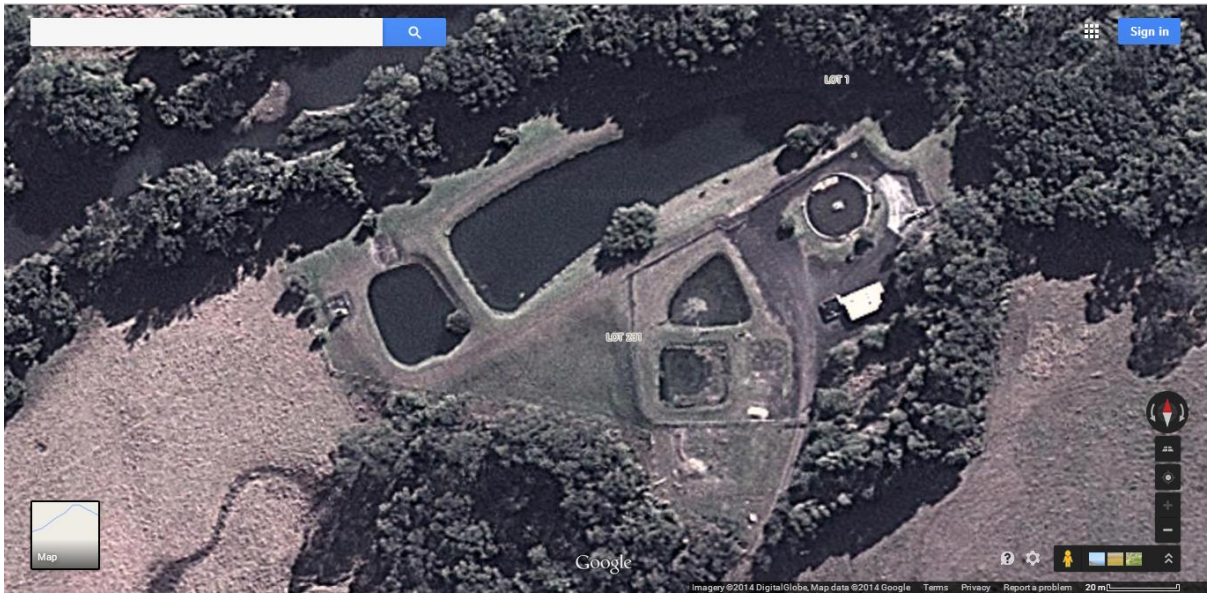
In terms of land availability at the site we understand that the sloped area near the landfill / MRF, and the flood levy wall may not be suitable for PV owing to land stability. However, the three tanks directly to the north-west of the bio-solids plant could potentially be used. Two of these tanks are decommissioned while the third receives leachate from the adjacent landfill.

For each of these tanks an added cost will be incurred to install an awning on which a PV array could be mounted. Estimated costs for the two decommissioned tanks were received at around $100,000. A competitive tender process may lower this somewhat, however it is fairly clear that this would be a significant expense that will affect the economic viability of such a project.

The use of all three of these tanks could potentially allow a further 300 kW of solar PV to be installed, with a fraction of this used onsite. The majority would have to be exported.

No other locations on the site were identified that might be suited to PV installation.

Figure 46: Nimbin Sewerage Treatment Plant

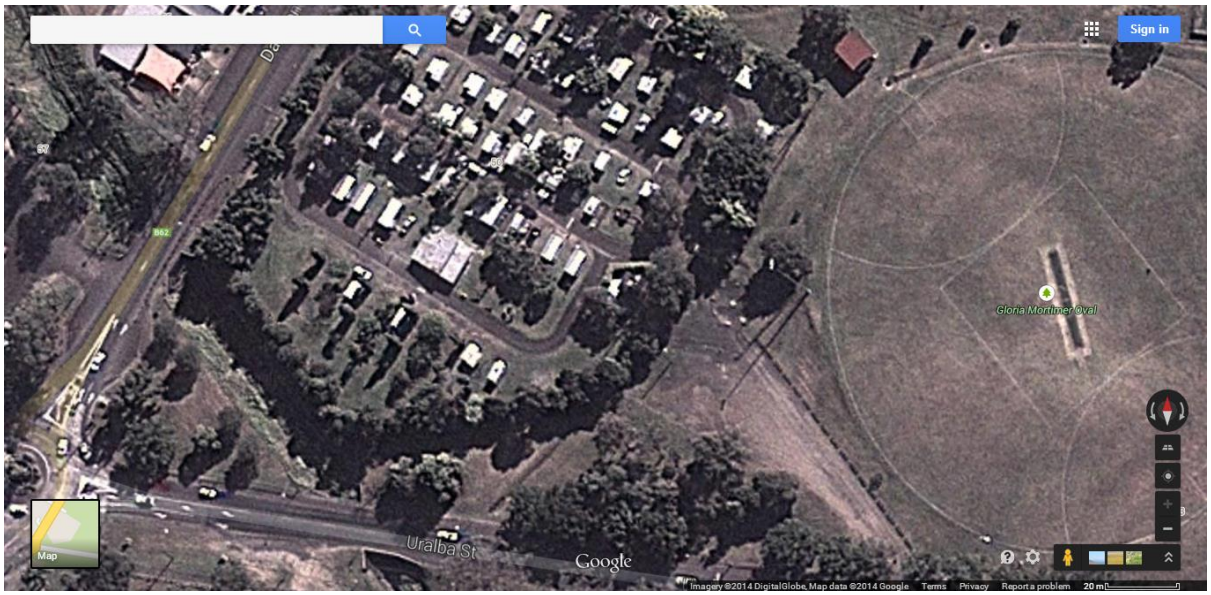


The Nimbin STP is a small user of electricity, consuming just 40 MWh in FY13, an average demand of less than 5 kW. Electricity use is intermittent, and as such it is unlikely that a PV system would be considered in order to meet on-site needs. However, the land on the western side of the site below the two ponds may be suited to the installation of a north-facing PV array; the site visit suggested this area may be suited to a system of 50-60 kW. A VNM model or storage would have to be in place and allow for 'export' to other Council sites or use on site as-needs. The relatively large distance from the site to most of Council's sites could be a barrier to VNM.

Figure 47: Wade Park SPS, Lismore

The land around the building, housing 2 x 75/150 kW pumps, is not Council's, limiting PV potential.

Figure 48: Dawson Street SPS, Lismore



In this aerial picture the Dawson Street SPS is located between the caravan park and the sports oval. Within the fenced compound there is very limited if any space to install solar PV systems. The SPS and the retention tank occupy most of the land area, and vehicle access is required, leaving no available land for other uses.

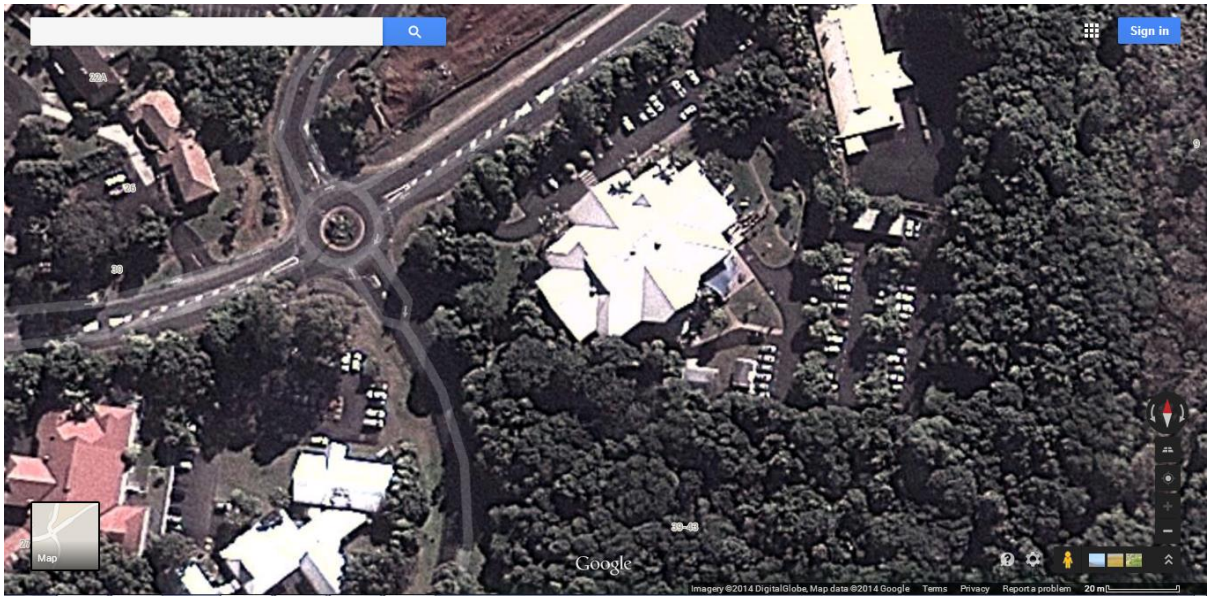
Buildings and facilities

In FY13, 33 Council buildings and facilities consumed 1,880 MWh of electricity. 52% was consumed by the Council Administration Building on Oliver Ave Goonellabah and the Blakebrook quarry. A further 25% of electricity (460 MWh) was consumed by six sites that each consumed more than 50 MWh. In recent years several sites have had PV systems installed, such as the Art Gallery, the SES building and the Brunswick Street depot. The 'facilities' in the portfolio include the quarry and the MRF on Wyrallah Road, and solar PV opportunities at these sites will be site-specific.

This initial desktop and site-based assessment of solar PV potential has looked at the following sites:

- Council Administration
- Library Magellan Street
- Wyrallah Road Depot
- Brunswick St Depot
- Community Centre, Goonellabah
- Lismore Airport Terminal
- Library HQ Goonellabah
- Lismore Neighbourhood Centre
- Tourist Information Centre
- SES Building
- Art Gallery
- CBD Depot, Molesworth Street
- Blakebrook Quarry
- MRF / Waste Facility

Figure 49: Council Administration Building, Oliver Ave Goonellabah



Some N-W and N-E facing sloped roof space may be available to host solar PV; an estimated 50 kW can be installed. The recent energy audit report noted that an assessment of the roof soundness may be warranted.

Figure 50: Library, 115 Magellan Street Lismore

Some N-W facing sloped and flat roof space may be available to host solar PV, including sloped and flat-roof arrays. Fitted flush to the sloped N-W roofs and flat at the rear of the building an estimated 10 kW can be installed. A recent energy audit report (accompanying Excel spreadsheet) noted that the roof may not be suited to the installation of a PV array, so this would require verification. The audit report noted that the heritage of the building may limit / prohibit certain installations, and this could possibly extend to PV.

Figure 51: Wyrallah Road Depot

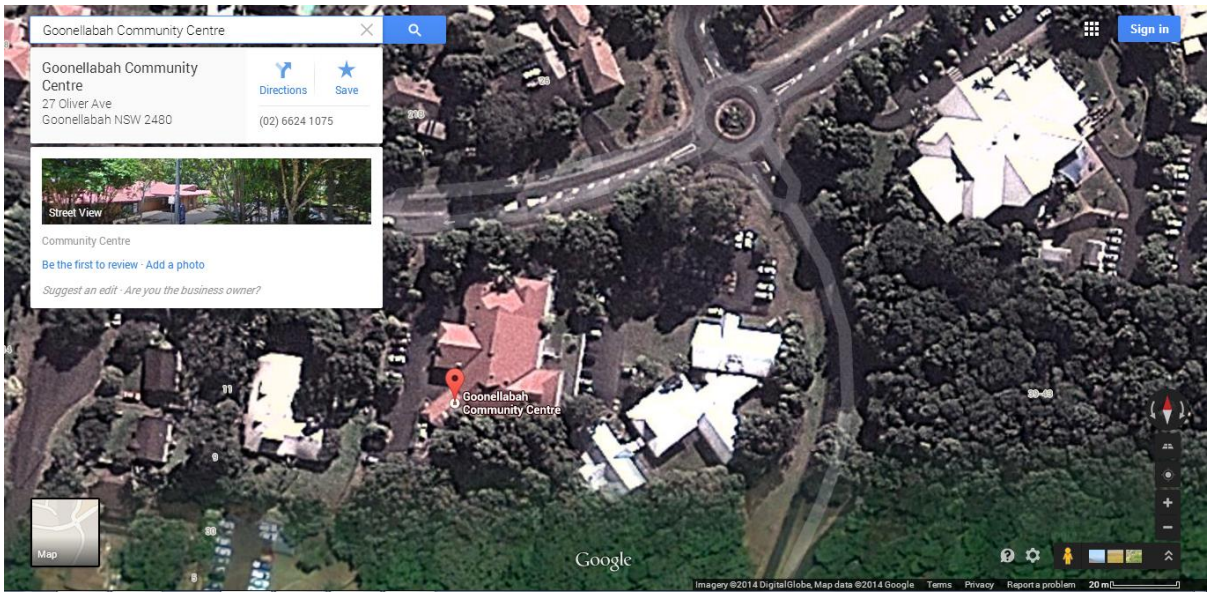
The majority of the buildings on the Wyrallah Road depot site have a N-S orientation, meaning most roof space faces east or west. 'Available' land to mount a solar PV array looks limited but would require assessment. Solar hot water was installed on one of the buildings in early April 2014.

Of the seven main buildings on site the middle building's roof slopes to the north and may be suited to a small PV array of about 5 kW. It is possible other roofs could support PV systems mounted on frames. A total site capacity of 50 kW may be possible.

Figure 52: Brunswick Street Depot

The Brunswick Street depot has two 5 kW (9.62 kW total) PV arrays located on its western side buildings, installed during 2010. We understand there is capacity on the eastern building to accommodate the same capacity again.

Figure 53: Community Centre Goonellabah



The community centre includes a library, space leased to community organisations, meeting rooms for hire, and amenities. The major roof spaces slope to the east and west. The site looks to be a good candidate for a small PV system.

Figure 54: Lismore Airport Terminal

Figure 55: Solar PV system at airport in Canada

[23]

The airport site has two areas where PV systems could be established. The roof of the terminal building recently saw a 15 kW system installed.

The land within the airport could also be potentially attractive, with our initial view of the site suggesting the grass area directly south of the terminal building may be the most suited to implementation of a PV system. Initial discussions with the *Civil Aviation Safety Authority* (CASA) suggests that there is no specific policy or approach to PV systems in airports (Grafton has a 10 kW on-ground system and Newman in WA has a much larger roof-mounted system). However CASA could seek to ensure that any proposed array satisfies their CAR-94 requirement relating to 'the extinguishing of bright lights' – i.e. any system should not produce excessive glare that could be a safety hazard.

A first appraisal suggests an array on the south side of the airport might be feasible. The runway direction is SE-NW and a north-facing array would be directed somewhat away from take-off or landings from the NE. The land size appears fairly large and could possibly host a system of over 1 MW.

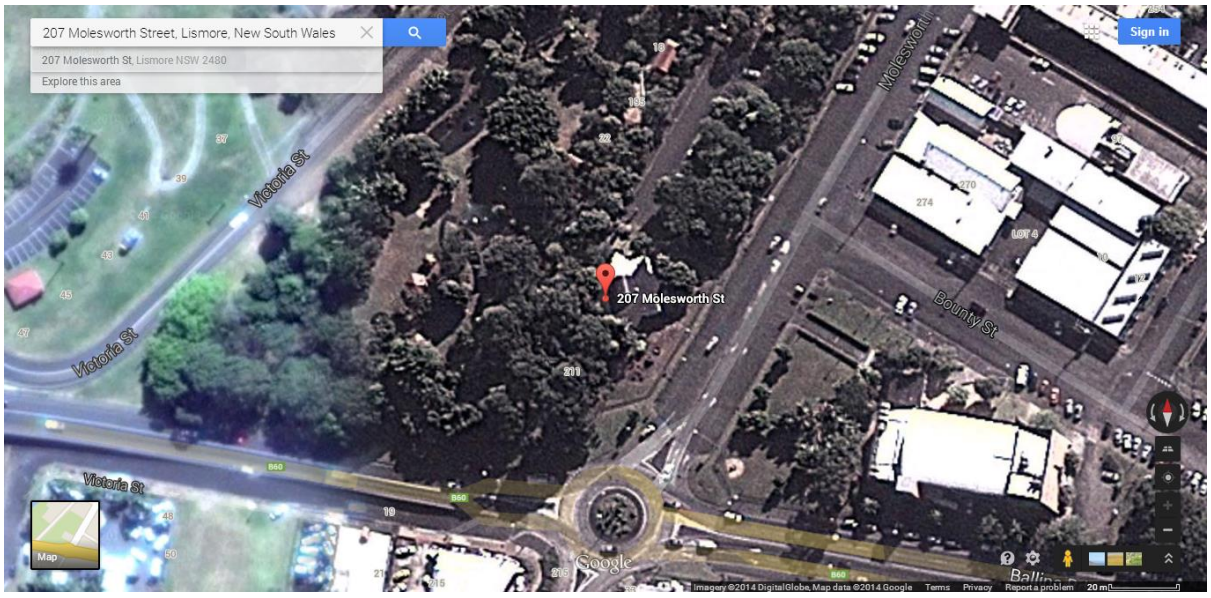
Other issues that would need to be considered include the possibility of a VNM model and the low level of the land on the south side of Lismore – i.e. whether or not a flood risk applies.

[23] http://reneweconomy.com.au/2013/airport-25705 An 8MW solar array at Thunder Bay airport in Ontario, Canada

Figure 56: Library HQ, Centenary Drive Goonellabah

The library HQ building was not visited as part of the initial investigations. Aerial shots of the site suggest that solar PV could be implemented.

Figure 57: Tourist Information Centre / Heritage Centre



This building appears to be extensively shaded by trees and therefore unlikely to be a candidate site for solar PV.

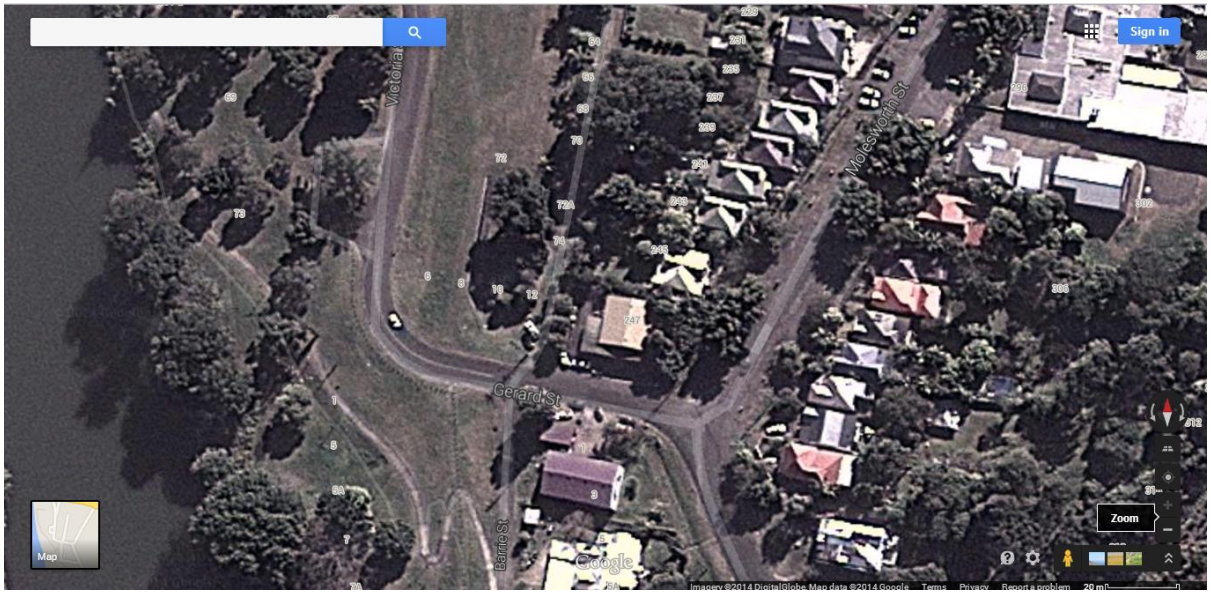
Figure 58: SES Building

The roof facing Brunswick Street already has a PV array installed, and this looks to be the most attractive location on this building. The shed at the rear of the site may offer added PV potential, though storage may be needed as the use of the site is intermittent.

Figure 59: Art Gallery

The roof of the gallery already has a PV array installed. It is unclear from the aerial image whether or not added PV potential exists.

Figure 60: CBD Depot, 247 Molesworth Street Lismore



This building's roof slopes towards the East and West directions and the pitch is quite shallow. A very small PV system could potentially be installed, though time-of-use of the site would need to be confirmed.

Figure 61: Blakebrook Quarry

A recent audit of the Blakebrook Quarry recommended a 20 kW solar PV system be considered, to be mounted on the shed behind the bitumen tank heating farm. A key issue to consider for a PV system

at the quarry will be dust, and its impact on array performance, as well as impact on maintenance costs.

Figure 62: Wyrallah Road Materials Recovery Facility (MRF)

The MRF recently undertook a tender process to select a supplier to install up to 165 kW of solar PV on the roofs of the MRF and other facilities. The majority of this capacity is to meet future demand for the newly-commissioned MRF. The site's management is reviewing further potential for PV at the site that could meet the needs of a yet-to-be-built processing site parallel to the new buildings.

Other potential solar PV host sites

This initial review of Council-owned sites has also identified two sites that may offer potential in terms of hosting of large-scale solar PV systems (or Concentrating Solar Technology). Sites include:

- Old quarry site on Three Chain Road, across the road from the South STP. An electrical substation is adjacent to this site. While fairly large, a water body, extensive tree coverage and uneven terrain may limit the total area of land that could be used. At this stage we estimate that up to 1 MW could be possible.
- 'Turf farm' land in front of the South STP – aerial maps suggest a site of around 30 Ha, which could potentially host a solar farm of up to 9 MW, greatly exceeding Council's energy demand. The land is a flood plain (similar to Valdora 15 MW planned PV plant) however, so care would need to be taken in considering its use for solar energy generation.

Figure 63: Old Quarry site, Lismore

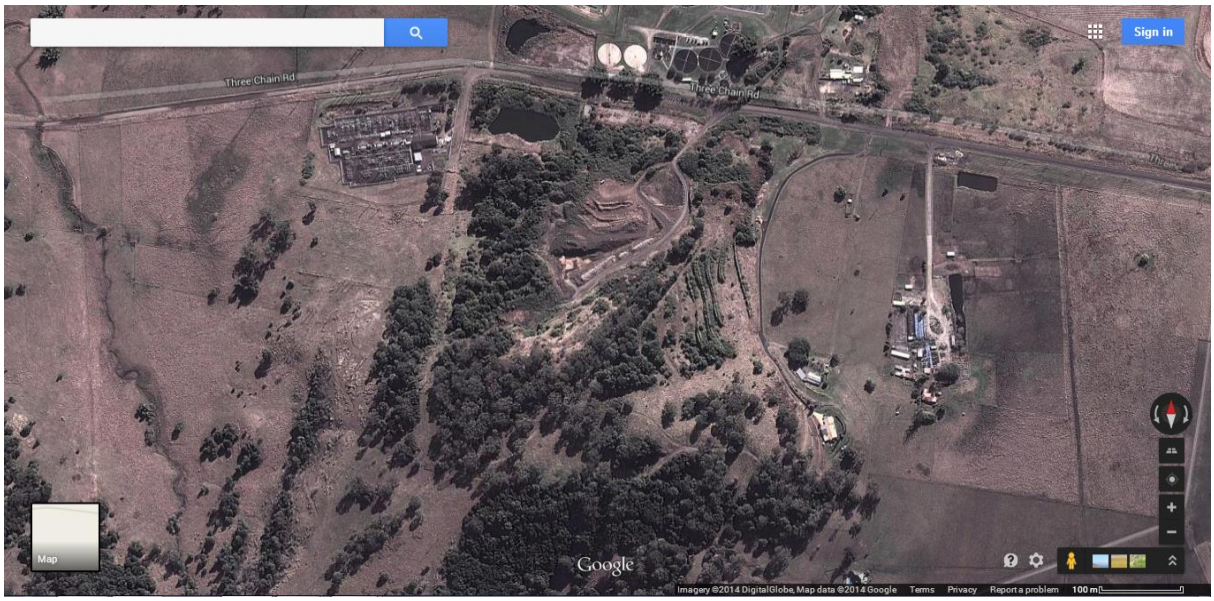
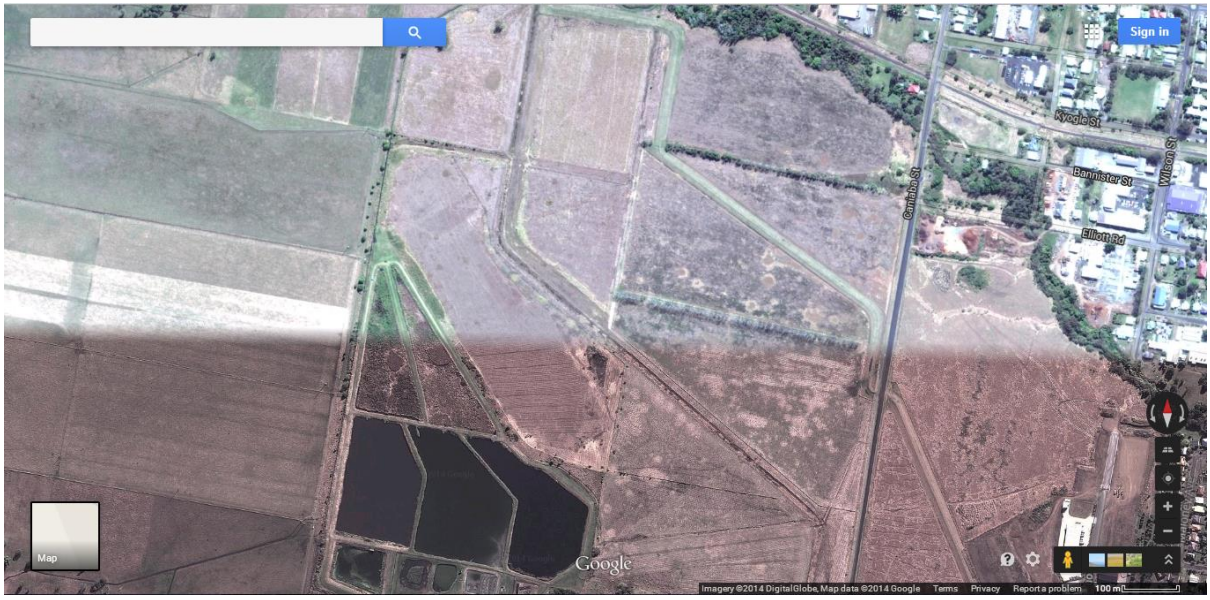


Figure 64: 'Turf Farm' in front of South STP



Summary of solar PV potential (initial)

This initial review suggested that solar PV can be an important part of the delivery of council's 100% renewable electricity target. A summary of the identified potential that formed part of the stakeholder workshop (May 2014) includes:

- More than 500 kW of roof-top PV, dominated by planned projects at the MRF, GSAC and East STP. These three sites are the best suited to medium sized arrays as the output can be fully used on site.
- Up to 750 kW of PV where larger systems are installed to meet site needs at East STP and GSAC.
- Around 1,250 kW of PV where storage of solar becomes cost-effective and can be used to meet site needs. This is based on larger systems being feasible at GSAC and East STP, as well as Wyrallah Rd depot, Nimbin STP & dam and the two main ovals – Oakes and Crozier.
- If virtual net metering and a more favourable retailing model were to be possible, then Council may be able to consider installing larger PV systems that could meet the demand (including time-of-use demand) of several sites. Potential host sites include Nimbin Dam, Lismore Airport, GSAC & East STP (alternative to storage for on-site use), the old quarry site and the old 'turf farm' north of the South STP. The generation capacity for these sites exceeds several MW.

Other RE technologies considered for Council's consultation workshop

A range of other technologies were considered having regard to both Council operations and the region. These are summarised below.

Street lighting

There may be a case for solar street lighting to be part of the RE solution for Lismore, for example through trialling solar with LED lighting in public spaces or selected lights on new local roads where the technology can be demonstrated and measured. The business case for solar street and public lighting is based around the avoided need for trenching and grid connection that is ordinarily needed when lighting is installed, together with the savings in electricity costs resulting from the use of stored solar energy at night. Several Australian companies are involved in the supply and installation of solar street and public lighting, for example:

Figure 65: Examples of solar street lighting

24

25

26

[24] http://www.solaronline.com.au/solar-street-lighting.html
[25] http://www.rpc.com.au/solar-systems/solar-street-lights.html
[26] http://saveenergyaus.com.au/solar-street-lighting/

Micro-hydro

Two potential micro-hydro opportunities using Pelton Wheel technology were considered at the South STP and East STP.

STP biogas

At present only the South STP generates biogas as part of its treatment process, but it does not produce enough methane for this RE option to become viable. The final decision on the upgraded South STP will have the greatest impact on the potential for biogas energy generation – if an IDEA / IDAL plant is built (as expected) then this opportunity will not eventuate.

Marine energy

The target states that electricity has to be generated within the boundaries of the LGA, however Lismore LGA is wholly inland.

Municipal green waste

A biochar and electricity generation plant is planned at Ballina (est 800 kW, 6,000 MWh pa), which will take green waste from the Lismore Council LGA.

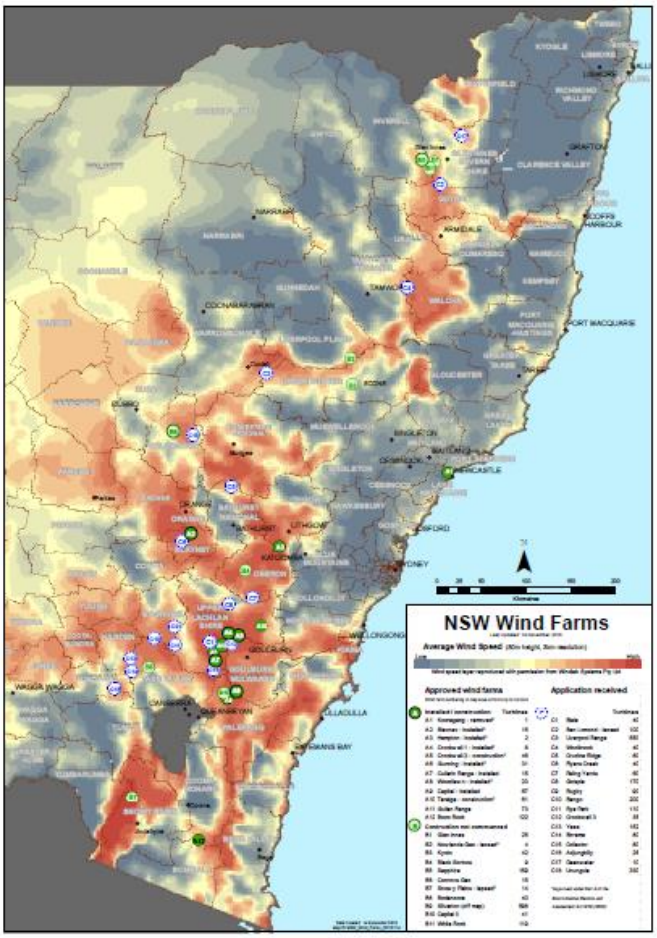
Landfill gas

Landfill gas levels in Lismore's tip are low. Organic waste matter is sorted elsewhere, and is thus not disposed of in landfill, meaning low gas levels are produced.

Wind energy

The NSW wind map suggests that there is low potential for wind energy generation in the Northern Rivers region (10-12 m/s is the optimum, but Lismore is only getting a maximum of 6-8 in mountainous areas) – refer below.

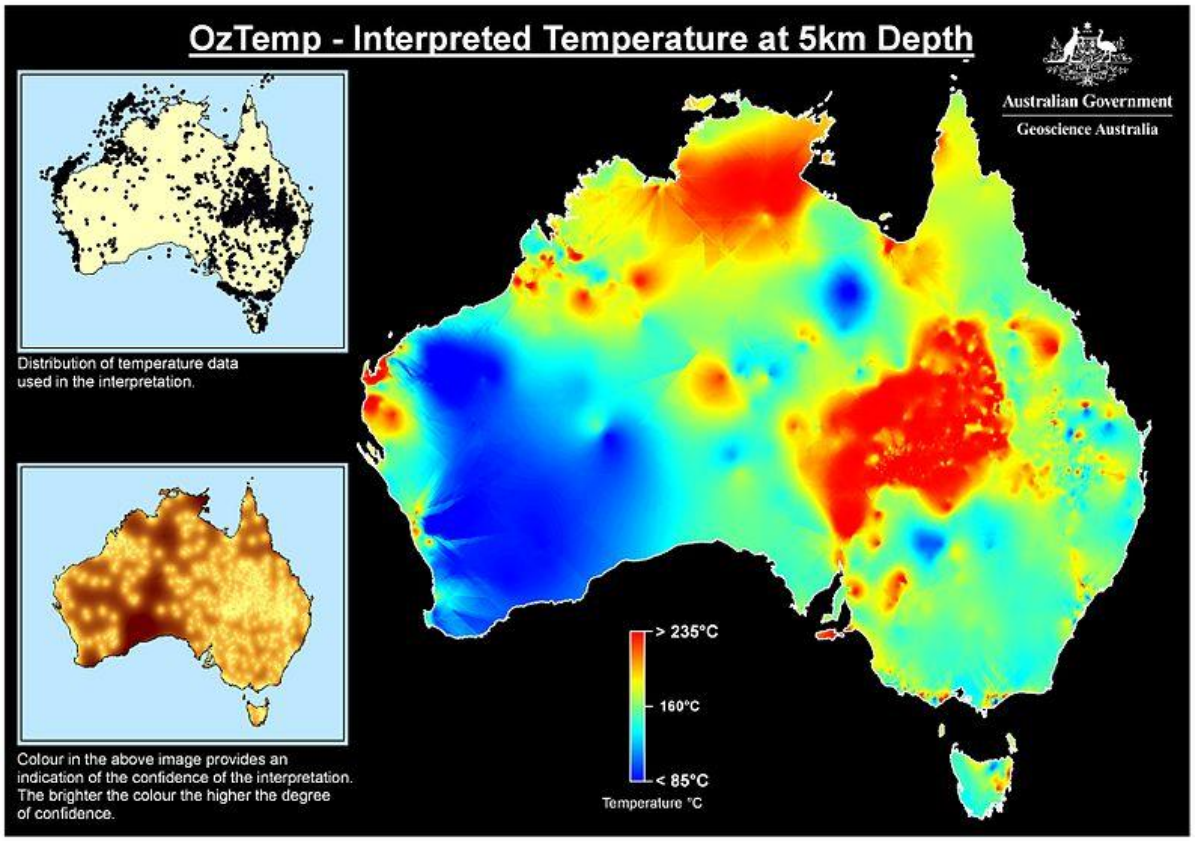
Figure 66: Wind speed in NSW



Hot rocks geothermal energy

Geothermal energy converts the earth's heat at depth to electricity. There appears to be no significant potential in Northern NSW – refer below.

Figure 67: Hot rocks geothermal energy in Australia



Purchasing Green Power

Green Power can either be purchased through a retailer or directly in the market.

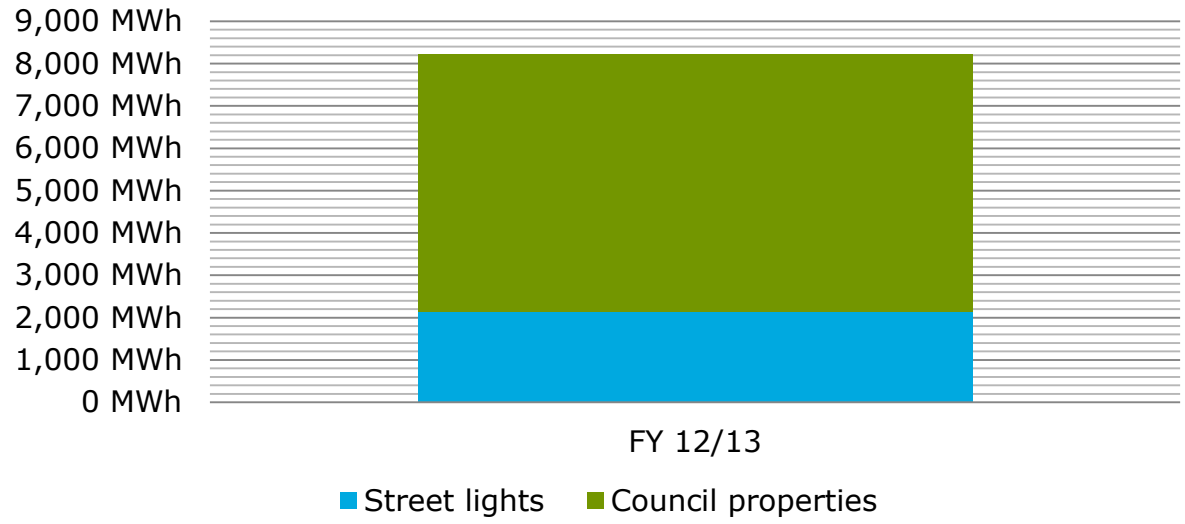
Appendix B: stakeholder engagement workshop #1

The stakeholder engagement workshop was held on 21 May 2014, from 1pm to 4pm, with the following participants:

NAME:	POSITION:
Gary Murphy	General Manager
Rino Santin	Manager Finance
John Eddy	Acting Manager People Services
Garth Hayhurst	Manager Information Services
Simon Adcock	Manager Corporate Services
Scott Turner	Manager Assets
Kevin Trustum	Waste Operations Coordinator
Anthony Magarry	Assets Engineer
Steven Dillon	Coordinator - Property Maintenance
Matt Potter	Water & Wastewater Systems Supervisor
Matt Torr	Water and Wastewater Operations Engineer
Rod Haig	Strategic Engineer
Brent McAlister	Executive Director
Graham Walker	Manager - Goonellabah Sports & Aquatic Centre (GSAC) and Memorial Baths
Wendy Adrianns	Manager Arts, Tourism & Leisure
Damian Licari	Acting Coordinator Environmental Strategies
Leanne Clark	Events Officer
Sharyn Hunnisett	Environmental Strategies Officer
Adam Blakester	Starfish Enterprise
Patrick Denvir	Technical Expert, Sustainable Business Consulting
Barbara Albert	Director, Sustainable Business Consulting

The workshop started with an analysis of Lismore City Council's energy situation. In FY12/13 LCC consumed 8,220 MWh of electricity, with a total cost of over $1.86m. 2,137 MWh was consumed by street lights (owned by Essential Energy) and 6,084 MWh was consumed by Council-owned properties.

Figure 68: LCC's electricity consumption in FY12/13



If this consumption was compared to the typical energy consumption of a 4 person household in Lismore it would equal 1,200 households.

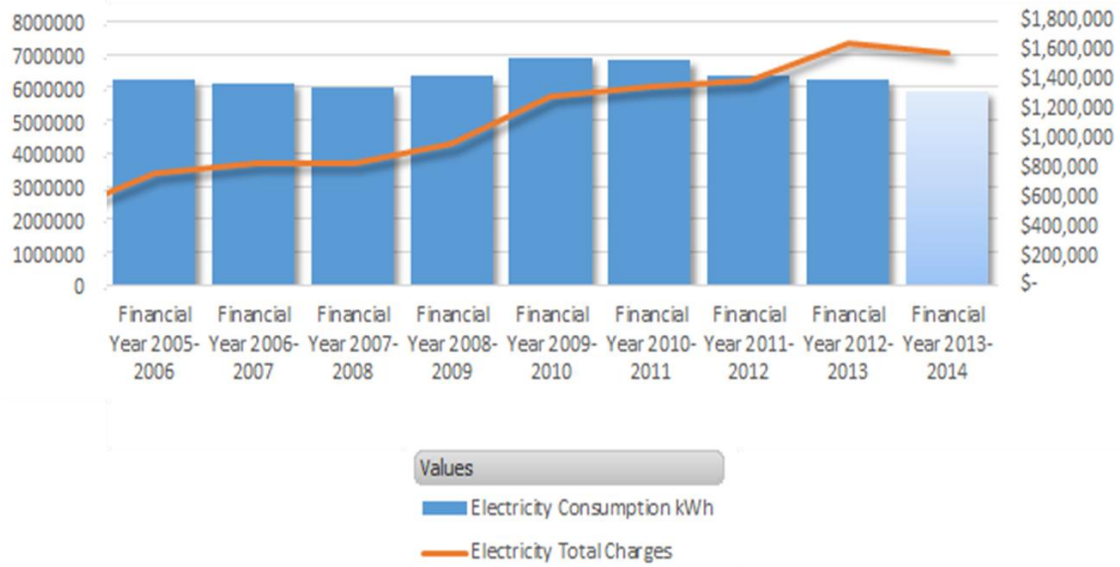
If Lismore City Council's operations grew with a rate of about 1% year on year, the electricity consumption in 2023, the target year, would be just over 9,000 MWh.

Before FY09/10 Lismore City Council's electricity consumption was growing year on year, but Council was able to reverse that trend in the following year. Electricity consumption has since fallen due to a number of energy efficiency actions that have been implemented at Lismore City Council assets.

Recent Planet Footprint data[27] is confirming this downward trend as can be seen in the following graphic.

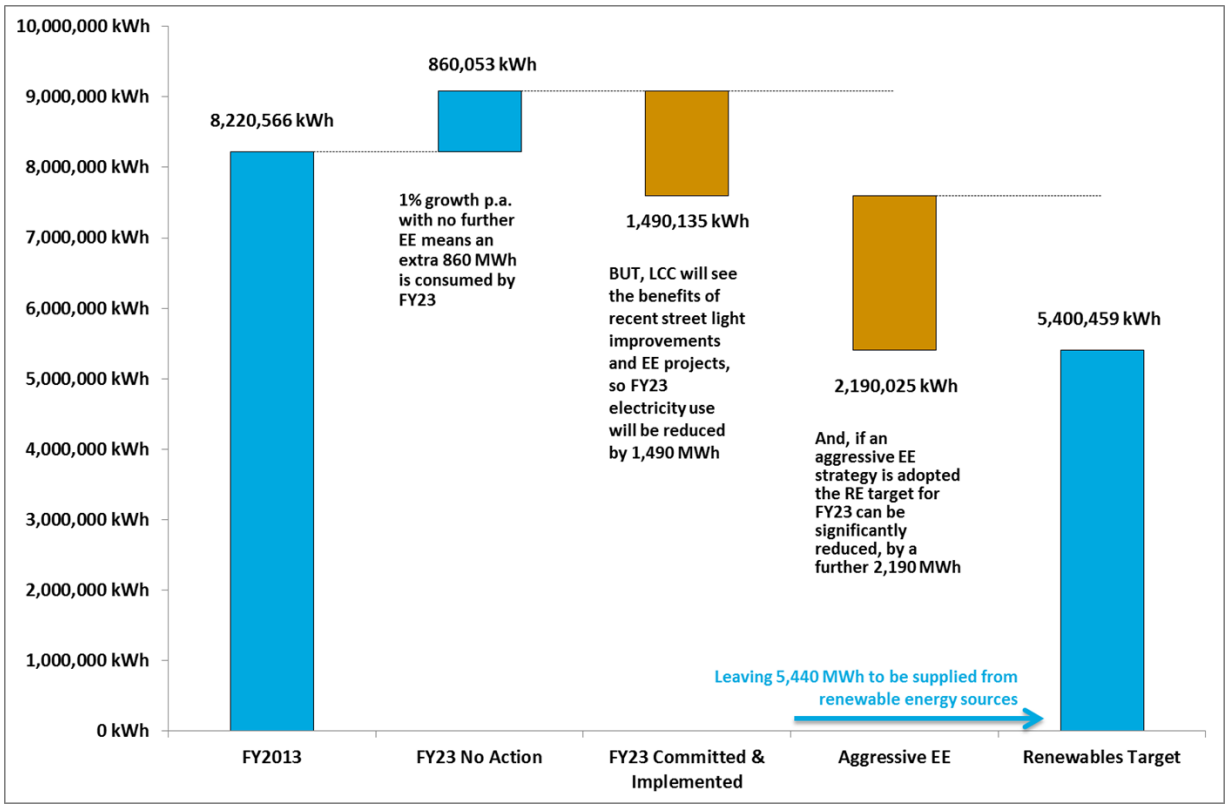
[27] Please note that the data for FY13/14 has been extrapolated and are not yet actual consumption figures

Figure 69: The effect of already implemented energy efficiency measures



Early on in the workshop it was proposed that Lismore City Council could reduce energy consumption aggressively, before offsetting the rest of the electricity consumption with renewable energy. The effect of current and planned energy efficiency measures can be seen in the following waterfall chart:

Figure 70: Waterfall chart showing the effect of energy efficiency measures on the RE target

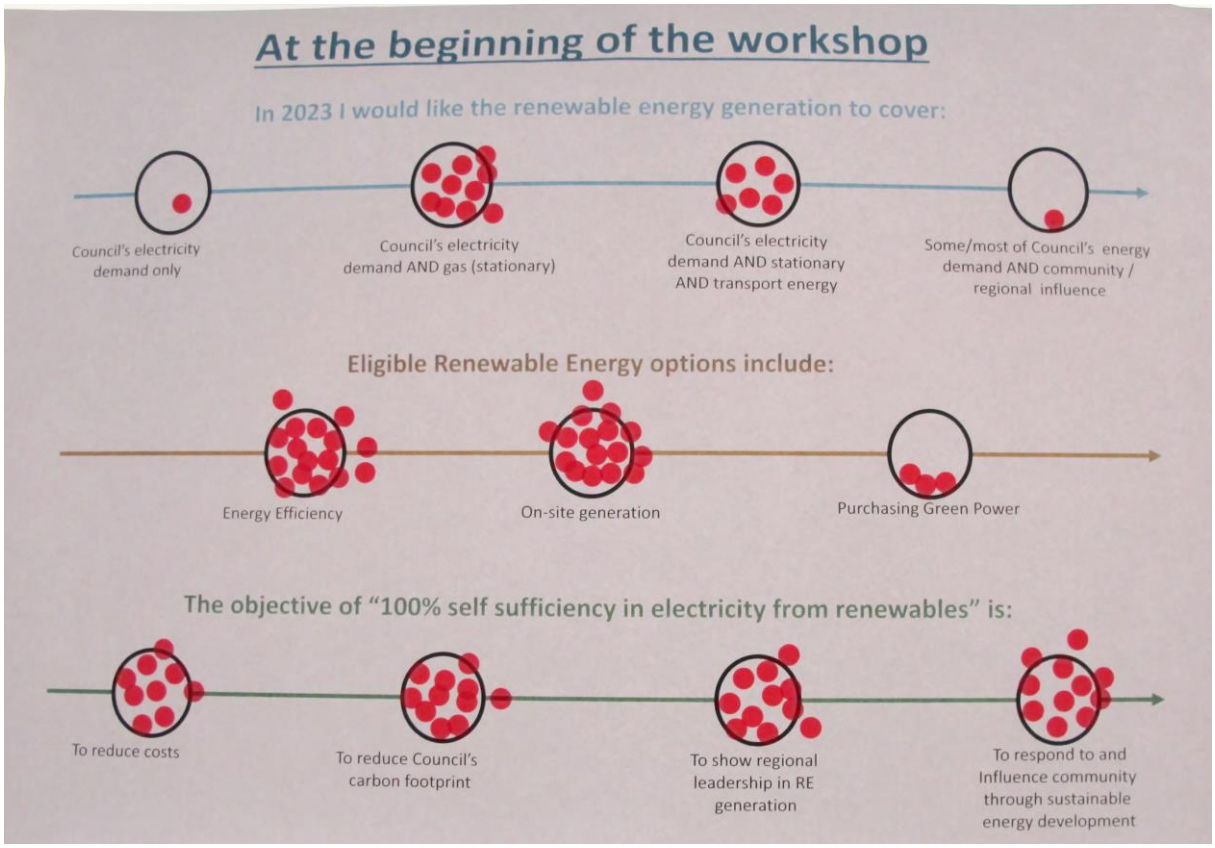


If an aggressive energy efficiency strategy was adopted by Council, then the Renewable Energy target for 2023 could be significantly reduced by almost 2,200 MWh, leaving 5,400 MWh to be supplied from renewable energy sources.

To get a feel for the sentiment of Lismore City Council, a set of three questions was put to the group with sliding scales on how operational staff perceived the target and what they thought renewable energy options included. At the beginning of the workshop most participants leant towards supplying all of Council's electricity needs and other stationary energy needs that are currently met by gas to be supplied from renewable energy sources. There was a heavy preference for self-generation of electricity and reducing demand as much as possible first. Only a few participants found the purchase of Green Power acceptable.

People felt that the benefits of the objective to become 100% self-sufficient in electricity from renewables were to reduce costs and the carbon footprint, show regional leadership in renewable energy generation and to respond to and influence the community through sustainable energy development.

Figure 71: Getting the sentiment of the group at the beginning of the workshop



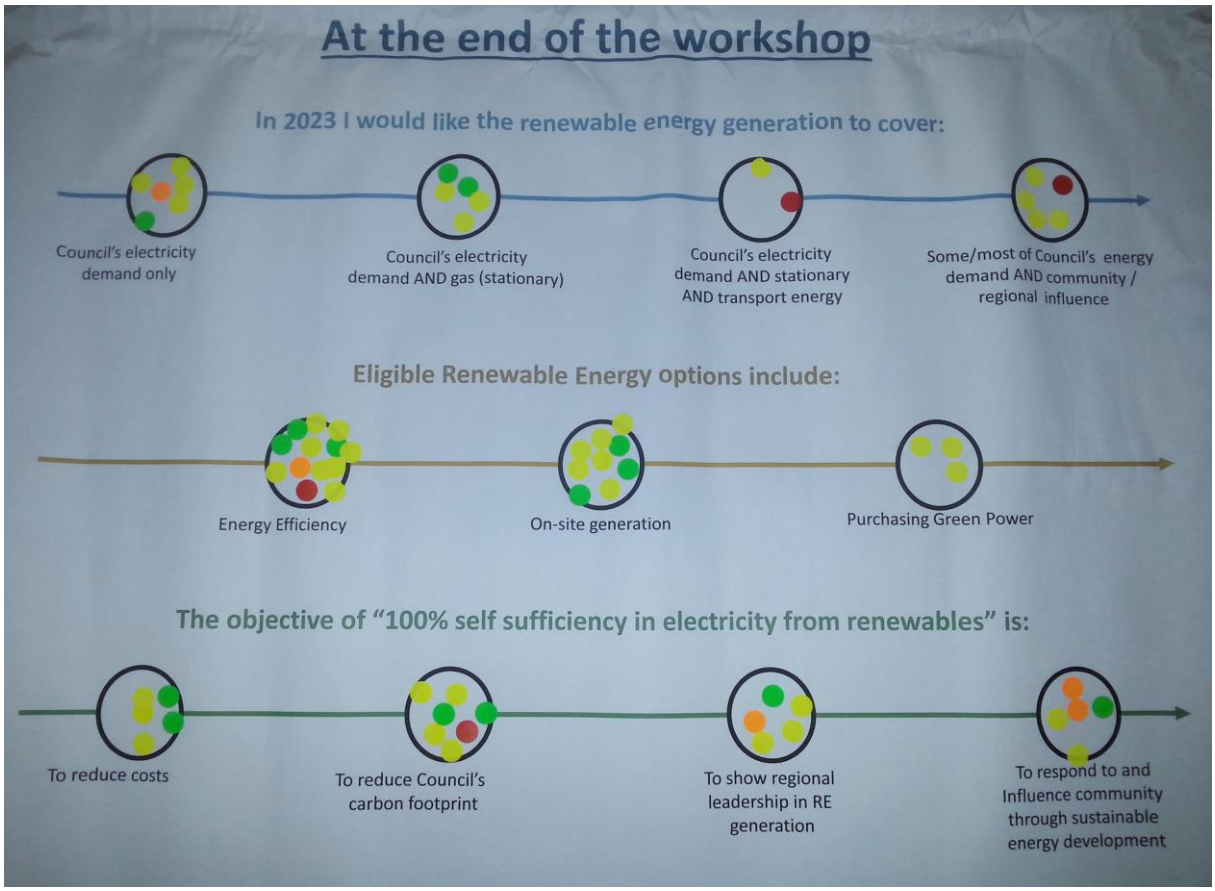
The same questions were asked at the end of the workshop. Some participants had changed their opinion on what should be covered by the renewable energy generation. More people felt that only Council's electricity demands should be met by the renewable energy generation, whereas conversely

also more people felt that the renewable energy generation should meet Council's and the community's demand. There were still a lot of supporters for the renewable generation to meet Council's electricity, as well as the stationary energy demand. Only two felt that transport energy should also be covered.

There was no change when it came to the question of what was acceptable in terms of energy efficiency, on site generation and the purchase of Green Power. Participants overwhelmingly supported energy efficiency and on site generation, with only three participants finding the purchase of Green Power acceptable.

There was no change with the last question. People felt that the benefits of the objective to become 100% self-sufficient in electricity from renewables were to reduce costs and the carbon footprint, show regional leadership in renewable energy generation and to respond to and influence the community through sustainable energy development.

Figure 72: Getting the sentiment of the group at the end of the workshop



The next stage of the workshop was evaluating the options for reaching the 100% self-sufficiency target in 2023.

The first three options focussed on implementing energy efficiency, ranging from aggressive to medium to light energy efficiency measures. The participants showed a clear preference for aggressive energy measures. Aggressive energy measures will bring down the consumption in FY23 to 5,400 MWh. These 5,400 MWh will have to be generated from renewable energy sources.

Renewable energy options for Lismore Council

The original renewable energy options identified for Lismore City Council (refer Appendix A) were:

1. Solar PV and Solar PV with storage
2. Solar Hot Water
3. Large Scale Concentrated Solar Thermal or Large Scale Solar PV
4. Solar street lights
5. Micro-hydro at Sewerage Treatment Plants
6. Biogas at the South STP if new development is anaerobic
7. Ballina's pyrolysis plant
8. Landfill gas
9. Wind
10. Hot Rocks Geothermal
11. Marine energy
12. Purchase of accredited Green Power or direct purchase of RECs

Workshop participants engaged with the renewable energy options by a mixture of listening to a presentation by Sustainable Business Consulting, reading the content on large posters that were fixed to the surrounding walls, and by having group discussions. The participants were then asked to express how they felt about the benefits of the technology, as well as about the cost and barriers. They were also able to express their opinion on whether they thought each renewable energy option was a good fit for Council and whether it was a viable technology for Council to pursue.

Figure 73: Pictures of the stakeholder engagement workshop

The pictures above show how the group listened to the presentation and engaged with the content on the posters.

The results of this engagement showed a clear preference for the following renewable energy technologies, in order of preference:

1. **Solar PV**
   Cost effective, high benefit, visible to the community, acceptable by the community, good fit for Council (innovation, sustainability), great for Lismore's climate, effective for daylight hours, independence from the grid. People associated medium costs and high benefits with this solution.
2. **Large scale solar PV or Concentrated Solar Thermal Plant**
   People like the idea, participants would like to see virtual net metering being standard procedure in Australia, staged implementation possible with virtual net metering (instead of full distribution charges), also interested in having storage associated. People associated high costs and high benefits with this solution.
3. **Solar Hot Water**
   Participants wanted solar hot water installations at the GSAC and LMB as they constantly need hot water. Participants also wanted to solar hot water installations at Oakes and Crozier ovals.

The reason for the exclusion of the other technologies are summarised in the following table, providing further detail / rationale to the notes against each technology at Appendix A.

Table 26: Reasons for excluding renewable energy technology options

Renewable Energy Technology	Reason for exclusion	Perceived benefit	Perceived cost	Good fit for Lismore City Council	Council thinks the solution is viable
Solar street lights	Participants felt that street lights are good for the community and that new developments should have them where there is no grid connection, but raised a number of issues including low ROI, vandalism/theft, maintenance, suitability in very dark parks.	Low	Low	No	No
Wind	Not enough wind speed	Low	Low	No	No
Micro-hydro at Sewerage Treatment Plants	Not enough net head pressure, but the Nimbin Water Supply upgrade could consider a micro-turbine for generation.	High	Low-Medium	Yes	Maybe
Biogas at the South STP if new development is anaerobic	Not feasible as plant does not produce enough methane to be viable, but worth considering in the plant upgrade process	Low	Low	No	No
Ballina's pyrolysis plant	Is seen as a good regional project with no relevance to Council's targets.	Medium	High	No	Yes
Landfill gas	Insufficient gas volumes to be viable.	Low-Medium	Low-Medium	No	No
Marine energy	Not viable at present and the Lismore LGA does not have any sea access	Low	Medium	No	No
Hot Rocks Geothermal	Not enough potential in the Northern Rivers area	Low	High	No	No
Purchase of accredited Green Power or direct purchase of RECs	Participants did not agree that Council could purchase Green Power as an alternative to self-generating electricity	Low	Low	No	No

Workshop with Councillors and the Mayor

A workshop with Councillors and the Mayor was also held on 21 May 2014, from 4pm to 4:45pm, and immediately followed the first workshop with operational staff. In addition to Councillors and the Mayor, representatives from the *Sustain Northern Rivers* group attended this workshop to observe and learn from the discussions. The following additional people participated in this workshop:

NAME:	POSITION:
Jenny Dowell	Mayor
Neil Marks	Councillor
Simon Clough	Councillor
Vanessa Ekins	Councillor
Ray Houston	Councillor
Debbie Firestone	Representative from Sustain Northern Rivers, Sustain Energy Working Group, Tweed Council
Robert Rosen	Representative from Sustain Northern Rivers, Sustain Energy Working Group, Community member
Neal Lake	Representative from Sustain Northern Rivers, Sustain Energy Working Group, Southern Cross University
Paul Cruickshank	RE Community Engagement Office of Environment and Heritage

The group first heard about the current energy situation at Council and how the target of 100% self/sufficiency in electricity could be reached. It was then explained that the stakeholder engagement showed a clear preference for aggressive energy efficiency measures to be implemented to reduce electricity demand as much as possible.

Looking at the investment dots on the posters on the wall that showed the various renewable energy technologies, it was clear that operational staff had a strong preference for the deployment of solar technologies to meet the residual energy demand in 2023.

The Councillors and the Mayor confirmed they share the view that there should be a strong focus on energy efficiency and that the implementation of solar technologies should be given preference over other renewable energy technologies.

The remainder of the workshop was spent revisiting the original target with all the new information that had emerged during the two workshops. The original target was for "*Lismore City Council to become 100% self-sufficient in electricity from renewable energy sources by 2023*". Discussions

amongst the stakeholders revealed that the target should be made more specific. It was agreed that the new target would be to:

"Self-generate all of Lismore City Council's electricity needs from renewable sources by 2023"

Figure 74: Re-defining the target for 2023

The picture shows Sustainable Business Consulting director Barbara Albert, Lismore City Council Environmental Strategies officer Sharyn Hunnisett, Lismore Mayor Jenny Dowell and SBC technical expert Patrick Denvir.

Stakeholder engagement workshop #1 outcomes

The outcomes from the workshop were:

- That the renewable energy target should be based around 'self-generation' and should exclude consideration of Green Power, RECs or other forms of offset against electricity supplied from the grid,
- That the target should be applied to Council's electricity and stationary fuel use (i.e. for heating), but should not extend to transport energy,
- That energy efficiency is a central part of the target and should be aggressively pursued,
- That solar technologies are strongly preferred for 'self-generation', with the maximum amount of 'behind-the-meter' opportunities to be developed, augmented by larger-scale solar PV or CST development(s) that will service Council's needs via a delivery model to be determined, but which may include consideration of a community-based retailer, virtual net metering and other options.

Next steps

It was agreed that the prioritised options identified in the workshop would be developed in more detail. These were:

- **Energy efficiency** – the setting of an aggressive energy efficiency target that seeks to maximise the implementation of cost-effective measures over coming years, so that the target for renewable energy generation is minimised. Included steps:
  - Engagement with asset owners to discuss EE opportunities and plans in greater detail,
  - Discussions to include feasible implementation timelines and approaches / delivery methods, including continued use of current funding and other financing options,
  - Refinement of the high-level target that has asset owner input,
  - Financial analysis of the business case, to be shared with asset owners,
  - Discussion and refinement of the business case for presentation as part of the draft action plan
- **Solar PV – behind-the-meter**
  - Engagement with asset owners to refine the list of sites where solar PV can be installed and utilised on-site, also to refine estimates of capacity that can be installed,
  - Engagement with suppliers of PV as well as battery storage suppliers and industry to get insight to current and future trends in technology development and pricing,
  - Financial analysis of solar PV at refined list of sites and capacity, shared with asset owners,
  - Investigation of financial delivery options including community owned (a la Farming the Sun), community retailer, Virtual Net Metering and others as needed, and refinement of the financial analysis,
  - Discussion and refinement of the business case for presentation as part of the draft action plan
- **Solar hot water**
  - Engagement with asset owners to refine the list of sites where solar HW can be installed, also to refine estimates of capacity that can be installed, taking account of recent installations especially at Memorial Baths,
  - Engagement with suppliers of solar HW to get pricing and information on pricing trends for solar HW,
  - Financial analysis of solar HW at refined list of sites and capacity, shared with asset owners,
  - Discussion and refinement of the business case for presentation as part of the draft action plan
- **Large scale solar PV or CST**
  - Engagement with Council to confirm potential for use of identified large areas for solar energy generation, and steps necessary to confirm suitability,
  - Engagement with similar-sized projects in Australia (e.g. ACT) to discuss costs, delivery options, financial viability,
  - Identification of all delivery options and confirm financial analysis parameters,
  - Financial analysis of PV / CST options and share with Council stakeholders / asset owners
  - Discussion and refinement of the business case for presentation as part of the draft action plan

Appendix C: enabling actions & delivery models workshop #2

The enabling actions and delivery models workshop was held on 24 September 2014, from 12:30pm to 3pm, with the following participants:

NAME:	POSITION:
Gary Murphy	General Manager
Rino Santin	Manager Finance
John Eddy	Acting Manager People Services
Garth Hayhurst	Manager Information Services
Darren Patch	Acting Executive Director Infrastructure Service (Previously Manager Works)
Scott Turner	Manager Assets
Phil Klepzig	Manager Commercial Services
Steven Dillon	Coordinator - Property Maintenance
Matt Torr	Water and Wastewater Operations Engineer
Kurt Bezjak	Quarry Manager
Steven Denize	Manager Integrated Planning
Wendy Adriaans	Manager Arts, Tourism and Leisure
Damian Licari	Acting Coordinator Environmental Strategies
Sharyn Hunnisett	Environmental Strategies Officer
Patrick Denvir	Technical Expert, Sustainable Business Consulting
Barbara Albert	Director, Sustainable Business Consulting

The purpose of the workshop was to discuss and finalise the business cases, talk about potential delivery models, get commitment for the implementation plan for the business cases, determine action items for the completion of the REMP, and to discuss the action plan for the implementation of the REMP.

The workshop started with discussing the outcomes of the previous workshop and a re-cap of the target. This was followed by an explanation of the following concepts:

- Virtual Net Metering
- Energy storage
- Life cycle Cost of Electricity
- Small scale solar
- Large scale solar
- Introduction to cash flow
- Introduction to financial metrics used

Prior to the workshop, the favoured energy efficiency and renewable energy options had been distilled into 7 business cases. In previous meetings with Council staff it was agreed to use the *payback period* and the *internal rate of return* as the financial metrics for the business cases.

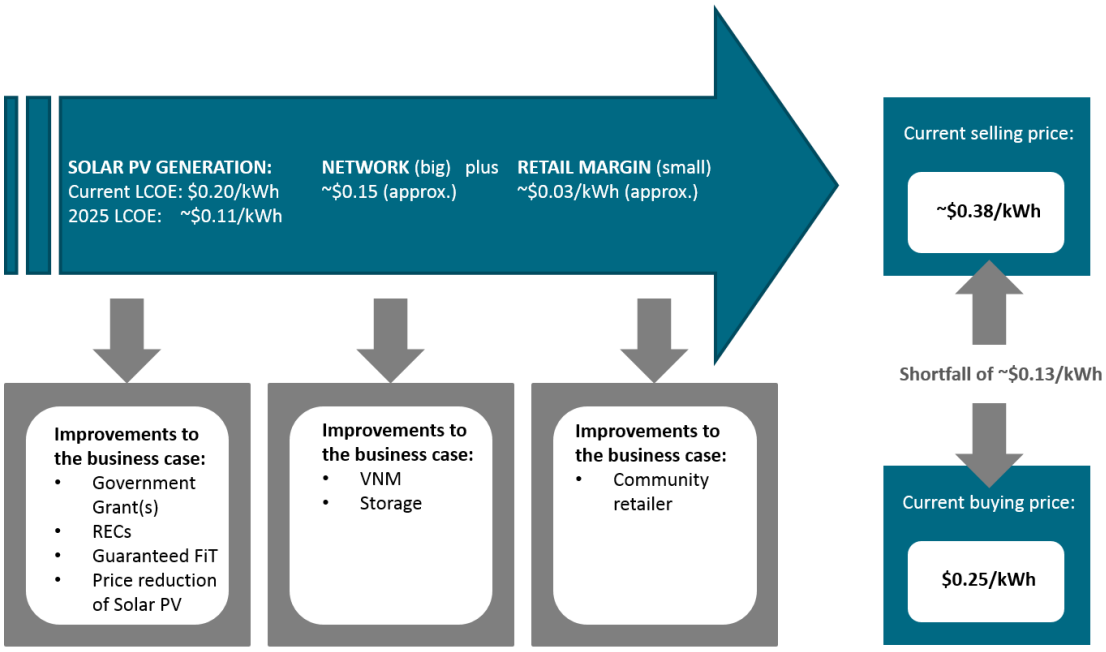
The workshop then proceeded with a discussion of every one of the seven business cases, as can be seen in the following picture. By implementing the current and proposed energy efficiency measures and behind-the-meter solar installations, Council's demand could be reduced to 5,400 MWh. This residual demand would have to be met with a large scale solar installation of around 3.8MW capacity. While each business case was being discussed, action items were captured so that the business cases could be finalised following the workshop.

Figure 75: Discussing the business cases

Enabling actions and delivery models workshop outcomes

An important outcome of this workshop was that the energy efficiency measures and behind-the-meter solar PV installations should be completed as a first priority. In 2014, especially with the political uncertainty around the *Renewable Energy Target*, the business case for a large scale solar PV implementation was not viable, as can be seen in the following graphic. It was agreed to wait a few years before the large scale solar PV project was developed in greater detail. In a few years, the LCoE might have come down sufficiently, more funding/grants might be available and *Virtual Net Metering* might be established then.

Figure 76: The current break-even point for a large scale solar implementation



In terms of delivery models for the business cases it was decided that it would either come off Council's balance sheet, or would be loan financed. In the case of the large scale solar development, Lismore City Council might enter a partnership agreement with an energy company.

Next steps

The meeting concluded with the next steps being the finalisation of the business cases, the action plan and the Renewable Energy Master Plan.

Appendix D: possible cash flow and investment scenario for stage 1 business cases #1 to #6 (excluding storage / VNM)

Cashflow	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Business Case 1	-$501,276	$51,553	-$25,888	$121,501	$124,538	$127,652	$130,843	$134,114	$137,467	$140,904	$144,426	$148,037	$151,738	$155,531	$159,420	$163,405	$92,826
Business Case 2	$0	$0	-$100,000	$11,619	$11,909	$12,207	$12,512	$12,825	$13,145	$13,474	$13,811	$14,156	$14,510	$14,873	$15,245	$15,626	$16,016
Business Case 3	$0	-$37,120	-$29,730	-$21,971	-$76,458	-$63,609	$49,617	$50,858	$52,129	$53,432	$54,768	$56,138	$57,541	$58,979	$60,454	$61,965	$63,514
Business Case 4	$0	-$36,963	-$30,310	-$23,301	-$15,922	-$8,160	$41,820	$42,866	$43,938	$45,036	$46,162	$47,316	$48,499	$49,711	$50,954	$52,228	$53,534
Business Case 5	$0	$0	-$643,383	$99,446	$101,933	$104,481	-$656,134	$333,014	$341,340	$349,873	$358,620	$367,586	$376,775	$386,195	$395,850	$405,746	$415,889
Business Case 6	$0	$0	-$1,138,642	$121,481	$123,827	$126,219	$128,655	$131,139	$133,670	$136,249	$138,878	$141,557	$40,287	$147,070	$149,905	$152,795	$155,740
Net Cashflow	-$501,276	-$22,530	-$1,967,953	$308,776	$269,827	$298,789	-$292,686	$704,816	$721,689	$738,969	$756,666	$774,789	$689,350	$812,359	$831,827	$851,765	$797,520
Cumulative Net Cashflow	-$501,276	-$523,806	-$2,491,759	-$2,182,983	-$1,913,156	-$1,614,367	-$1,907,053	-$1,202,237	-$480,548	$258,421	$1,015,087	$1,789,876	$2,479,226	$3,291,586	$4,123,413	$4,975,178	$5,772,698
NPV	$1,792,982																
IRR	15%																

Investment	FY14	FY15	FY16	FY17	FY18	FY19	FY20
Business Case 1	$501,276	$0	$78,730	$0	$0	$0	$0
Business Case 2	$0	$0	$100,000	$0	$0	$0	$0
Business Case 3	$0	$37,120	$37,120	$37,120	$99,750	$99,750	$0
Business Case 4	$0	$36,963	$37,887	$38,834	$39,805	$40,800	$0
Business Case 5	$0	$0	$643,383	$0	$0	$0	$763,227
Business Case 6	$0	$0	$1,138,642	$0	$0	$0	$0
Annual Investment	$501,276	$74,083	$2,035,762	$75,954	$139,555	$140,550	$763,227
Cumulative Investment	$501,276	$575,359	$2,611,121	$2,687,075	$2,826,631	$2,967,181	$3,730,408

Appendix E: action plan strategies and project tracking

Strategy	Action	Tasks for 2015-16, including 2014-15 tasks	Responsibility (individual or Group)	Target Date	Performance Measure	Progress Update DD/MM/YYYY	Corrective Action	Indicative tasks for 2016-17	Indicative tasks for 2017-18 and later
Strategy 1: MANAGEMENT ACTIONS	**ACTION MN1: Energy Management Action Plan Development**	LCC to create a process for developing energy efficiency projects to be included in the Action Plan and budget for FY15/16 and subsequent years.		28/02/2015	Action Plan development process is documented			Maintenance / improvement of Action Plan process	Maintenance / improvement of Action Plan process
		An Action Plan and budget for FY15/16 will be developed in early 2015 and endorsed by Council's Executive.		30/04/2015	Endorsed 2015-16 Action Plan			Endorsed 2016-17 Action Plan	Endorsed 2017-18 Action Plan
	ACTION MN2: Overall Performance M&V	Council will seek to improve the rate and accuracy of energy use and cost data entry into Planet Footprint. Council will also seek to have MWh of electricity generated from renewable energy sources entered into Planet Footprint in a timely manner.		30/06/2015	Timely action by PF, input of RE generation into PF			Timely action by PF, input of RE generation into PF	Timely action by PF, input of RE generation into PF
	ACTION MN3: Project Performance M&V	At this stage the employment of more complex analytical tools is not planned, such as those based on the International Performance Monitoring and Verification Protocol (IPMVP), e.g. M&V resources developed by OEH. The need for project-level M&V will be evaluated on a case-by-case basis by Council.		30/06/2015	Update on case-specific M&V			Update on case-specific M&V	Update on case-specific M&V
	ACTION MN4: Project Tracking	An excel spreadsheet will be the main tool used to collate and record project ideas and committed actions. This will also be used to track progress on a 'day-to-day' basis. Periodically project data (descriptions, dates, costs and benefits) will be uploaded from Excel to Planet Footprint, so that implementation and planned project information is accessible to users with the requisite access, and so that professional reports can be created easily.		30/06/2015	Annual PF-generated report of actions aligns with tracked project list			Annual PF-generated report of actions aligns with tracked project list	Annual PF-generated report of actions aligns with tracked project list
	ACTION MN5: Communication planning	Council will conduct a communication assessment that examines the needs of a range of internal and external stakeholders, current communication methods relating to Council's energy efficiency and renewable energy actions and objectives, and identifies actions that will help to make communication as effective as possible. This will consider the type and frequency of communications, and in particular how the Sustainability Team can meet these needs via the Action Plan management process.		30/04/2015	Communication plan / matrix completion			Reviewed and updated communication plan	Reviewed and updated communication plan
	ACTION MN6: Resourcing	Annually, concurrent with the Action Plan review and renewal process, Council will incorporate estimates of resourcing requirements. This will include estimated time and cost for internal and external resources to manage and implement the Action Plan.		30/04/2015	Action Plan is fully resourced			Action Plan is fully resourced	Action Plan is fully resourced
	ACTION MN7: Financial planning and analysis	All business cases developed to support energy efficiency and renewable energy initiatives / projects will use a level of analysis appropriate to the proposed activity. As part of the Action Plan approval / endorsement process the estimated costs (capital and resourcing) will be summarised and presented, based on known costs (e.g. from audits or quotes) or past experience (e.g. where an opportunity has yet to be assessed). Where approved, Council will budget for these funds to be available to implement the Action Plan.		30/04/2015	Action Plan is fully costed and initiatives are adequately supported			Action Plan is fully costed and initiatives are adequately supported	Action Plan is fully costed and initiatives are adequately supported

Strategy	Action	Tasks for 2015-16, including 2014-15 tasks	Responsibility (individual or Group)	Target Date	Performance Measure	Progress Update DD/MM/YYYY	Corrective Action	Indicative tasks for 2016-17	Indicative tasks for 2017-18 and later
STRATEGY 2: ENERGY EFFICIENCY	**ACTION EE1: Energy Audits, Assessments, Project Evaluations (Energy Audits)**	Planned audits for 2015-16 (if any) are to be determined in the Action Plan development process for 2015-16.		30/04/2015	Audits in the 2015-16 Action Plan			Audits in the 2016-17 Plan	Audits in the 2017-18 Plan
	ACTION EE2: Staff Engagement & Operational Savings	Planned staff engagement actions (if any) are to be determined in the Action Plan development for 2015-16. Planned operational savings (e.g. control vending machines) are to be determined in the Action Plan development for 2015-16.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan
	ACTION EE3: Large Sites – Blakebrook Quarry	The feasibility of fuel switching for bitumen heating will be investigated further in 2014/15 and into 2015-16, with a view to implementation in the 2015/16 or 2016/17 financial year.		30/06/2015	Business case progressed, update on implementation progress / plan			Implementation if cost-effective and aligned with site strategy	N/A
	ACTION EE4: Large Sites – Goonellabah Sports and Aquatic Centre	Opportunities for further optimization of energy use at the GSAC will continue to be identified by staff based on relevant site and industry information.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan
		Implementation of HVAC improvements as indicated in the GSAC audit report are to be assessed.		30/06/2015	Report on implementation of HVAC initiatives			N/A	N/A
	ACTION EE5: Large Sites – Council Administration Building	Opportunities for further optimization of energy use at the Admin building will continue to be identified by staff based on relevant site and industry information.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan
	ACTION EE6: Large Sites – Memorial Baths	Opportunities for further optimization of energy use at the Memorial Baths will continue to be identified by staff based on relevant site and industry information.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan
	ACTION EE7: Large Sites – East STP	Opportunities for further optimization of energy use at the East STP will continue to be identified by staff based on relevant site and industry information.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan
	ACTION EE8: Water & Wastewater	Water network optimization opportunities are to be investigated for Ross Street WPS, and VSD control assessed if the site is to remain in use as a major WPS.		30/06/2015	Report on cost-benefit options for Ross St			Implementation if cost-effective and aligned with site strategy	N/A
		Opportunities for further optimization of energy use by water and wastewater services will continue to be identified by staff based on relevant site and industry information.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan
	ACTION EE9: Street Lighting	Council will set in place a process to upgrade local road lighting to LED, ideally timed to coincide with planned bulk replacement timing. Initial action will focus on discussion with Essential Energy relating to potential timing, technology, costs.		30/06/2015	Draft implementation plan for LED on local roads			Implementation if cost-effective.	N/A
		Keep abreat of developments on maintenance costs for LEDs and reflect outcomes from this process in the business case.		30/06/2015	Update on AER application by Ess Energy & impact on LED cost-benefit			Maintain input to maintenance of street lighting costs	Maintain input to maintenance of street lighting costs
		Council will work with other stakeholders – Councils and/or a region of Councils – to examine relevant issues such as LED technology, rollout scale, ownership and future maintenance options.		30/06/2015	Minutes or meetings or similar			TBC	TBC
		Council will maintain a watching brief on developments in major road LED lighting.		30/06/2015	Update on major road LED trials			Update on major road LED development and acceptance.	Update on major road LED development and acceptance.
	ACTION EE10: LED Lighting	A plan for sites to have their lighting (general, public, exit signs) upgraded to LED will be prepared annually, commencing with the most cost-effective opportunities.		30/04/2015	Implementation plan schedule for 2015-16			Implementation plan schedule for 2016-17	Implementation plan schedule for 2017-18
	ACTION EE11: Air Conditioning	Annually Council's Action Plan development will assess the potential to upgrade the oldest and poorest-performing systems with more modern units and controls.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan
	ACTION EE12: PC Power Management Project	Council will investigate solutions that could help to reduce PC power consumption without interfering with personal use or system needs.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan
	ACTION EE13: Sustainable Procurement Policy	Council will investigate the potential to augment and strengthen procurement policies in relation to equipment, specifically setting out guidance for minimum energy standards for stationary energy-using equipment where feasible.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan
	ACTION EE14: Staff Training	Council will review the skills needs in relation to energy efficiency / management of key stakeholders, and will identify training / skills development opportunities. Initial training opportunities will be identified for funding in 2015-16.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan

Strategy	Action	Tasks for 2015-16, including 2014-15 tasks	Responsibility (individual or Group)	Target Date	Performance Measure	Progress Update DD/MM/YYYY	Corrective Action	Indicative tasks for 2016-17	Indicative tasks for 2017-18 and later
STRATEGY 3: ON-SITE SOLAR ENERGY SOLUTIONS	**ACTION SS1: Solar Energy Assessments**	No PV assessments are planned for the remainder of FY14/15. Action Plan development for FY15/16 will consider whether any new assessments are required.		30/04/2015	Actions in the 2015-16 Plan			Actions in the 2016-17 Plan	Actions in the 2017-18 Plan
	ACTION SS2: Energy Storage	Council will maintain a watching brief on developments in this area and, at the appropriate time, will evaluate the business case for augmenting PV systems with storage, or for installing PV + storage at suitable sites.		30/06/2015	Update on energy storage technology			Update on energy storage technology	Update on energy storage technology
	ACTION SS3: Solar Hot Water Systems	Council will seek OEH support to investigate whether there is a cost-effective opportunity to augment the GSAC SHW system and reduce the LPG usage at the site, currently 120 kL per year.		30/04/2015	Application for OEH support and appointment of advisor to conduct feasibility			Implementation of additional SHW if cost effective.	N/A
	ACTION SS4: GSAC + East STP	Council will take a decision in 2014-15 on the 'Farming the Sun' proposal, which could see which could see up to 390 kW of PV installed (250 kW at East STP, 140 kW at GSAC).		30/06/2015	Council decision on FTS			Finance-raising and implementation if approved	Implementation if approved
		The opportunity to install a further 350 kW across the two sites with energy storage will be assessed at a later time, and would be considered together with opportunities for Virtual Net Metering (VNM).		30/06/2015	Update on energy storage technology			Update on energy storage technology	Update on energy storage technology
	ACTION SS5: Waste Services Facility	Subject to a further expansion of the site proceeding, a third PV system of 70 kW may be installed.		30/06/2015	Update on 70 kW PV opportunity			TBC	TBC
	ACTION SS6: Council Administration Centre	Council will investigate the implementation of PV at this site in 2015-16.		30/04/2015	Actions in the 2015-16 Plan			Evaluation of PV at Admin building	Implementation of PV if cost effective
	ACTION SS7: Blakebook Quarry	A review of a 20kW PV opportunity will be undertaken concurrent with a review of the bitumen heating system, and will take into account future plans for the site as a whole.		30/06/2015	Business case progressed, update on implementation progress / plan			Implementation if cost-effective and aligned with site strategy	N/A
	ACTION SS8: Lismore Airport	As energy storage becomes cheaper and more reliable in the future Council will investigate the potential for additional PV to be installed at the site to supply additional demand at the site during the main usage periods. No assessment is planned for 2014-15.		30/06/2015	Update on energy storage technology			Update on energy storage technology	Update on energy storage technology
	ACTION SS9: Wyrallah Rd Depot	Several buildings at the Wyrallah Road depot may offer potential for solar PV implementation and these will be evaluated in 2015-16. Implementation in 2015-16 or 2016-17 will be considered for cost effective solutions.		30/04/2015	Actions in the 2015-16 Plan			Implementation if cost-effective	Implementation if cost-effective
		Energy storage may also be viable at a later time and will be evaluated in due course.		30/06/2015	Update on energy storage technology			Update on energy storage technology	Update on energy storage technology
	ACTION SS10: Community Centre, Goonellbah	The Community Centre roof could potentially host a small PV system (est 10 kW). This opportunity will be evaluated in 2015-16 with implementation considered for 2015-16 or 2016-17.		30/04/2015	Actions in the 2015-16 Plan			Implementation if cost-effective	Implementation if cost-effective
	ACTION SS11: South STP	Council will consider the potential for renewable energy generation to meet part of the site's energy demand.		30/06/2015	Update on site plans and RE options			Implementation if cost-effective	Implementation if cost-effective
	ACTION SS12: Library Headquarters, Goonellabah	There is potential for a small PV system (est 10 kW) to be installed at this site, subject to assessment of the roof space. The viability of this project will be investigated in 2015-16 with implementation to be in 2015-16 or 2016-17 depending on the assessment findings.		30/04/2015	Actions in the 2015-16 Plan			Implementation if cost-effective	Implementation if cost-effective
		Storage of energy at this site may also be feasible, subject to an assessment when technology costs for storage come down. This opportunity will be investigated at a later date.		30/06/2015	Update on energy storage technology			Update on energy storage technology	Update on energy storage technology
	ACTION SS13: Oakes Oval & Depot Lismore	The viability of this project will be investigated in 2015-16 with implementation to be in 2015-16 or 2016-17 depending on the assessment findings.		30/04/2015	Actions in the 2015-16 Plan			Implementation if cost-effective	Implementation if cost-effective
	ACTION SS14: Nimbin STP	The intermittent demand at the Nimbin STP means that an energy storage system would need to be integrated with a PV system to be useful at the site. Space on the western side of the site appears to be suitable for a solar PV system subject to assessment. As storage costs come down this opportunity will be evaluated.		30/06/2015	Update on energy storage technology			Update on energy storage technology	Update on energy storage technology
	ACTION SS15: Nimbin Dam	The intermittent demand at the Nimbin Dam means that an energy storage system would need to be integrated with a PV system to be useful at the site. Space on the north-eastern corner of the site appears to be suitable for a solar PV system subject to assessment. As storage costs come down this opportunity will be evaluated.		30/06/2015	Update on energy storage technology			Update on energy storage technology	Update on energy storage technology
	ACTION SS16: SES Building Brunswick Street	There is already a PV system on the SES building, and owing to the intermittent nature of use / demand at the site additional PV panels would likely only be useful if accompanied by energy storage. Stored energy could meet night lighting demand, base demand at the site or peak demand during operational periods. This opportunity will be evaluated at a later time when storage costs are much lower.		30/06/2015	Update on energy storage technology			Update on energy storage technology	Update on energy storage technology
	ACTION SS17: Crozier Oval	Daytime demand at the oval is minimal or intermittent, and solar PV with storage to meet field lighting or grandstand energy demand may be viable. This opportunity will be evaluated at a later time when storage costs are much lower.		30/06/2015	Update on energy storage technology			Update on energy storage technology	Update on energy storage technology

Strategy	Action	Tasks for 2015-16, including 2014-15 tasks	Responsibility (individual or Group)	Target Date	Performance Measure	Progress Update DD/MM/YYYY	Corrective Action	Indicative tasks for 2016-17	Indicative tasks for 2017-18 and later
STRATEGY 4: OFF-SITE SOLAR ENERGY SOLUTIONS	**ACTION LS1: Large-Scale Solar Energy Plant**	Technology costs – maintain watch on developments via BREE and other sources to track improvements in the LCOE of large scale PV.		30/06/2015	Update on large scale PV technology			Update on large scale PV technology	Update on large scale PV technology
		Grants and other incentives – maintain watch on developments and use resources to seek to influence support for renewables at Commonwealth and State levels.		30/06/2015	Update on grants and incentives for large scale PV			Update on grants and incentives for large scale PV	Update on grants and incentives for large scale PV, Conduct of a pre-feasibility study for a large-scale PV plant.
		Sunshine Coast Regional Council – Council should remain abreast of the progress of the SCRC Valdora PV project given the apparent parallels with Council's potential PV project.		30/06/2015	Update on SCRC Valdora project			Update on SCRC Valdora project	Update on SCRC Valdora project
	ACTION LS2: Virtual Net Metering	Maintain a watching brief on the VNM trial process at Byron.		30/06/2015	Update on Byron VNM			TBC	TBC
		Investigate joining or establishing a parallel trial, potentially using output from GSAC to be credited to the Administration Centre.		30/06/2015	Update on Council's intent to progress a parallel trial			TBC	TBC
		Maintain a watching brief on VNM developments elsewhere, such as efforts led by UTS and the Total Environment Centre to progress acceptance of VNM in Australia.		30/06/2015	Update on VNM developments in Australia			TBC	TBC
	ACTION LS3: Community Electricity Retailer	The main action for Council at this time is to remain involved in this regional initiative, and examine the viability of locally-built renewables to use this channel to supply renewable energy to Council facilities.		30/06/2015	Update on community electricity retailer business case development			TBC	TBC
	ACTION LS4: GSAC + East STP	No action is required at this time, until issues such as VNM, community retailer, technology costs and the like have changed substantially in favour of PV developments.		30/06/2015	N/A			N/A	N/A
	ACTION LS5: Lismore Airport	No action is required at this time, until issues such as VNM, community retailer, technology costs and the like have changed substantially in favour of PV developments.		30/06/2015	N/A			N/A	N/A
	ACTION LS6: South STP	No action is required at this time, until issues such as VNM, community retailer, technology costs and the like have changed substantially in favour of PV developments.		30/06/2015	N/A			N/A	N/A

EE AND RE PROJECT TRACKING

Action ID	Description	Responsibility	Planned start date	Planned completion date	Electricity Savings - MWh p.a.	Gas Savings - GJ p.a.	Energy cost Savings $ p.a.	Other cost savings (eg. Maintenance) $ p.a.	Total savings $ p.a.	Capital cost of opportunity	Payback period (years) or IRR%	GHG savings tonnes CO2 p.a.	Energy Saving Certificates Generated	STATUS (Implemented, Planned, or Not to proceed)
ACTION EE1: Energy Audits, Assessments, Project Evaluations (Energy Audits)	Audit of GSAC solar HW	X.Y	30/01/2015	30/06/2015	0	0	$ -	$ -	$ -	$ 2,500.00	0%			
	Audit light count at Site 1 for LED upgrade	A.B	21/02/2015	30/06/2015	0	0	$ -	$ -	$ -	$ 1,000.00	0%			
	Audit light count at Site 2 for LED upgrade	A.B	21/02/2015	30/06/2015	0	0	$ -	$ -	$ -	$ 1,000.00	0%			
ACTION EE10: LED Lighting	Implement LED at site 3	C.D	25/05/2015	30/06/2015	22	0	$ 5,500.00	$ 850.00	$ 6,350.00	$ 18,000.00	2.83 Years			
	Implement LED at site 4	C.D	25/05/2015	30/06/2015	12	0	$ 3,000.00	$ 600.00	$ 3,600.00	$ 14,000.00	3.89 Years			
	Implement LED at site 5	C.D	25/05/2015	30/06/2015	16	0	$ 4,000.00	$ 650.00	$ 4,650.00	$ 16,000.00	3.44 Years			

Abbreviations and glossary

AEMO	Australian Energy Market Operator
BAU	Business As Usual
BMS	Building Management System - computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire, and security systems
CASA	Civil Aviation Safety Authority
c/kWh	Cents per kilowatt hour – energy unit costing metric
CST	Concentrating Solar Thermal – a renewable energy technology
DNI	Direct Normal Insolation – a measure of the intensity of sunlight
DNSP	Distribution Network Service Provider – organisations that own and maintain the electricity grid (poles and wires)
DUOS	Distribution Use of System – charges paid to distribution network operator on whose network the meter is located
EE	Energy Efficiency
ESCo	Energy Service Company
EUA	Environmental Upgrade Agreement
EPC	Energy Performance Contract
GWh	Gigawatt hour – a measure of energy (1 GWh=1000 MWh)
HVAC	Heating Ventilation Air Conditioning
HW	Hot Water
IRR	Internal Rate of Return
kWh	Kilowatt hour – a measure of energy
kW	Kilowatt – a measure of power
KWp	Kilowatt peak – amount of peak demand reduction potential
LCC	Lismore City Council
LCOE	Levelised Cost of Energy - indicates the cost at which each unit of electricity needs to be sold at in order for project/plant to break even
LED	Light-Emitting Diode - a semiconductor diode which glows when a voltage is applied
LGA	Local Government Area
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
MWe	Megawatts electric – a measure of electrical power
MWh	Megawatt hours (1MWh = 1000kWh) – a measure of energy
MW	Megawatts – a measure of power
NPV	Net Present Value
NUOS	Network Use of System
PPA	Power Purchase Agreement
RE	Renewable Energy
PV	Photo-voltaic
REMP	Renewable Energy Master Plan
ROI	Return on Investment

SHW	Solar Hot Water
SNR	Sustain Northern Rivers
SPS	Sewer Pumping Station
STP	Sewerage Treatment Plant
ToU	Time of Use – refers to a particular electricity tariff structure
Tonnes CO_2-e	Tonnes of Carbon Dioxide equivalent – greenhouse gas measurement unit
VNM	Virtual Net Metering – an electricity customer with on-site generation is allowed to assign their 'exported' electricity generation to another site
VSD	Variable Speed Drive - a piece of equipment that regulates the speed and rotational force, or torque output, of an electric motor
WTP	Water Treatment Plant

Sustainable Business Consulting is an Australian industry leader in sustainability, carbon & energy consulting and training. We are driven by quality and take pride in a job well done. For more information please contact: Barbara Albert, Managing Director, at b.albert@sustainablebizconsulting.com.au

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