DPIE

Northern NSW Renewable Energy Blueprint for Local Governments

Final

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Contents

1 Preamble

This document is a blueprint to guide councils on how to start renewable energy projects in their operations and in their local communities, and to learn from the experiences of others, including understanding known barriers and how to overcome them, potential financing models and case studies of regional collaboration and partnership.

In addition to highlighting technology solutions and how these can be developed or supported by councils, the importance of councils in providing education and information to their communities is highlighted, and the importance of obtaining a social license and support from communities to act on climate change and renewables in the community.

2 Glossary – acronyms and key terms

Acronym	Definition
AC & DC	A solar panel produces Direct Current power, which is converted to Alternating Current power via an inverter so it can be used in buildings
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
APVI	Australian Photovoltaic Institute
BMS	Building Management System
BRC-A	Business Renewables Centre – Australia
CEC	Clean Energy Council
CER	Clean Energy Regulator
CFD	Contract for Difference
CPP	Cities Power Partnership: a free, national program that brings together Australian towns and cities making the switch to clean energy. An initiative of the Climate Council.
CEFC	Clean Energy Finance Corporation
CSP	Community Strategic Plan
DPIE	NSW Department of Planning, Industry and Environment
EPC	Energy Performance Contract (to deliver guaranteed energy and cost savings and financial return for energy improvement and renewable energy works)
EV	Electric Vehicle
GIS	Geographic Information System
HVAC	Heating Ventilation and Air Conditioning
JO & ROC	Joint Organisation and Regional Organisation of Councils – formal and collaborative structures for local councils to deliver initiatives that are mutually beneficial
kW, MW	Units of power – usually used for electricity
kWh, MWh, GWh	Units of energy – usually used for electricity
LED	Light Emitting Diode (lighting technology)
LGA	Local Government Area
LGC	Large-scale Generation Certificate
MREP	Melbourne Renewable Energy Project
NEM	National Electricity Market
OEH	(former) NSW Office of Environment and Heritage, now NSW Department of Planning, Industry and Environment (DPIE)
PPA	Power Purchase Agreement (for the purpose of this document PPAs are assumed to be with renewable energy projects only)

PRV	Pressure reducing valve
PV	Solar photovoltaic technology
RAPS	Remote Area Power Systems
RET	Australia's Renewable Energy Target
SSROC	Southern Sydney Regional Organisation of Councils

Key Term	**Meaning/description in the context of renewable energy projects**
Approved Solar Retailers	Companies who have signed the Solar Retailer Code of Conduct and display the Clean Energy Council Approved Retailer logo, which can be verified via the CEC website. You can also check if a company has been suspended or cancelled.
Australian Energy Market Operator (AEMO)	AEMO plays multiple roles in the NEM including: • Monitoring electricity consumption and the flow of energy across the power system, and making adjustments or intervening to resolve system limitations or risks to supply. • Monitoring of electricity voltage and frequency to make sure the system stays secure, including monitoring the impact of planned power outages to make sure the system can accommodate any subsequent loss of generation or transmission capacity. • Protection of the power system via instructions to network service providers to cut off supply to some customers if required as a last resort when supply in a NEM region cannot meet demand. • Operation of the retail electricity markets across the NEM.
Behind-the-meter	A renewable energy system that is installed behind your main meter. The purpose of the renewable energy generation is to serve the building's energy demand.
Bioenergy	Renewable energy made available from materials derived from biological sources. For councils, good sources of bioenergy are food and green organics waste.
Clean Energy Finance Corporation	The CEFC is responsible for investing $10 billion in clean energy projects on behalf of the Australian Government. CEFC helps to lower Australia's carbon emissions by investing in renewable energy, energy efficiency and low emissions technologies, and supports innovative start-up companies through the Clean Energy Innovation Fund.
Clean Energy Regulator	The Clean Energy Regulator administers schemes legislated by the Australian Government for measuring, managing, reducing or offsetting Australia's carbon emissions, including the National Greenhouse and Energy Reporting Scheme, Emissions Reduction Fund, Renewable Energy Target, and Australian National Registry of Emissions Units.
Climate emergency	A public climate emergency declaration signals that current approaches to climate change mitigation are not sufficient, and that unprecedented steps need to be taken at all levels of government to respond. It may be accompanied by a capacity for councils to direct funding to measures to respond locally.
Community energy projects	Renewable energy projects initiated and developed by the community to deliver broad benefits to the local community.
Contract for Difference	A financial derivative contract in that its value is derived from another market. In the case of renewable energy, this means the wholesale electricity market. Typically, a contract is between a renewable energy project developer and another party. Both parties agree on a price level that is usually set at a cost per MWh that the renewable energy project requires to finance its development and achieve a return on investment.

	When the renewable project generates electricity into the market, it receives the wholesale market price. If the wholesale price it receives is above the agreed price, then the other party will be paid the difference by the project. If the wholesale price is below the agreed price, then the other party will pay the project the difference. This ensures that the project is guaranteed revenue for generated electricity at the agreed price. CFDs are commonly used as the basis of a "virtual PPA" where no actual electricity is delivered to the customer, instead only a financial transaction occurs, completely separate to any agreement for electricity supply. A Ministerial order prohibits Councils in NSW from entering into such an agreement (for a derivative product), hence NSW councils are seeking alternate power purchase solutions.
Delivery Program & Operational Plans	Linked to CSPs and in accordance with statutory Integrated Planning and Reporting requirements, Councils have fixed-term Delivery Programs with associated annual Operational Plans. The Delivery Program implements the Council's strategic priorities and is a 'statement of commitment' to the community from each newly elected council.
Distribution Network Service Providers	Electricity and natural gas distributors own and maintain the distribution networks, including substations, transformers, electricity powerlines and power poles ('poles and wires'), and natural gas pipelines that carry electricity and natural gas to houses and businesses. In NSW electricity distributors (DNSPs) include Essential Energy, Endeavour Energy and Ausgrid. DNSPs build and maintain poles and wires to ensure reliable and safe delivery of power to homes and businesses. Their charges for pass-through of electricity are regulated by the Australian Energy Regulator (AER), and are passed through on electricity bills by an organisation's electricity retailer. Regulated charges are published annually in tariff pricing plans, with the tariff applicable to a particular business or home dependent on their level of electricity consumption.
Engineer Procure and Construct	Typical agreement underpinning the implementation of a renewable energy project.
Feed-in-Tariff	A rate in $/MWh offered by a retailer for renewable energy exported to the grid, typical in many retail energy supply agreements.
Firming	Firming is the mechanism by which an intermittent or fluctuating electricity load can be made firm in terms of volume. Renewable projects can use financial or physical firming products to guarantee delivery of a set amount of MWh of electricity even in times of low or no generation.
GreenPower®	Government accredited renewable energy that is additional to Australia's Renewable Energy Target. Buying GreenPower® means that renewable energy equivalent to your energy consumption is added to the grid on your behalf.
Grid Connection / Connection Agreement	Application must be made, and agreement reached with the distributor to connect a renewable energy generator to the grid.
Grid-side or in-front-of-the-meter	The main purpose of an in-front-of-the-meter renewable energy installation is to feed energy into the grid. These installations are also called 'grid-side'.
Large-scale Generation	An LGC represents one MWh of electricity generated from an eligible renewable energy plant under the Renewable Energy Target. Liable

Certificate (LGC)	parties such as electricity retailers must purchase and surrender LGCs in proportion to their market share.
Microgrid	A discrete energy system consisting of distributed energy sources and energy demand response capable of operating in parallel with, or independently from, the main power grid
National Electricity Market	The NEM interconnects five markets – Queensland, New South Wales (including ACT), Victoria, South Australia, and Tasmania, and involves wholesale generation that is transported at high voltage from generators to large industrial users and electricity distributors. The transport of electricity from generators to consumers is facilitated through a spot market managed by AEMO.
Remote Area Power Systems	Typically edge of or offgrid power systems delivering reliable energy to communities. Historically delivered via diesel or other fuel or fuel / solar technologies, it is increasingly common for integrated renewables, battery storage and controls to deliver RAPS initiatives.
Renewable energy bulk buy	Renewable energy bulk buys have been an effective way to increase the level of solar PV and solar hot water and air-sourced heat pump systems in communities. Bulk buys can help communities get access to cheaper renewable energy via discounted prices for volume, from pre-vetted suppliers to increase the uptake of renewable energy.
Renewable Energy Power Purchase Agreement (PPA) – including onsite and offsite PPAs	An agreement between an electricity retailer and an energy user to purchase renewable energy. • An onsite PPA is a financing method for an onsite solar PV installation. An onsite solar PPA provider installs and owns the system and sells the electricity to Council. • An offsite PPA means that your Council purchases renewable electricity from a project on the grid-side of Council's facilities / land, which may be a mid-scale or customer-scale project owned by Council or potentially on Council land, or may be from third-party owned and operated projects
Renewable Energy Target (RET)	The RET is a Commonwealth legislated target to ensure that 20% (expressed as a quantity equal to 33,000 GWh) of electricity supply in Australia comes from eligible renewable energy sources by 2020. This target is the driver of large-scale solar and wind projects that have been developing rapidly in Australia in recent years, and also the rise in small and commercial scale rooftop solar PV systems.
Solar my School	An initiative of Waverley, Woollahra and Randwick City Councils to engage with and help local schools implement solar PV on their facilities. This program has since expanded to include numerous other local councils and schools.

3 Developing renewable energy opportunities in council operations

This section focuses on how councils can develop renewable energy opportunities in their own operations, such as solar panels on administration buildings, depots and libraries, and Power Purchase Agreements (PPAs) for renewable energy supply across Council's facilities for example.

3.1 The leadership roles of councils in the community

The first way in which a council can initiate action on renewables in the community is to lead-by-doing. In the past few years, local governments have been accelerating their commitments and implementation of actions to respond to the challenge of climate change. More and more councils are committing to ambitious renewable energy and/or carbon emissions goals.

Examples of councils in Northern NSW who have committed to ambitious targets include:

- Lismore City Council, 100% renewable energy by 2023
- Byron Bay Council, 100% renewable energy by 2027 and net zero emissions by 2025
- Tweed Shire Council, 50% renewable energy by 2025
- Kyogle Council, 25% on-site solar & 50% renewables by 2025, 100% renewable energy by 2030
- Coffs Harbour City Council, 100% renewable energy by 2030
- Port Macquarie Hastings Council, 100% renewable energy by 2027
- Nambucca Shire Council, zero net emissions within the 2030 to 2050 timeframe

In addition to councils taking action on climate change, many communities in Northern NSW are setting themselves ambitious targets. Examples are:

- Uralla town, plan to be the first zero net energy town
- Tyalgum village, plan to be off the grid, 100% renewable energy with batteries
- Mullumbimby, 100% renewable energy by 2020
- Byron Bay community, plan for first zero net emissions community

3.2 Develop a renewable energy strategy

It is common for long term targets for renewables or carbon emissions to be aspirational or based on what is understood to be required to respond to climate change. To make long term targets meaningful and achievable, an increasing number of local councils are looking to develop interim targets and staged plans with an evidence base for how to reach these targets.

The best way to know *what measures* will take you *where* for your unique circumstances is to develop a strategy and action plan. Ideally, your renewable energy or carbon reduction strategy will contain short, medium and long-term targets, and costed actions to get you there, so you know how much implementation of your strategy will cost and how much it will return in savings.

3.2.1 Alignment with Community Strategic Plan

A Community Strategic Plan (CSP) represents the highest level of strategic planning undertaken by a local government. The CSP identifies the main priorities and aspirations of your community and provides a set of strategies and actions to achieve this vision of the future. Your renewable energy strategy development should take the overarching key objectives of

your CSP into account; in particular where a CSP aims to develop a 'greener' or more sustainable community, this should provide the underpinning basis for a strategy to increase renewable energy and reduce carbon emissions.

3.2.2 Adopt goals for renewables or carbon emissions

Local governments can play a crucial role in achieving a nation-wide climate response by demonstrating successful carbon reduction initiatives at the local level and committing to ambitious targets with timeframes to achieve these. Councils who are making public commitments to ambitious renewable energy goals (or declaring climate emergencies, as Byron Shire Council, Clarence Valley Council and Bellingen Shire Council have done) are signalling to their communities that action on climate is urgent, feasible and cost-effective.

The greater the level of organisational support and understanding of the scale of the task and the nature and timing of opportunities, as well as knowledge of changes that will occur to your facilities and assets over time will help you to set targets that are realistic and achievable.

The pathway towards meeting ambitious goals is likely to include a small number of actions that have individually significant impact (renewable energy Power Purchase Agreements, LED street lighting), and a large number of small measures that have low individual but a large aggregate impact and are good for the bottom line.

3.2.3 Build your renewable energy pathway – hierarchy of actions

A renewable electricity goals could be achieved by simply purchasing all your electricity from GreenPower® or a renewable energy Power Purchase Agreement (PPA). However, the most cost-effective way to achieve this goal will involve implementing energy efficiency and onsite renewable energy initiatives in your operations.

Lower energy demand can be achieved by managing growth and service increases with energy efficient design, by retrofitting existing controls and equipment with energy efficiency measures, and by selecting efficient equipment when buying new plant and appliances.

Solar panels can be installed on roofs and land at your facilities to reduce daytime energy demand. This can be done in parallel with energy efficiency measures, though it is important to size solar systems with knowledge of the savings you can make through energy efficiency. In this way there will be less risk of oversizing solar systems, which may make efficiency projects economically inviable.

Efficiency and onsite renewables can typically reduce a local government's operational energy use by 20% to 40%, depending on past initiatives, age of equipment and controls, and available land and roof space. If a local government wants to source all of its electricity from renewables, then purchasing green energy must be the major part of the solution, so integration of renewables with your electricity purchasing process is needed.

This systematic approach to cost-effectively achieving significant levels of renewables is illustrated in the "*Reduce, Produce, Purchase*" model below.

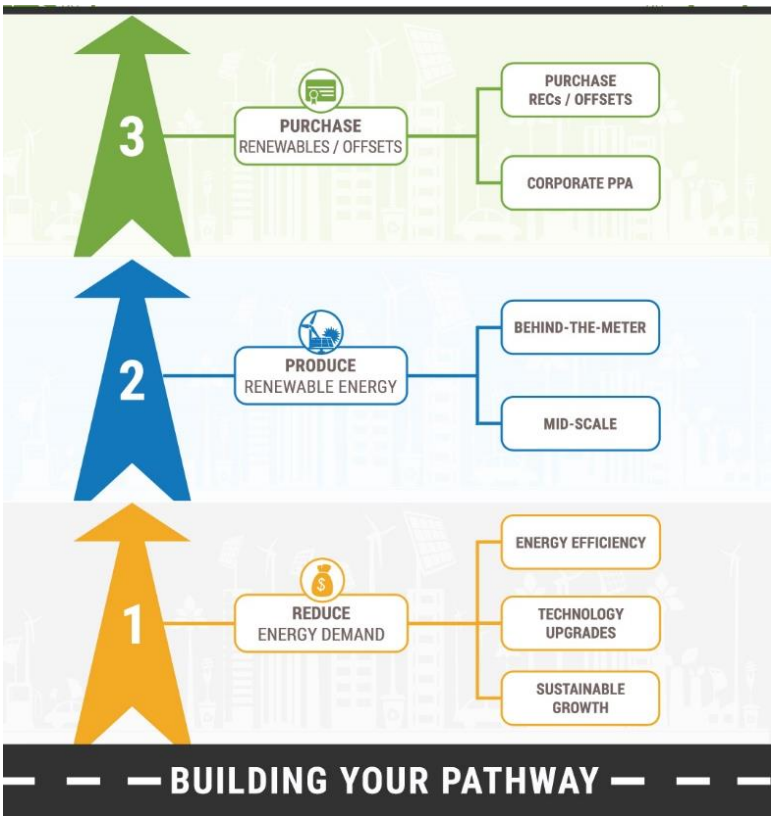

FIGURE 1: PATHWAY TOWARDS RENEWABLES

3.2.4 Develop a staged implementation approach

As noted above, as a first step in any renewable energy or carbon abatement strategy you should reduce your energy and carbon footprint wherever feasible and cost-effective, so that the amount of energy that has to be sourced from renewables is reduced. Alongside energy efficiency, your focus should be on the implementation of on-site renewables, including future opportunities that involve battery energy storage. Your electricity procurement strategy and process should include sourcing of renewable energy to meet part or all of your council's electricity needs over time, aligned with your energy contract periods.

Your staged action plan should contain actions that are achievable now, as well as actions you will be able to do in future, such as battery energy storage, changing your fleet to electric and hydrogen fuels, and electrification of gas-consuming plant. Once you have developed your staged plan, get the plan approved by management and get it adopted by Council, if required. Then, develop your financing and resourcing strategy.

3.2.5 Embed implementation within delivery and operational plans

Aligning your renewable energy strategy with your delivery program and operational plans will give you the best chance of success. You need a mandate from the community to spend money on renewables and carbon reduction initiatives, so make sure your strategy gets funded, and that actions feed into your delivery program and operational plan. Also, if your renewable energy strategy is anchored to the corporate objective, it will add strength to potential grant funding applications.

FIGURE 2: ALIGNING YOUR RENEWABLE ENERGY STRATEGY TO YOUR CSP AND OTHER KEY PLANS

3.2.6 Tell the community about your goals and successes

If you are implementing energy efficiency or renewable energy projects, you should tell your community about the successes you are achieving. Tell them how much energy you are saving, how many dollars you are saving, and about any co-benefits you are achieving.

Examples of how you can tell your community about your goals and successes are:

- Annual reports/scorecard/CSP
- Your social media
- Your webpages
- Uptake of renewables in the LGA via the Clean Energy Regulator or the APVI tool
- Signage that promotes what you have implemented (e.g., at community facilities and spaces)
- Signage that shows how much solar you are producing (e.g., a screen in your customer service centre that shows the energy generated from the sun for all your facilities)
- Link savings that are being achieved to improvements in services provided in the community. For example:
    - LED lights on sporting fields can deliver significant energy savings while providing better lighting levels, flexibility in choice of light levels for users, and better control of use and costs to clubs.
    - Savings from energy efficiency and solar in childcare can provide additional funds from savings to buy new early education resources.

You can even communicate your success stories using videos. An example of where a council has used this innovative method is Parkes Council, which is a member of the Cities for Power Partnership.

3.3 Energy efficiency opportunities for councils

The most cost-effective renewable energy is often energy that is not used. The most important energy demand reduction actions for councils are:

- Streetlighting LED upgrades and smart controls
- Building and parks & sporting field lighting upgrades
- Building Heating, Ventilation and Air Conditioning (HVAC) and Building Management Systems (BMS) upgrades and optimisation
- Upgrading facilities lighting systems to LED technology and controls
- Building power such as appliance selection and use, and ICT systems
- Motor systems upgrades and optimisation, for example at wastewater treatment plants

> ***Tip:***
> *When you develop your renewable energy strategy, you need to be mindful of your future energy consumption. Your energy demand may grow to meet improved service levels and to supply electric vehicles. For instance, a new sewerage treatment plant may be energy efficient but if it replaces older treatment technology then energy demand may still be higher.*

If you implement energy efficiency measures across your facilities and assets, then the required size of your renewable energy installations will reduce, which decreases costs to implement and leaves funding available for other initiatives.

You can develop and deliver energy efficiency opportunities by assigning and supporting skilled staff, engaging experts and by adopting sustainable procurement and design policies to ensure that new buildings, refurbishments and energy-using equipment is energy efficient.

Your carbon management software analytics may also be able to help with identifying energy efficiency opportunities.

The Department of Planning, Industry and Environment (DPIE) have great resources that can help with your initial thinking. You can visit www.EnergySaver.nsw.gov.au for DPIE Energy Efficiency information and programs. You can also contact government@environment.nsw.gov.au to obtain the following documents developed by DPIE and Local Government Procurement (LGP):

- Solar, Battery, Lighting RFQ template
- Solar, Battery, Lighting Implementation contract
- Energy Performance Contract (EPC) RFQ template
- EPC Detailed Facility Study (DFS) template
- EPC Implementation contract

3.4 Onsite renewable energy opportunities for councils

Onsite (or 'behind the meter') renewable energy opportunities generally refer to energy generation technologies like solar photovoltaics, heat pumps or solar hot water systems at

your facilities. At some specific sites such as water treatment and landfill operations there may be opportunities to implement micro-hydro or bioenergy generation projects, but these opportunities are less common.

If your renewable energy project is *behind* the meter and all the generated energy is consumed onsite, your project will offset the price you would usually pay for electricity at the time of renewable energy generation.

3.4.1 What onsite renewable energy opportunities exist?

If your roof space and/or land is suitable and you do not have barriers like shade from rooftop obstacles or trees, you can install solar photovoltaic (PV) panels. **Solar PV** is ideally suited to many council assets because there is daytime demand for electricity. If sized correctly, most of your renewable energy generation can be used directly, without exporting anything to the grid.

However, with lower solar PV prices, feed-in-tariffs and declining costs of battery energy storage systems, it can make sense to oversize PV systems if you have roof or land space available**.**

Battery energy storage systems and complementary technologies are also constantly improving, and their costs are reducing over time. They may help you to maximise the value of renewable energy systems in future and may help to further reduce grid costs.

For further information about battery energy storage systems, please visit the DPIE solar battery storage guide at https://energysaver.nsw.gov.au/households/solar-and-battery-power/solar-battery-systems and the DPIE Business Battery guides at https://energysaver.nsw.gov.au/business/equipment-and-technology-guides/battery-storage. Other DPIE and LGP resources that are useful for councils looking at onsite solar PV opportunities can be accessed by emailing government@environment.nsw.gov.au, and include:

- DPIE developed Solar standard
- DPIE developed rooftop Solar/ rooftop Solar PPA RFQ template
- DPIE/ Local Government Procurement (LGP) Solar PPA contract
- Solar, Battery, Lighting RFQ template
- Solar, Battery, Lighting Implementation contract

Solar hot water is also an excellent opportunity to switch to a renewable energy source for heating water. **Heat pumps** are a mixture of an energy efficiency and renewable energy opportunity. They utilise the latent heat in the ambient air to heat or cool air or water, depending on your requirements.

As noted above, there may be many opportunities for solar and heat pump systems, but it is much less common to find opportunities for micro-hydro and bioenergy generation.

Micro hydro is a type of hydroelectric power that typically produces from 5 kW to 100 kW of electricity using the natural flow and pressure of water. Given that many regional councils own water and sewer assets, it can be an opportunity for your council to generate renewable energy. For example, water incoming to a treatment plant from a dam may pass through a pressure reducing valve (PRV). This valve could potentially be replaced with a micro-hydro system that performs the same function as the valve but uses the energy in the water to generate electricity at the same time.

Bioenergy is renewable energy made available from materials derived from biological sources. For councils, a good source of bioenergy is food and organics waste. Hence bioenergy opportunities are most likely to be found at landfill sites. At this time bioenergy generation from organics may be a less economic and higher risk initiative than say composting, which can also see large reductions in carbon emissions.

3.4.2 How do you evaluate your onsite renewable energy opportunities?

To assess how applicable these opportunities are for your sites and circumstances, you can assign them to skilled staff, or consider engaging experts who are skilled in performing and providing detailed analyses.

Here is a list of steps you can consider:

Step 1: Identification and prioritisation of sites

In the first instance it is recommended that you look at all your sites and begin to prioritise those you will assess and implement first. Many councils have between 100 and 300 sites, so it is not practical to assess them all at once. There are several steps you can take to group your facilities in terms of their priority for onsite renewables, including:

- Use your energy data to identify your highest energy using sites, for example those using more than 100 MWh per year. Where available, access and plot the daily energy demand for these sites to understand daytime usage patterns in particular,
- Use freely available mapping tools and/or your internal GIS system maps to view these sites from above and identify areas of rooftop (ideally north, east and west) and land that appear to be unused and free of shade,
- Engage with staff responsible for these sites to get further understanding of building structural condition, what areas might be useable, and what future site plans could help or hinder implementation of renewables,
- It may also be helpful to engage with a CEC Accredited supplier to discuss your findings and other considerations, such as metering and connection requirements, type of energy supply to buildings and any implications for sizing of solar PV systems, and available space for inverters for example,
- Based on energy data, mapping information and engagement, draw up a list of sites and the size of areas that are likely to be suitable for solar PV

You can easily extend this analysis to other groups of sites, based on size of energy demand (e.g. 20-50 MWh, 50-100 MWh pa), or even on activity. For example, you may look at all childcare centres, libraries and community centres. Since these tend to have daytime energy demand, and are highly visible in the community they are great sites to both save money with solar and demonstrate your initiatives to the community.

Step 2: Desktop assessment of your opportunities

For every location that is suitable for behind-the-meter solar PV, solar modelling experts can match the solar output as closely as possible to your load profile within the constraints of your facility. Your modelling expert (who could be a solar installer or an independent party) assesses space for panels, taking into account shading, orientation, wind-loading aspects, structures, and other obstacles, as well as electrical infrastructure, space for inverters, amongst others.

If you plan to install batteries, the assessment determines whether you have a suitable space that protects them from theft and the weather and complies with relevant standards.

If you have identified a bioenergy opportunity, you will need to assess the quantity, quality, and seasonality of your feedstock, transport needs and final product, and processing needs, as well as identify suitable locations. To determine the feasibility, assess the current status, as well as future prospects.

> ***Tip:***
> *Evaluating opportunities does not only relate to existing buildings. You also need to make sure that future assets take energy efficiency and renewable energy considerations into account.*

For potential micro hydro locations, it is necessary to analyse the flow and head pressure of the system over the course of a year or more. A typical rule of thumb for hydro projects is that 50–60% of available power can usually be converted into electricity generation output, indicating the expected savings or revenue from such a project. However, costs for micro-hydro projects tend to be highly site-specific.

Step 3: Detailed feasibility and cost/benefit analysis

It is important to develop a cost-benefit analysis for your opportunities so that in the next piece of work, you can look at how to deliver and finance them. Good benchmark information is available online that can give an indication of likely costs. These can be amended based on your assessment of each specific site, including potential complexities in getting safe access to roofs, cable distance from generation to your main switch or distribution board, any roof, distribution board or metering works required, and so on. You may also have implemented other recent renewable energy projects and can draw on these costs to inform the analysis for new sites.

Savings analysis should take into account:

- Solar energy generation, and the fractions that will be self-consumed and exported
- The value of each kWh of energy saved where consumed on site, and the value of exported energy. Remember to include savings from peak demand if these will be achieved (this can be modelled for your sites that have 30-minute energy data)
- Future energy rates that are forecast to apply
- Loss of savings over time. Most solar PV systems for example are warranted to produce 80-83% of their initial rated power after 25 years
- Maintenance costs for renewable energy systems, and replacement of inverters if applicable

Apart from the feasibility, costs and benefits assessment, you should also consider internal timing requirements, resources available in your contracts and projects teams to source and manage the project, and seek the relevant internal approvals for the budget required.

In many cases a council may prefer or be required to separately carry out additional feasibility assessment such as structural certification of roof surfaces, geotechnical analysis of ground mount systems, or preparation of development applications. Alternatively these may be included as works to be carried out, within specifications issued to potential suppliers.

You can engage a consultant for assistance or use the DPIE solar analysis tool. Please email government@environment.nsw.gov.au for further information about their analysis tool and how it can support your assessment.

3.4.3 How do you finance onsite renewable energy opportunities?

Most sustainability initiatives require some sort of financing, and it pays to plan so that you can seamlessly execute your renewable energy strategy and reach your stated targets. Knowing beforehand what your needs will be, will also make sure that you are ready to submit your business cases in line with budgetary cycles.

Every council's needs, circumstances and objective are different, so a financing strategy needs input from senior management to make sure it is fit for purpose.

In most cases, your financing strategy is based around the following methods:

1. External funding including incentives and grants
2. Funding from your budget
3. Loan financing (e.g. via T-Corp or Clean Energy Finance Corporation)
4. Third-party borrowing (Energy Performance Contracts, or onsite solar PPAs)

Councils can consider using solar PPA providers from the panel of preferred suppliers established by the NSW Government Office of Environment and Heritage (OEH) (now Dept. of Planning, Industry and Environment (DPIE)).

> ***Using energy data and staff knowledge to help select the right solar solutions***
> *A council received initial supplier quotes for solar PV at two community facilities. To sense-check the suggested solar PV sizes the council officer analysed quarterly electricity bills for the most recent year, and discussed opening times and energy utilisation with managers of the two sites. Based on the advised operation of the sites, the energy peak and offpeak consumption data suggested that daytime demand was considerably lower than the solar quotes estimated. Based on this revised quotes for solar that were around 60% of the initial estimated size were sought and a preferred solution selected.*
> *By analysing energy information and engaging with operations staff, the council was able to avoid over-spending on solar for the two sites, and was able to use funds to implement other renewable energy projects.*

3.4.4 How do you implement onsite renewable energy opportunities?

Step 1 – Develop specifications

After your business cases for renewable energy opportunities are approved, you can go to market to select suitable implementation partners, like suppliers or project managers, for your projects. In addition to your council's standard tender documentation and contract schedules, you would include a specification for the renewable energy works you want to be implemented. For a solar PV project for example this may include:

- A summary of your project requirements,
- Copy of all feasibility assessment, solar modelling, structural assessment and other works you have carried out,
- Technical specifications, including:
    - Solar module
    - Inverters
    - Mounting system
    - Electrical specifications (AC & DC cabling and switchgear, labelling)
    - Structural assessment and certification (if required)

- Testing and commissioning (PV array installation, strings, AC connection, insulation resistance, thermal imaging, array frame equipotential bonding, start-up and shut-down, data monitoring testing)
- Handover (as-built drawings, owners' manual, training)
- Data monitoring
- Performance guarantees (if required)
- Maintenance services (under warranty and extended if required)
- Equipment warranties (supplier's installation, solar modules, inverters, mounting frames). This is particularly important as bankable warranties are your primary recourse for remedies if something goes wrong with your renewable energy system. The Clean Energy Council Accredited Installer webpage has good information on solar PV warranties, complaints and disputes for consumers.
- Any other technical specifications
- Standards and guidelines to be adhered to for all works

Step 2 – Go to market

Based on your specifications and design, you will then conduct a formal request for proposal or tender and invite suitably qualified parties to submit bids. If seeking quotes from a limited number of suppliers it pays to do some background work to find companies that have done this kind of work before, or who may work in your local area or region. It is a good idea to ask other organisations that have implemented similar projects for their recommendations.

To make it easier to compare proposals, ask for a clear itemisation of the solution's component and installation costs, as well as specific responses to items such as experience, expertise, capacity, financial performance, warranties and guarantees, safety, training, maintenance, and monitoring, for example.

Plan a day during your request-for-proposal period when tenderers can come to your site to conduct a physical inspection to make sure bids are coming from contractors with a sound knowledge of your site and your needs.

> ***Tip:***
> *For solar PV contractors, it is a good idea to choose a Clean Energy Council (CEC) Approved Solar Retailer. Solar Quotes is a good website to compare different solar installers.*

Step 3 – Evaluate offers

Once you receive the proposals, carry out an evaluation against a set of agreed criteria, which may include some mandatory (pass or fail) ones, as well as some that are scored against a rating scale. As a first step, check whether the bids are professional, address your evaluation criteria, and are sufficiently detailed. The following is a list of criteria to help you select a suitable bidder:

- Mandatory criteria, such as site meeting attendance, on-time receipt and conformance with tender documentation, financial records and adequate insurance coverage for public liability, professional indemnity and workers compensation, for example.
- Weighted criteria, including:
  - Proposal price and value for money. Bear in mind that the cheapest bid may not always be the best

- The quality of the proposed solution
- Workplace health and safety systems, environmental systems and quality management systems of the contractor.
- Experience of the business and experience and expertise of the staff who will deliver the project.
- Proposed project plan and project management systems.
- Equipment warranties and proposed performance guarantees.
- Proposed maintenance services
- Proposed monitoring solution
- References

Step 4 – Appoint contractor

Shortlist the bidders and contact their referees. Confirm the suppliers have the capacity to deliver the project on time, and analyse further whether the proposed staff have the skills and experience required for the job.

It is important at this stage to also carry out a thorough check of each bidder's project financial analysis, to ensure that proposal financials can be compared on a like-for-like basis, and to conduct your own sensitivity analysis on input parameters.

Based on your evaluation criteria, the initial evaluation and follow-up checks, and the financial assessment, you can decide on your preferred contractor.

Step 5 – Implement the project(s)

Implementation of your projects should follow the processes already used in your council to manage any building, or asset improvement works.

Step 6 – Maintain system and monitor performance and warranties

The most important thing in this step is the question of whether the project or system performs according to specification. Your most reliable source of information to inform this is your monitoring system. Comparing actual yield to expected levels regularly over the first year is an important task, as early identification of issues will mean these can be rectified in a timely manner.

Ongoing monitoring as well as ensuring that maintenance schedules are adhered to, and receipt of maintenance inspection reports should also be prioritised. If you have multiple renewable energy systems it is good practice to have a maintenance program across all sites that is managed by a council staff member.

More information

NSW Government resources, listed below, can help you with implementation.

- Solar, Battery, Lighting RFQ template
- Solar, Battery, Lighting Implementation contract

If you want to find out more, please send an email to government@environment.nsw.gov.au.

3.5 Purchase renewable energy

For most local governments, the carbon reduction that can be achieved with energy efficiency and onsite renewable energy installations is typically 20-40%. If you want to meet more ambitious targets, you have to procure renewable energy.

The traditional way for energy users to source renewable energy has been through the purchase of accredited GreenPower®. An emerging way to purchase renewable energy is with renewable Power Purchase Agreements (PPAs) that include renewable energy certificates.

3.5.1 What is GreenPower?

The easiest way to buy renewables is to purchase GreenPower®, which is government accredited renewable energy that is additional to Australia's Renewable Energy Target. Buying GreenPower® means that renewable energy equivalent to your energy consumption is added to the grid on your behalf.

Most electricity retailers have their own products sourced from accredited GreenPower® generators, and it is easy to make the switch. GreenPower® is a great option for smaller energy users who may not be able to enter into a Power Purchase Agreement. However, GreenPower® comes at a premium to grid electricity prices.

3.5.2 What are renewable energy PPAs?

In the 'traditional' electricity market, only large energy retailers and a small handful of very large energy users could buy power directly from generators. In the emerging renewable energy market, corporates and (groups of) organisations can now buy renewable energy from specific renewable energy projects. This approach is called a 'corporate PPA'. Organisations enter into these agreements primarily to lock in future energy prices and to meet carbon reduction or renewable energy targets, where this can be achieved at no greater cost and with no greater risk than purchasing regular grid power.

> ***Onsite versus offsite PPA:***
>
> *An onsite PPA is a financing option for the installation of solar panels on Council's roofs ('behind-the-meter'). An offsite PPA, however, is where Council purchases energy from a utility-scale project located on the grid side of any of Council's facilities.*

With offsite Power Purchase Agreements (PPAs), you are contracting for renewable electricity for a minimum number of years; in the current market this is much longer than a regular electricity contract (e.g. 7 to 10 years). You agree to pay a certain amount of money per MWh, which covers all costs including financing, construction and maintenance of the renewable energy asset. No capital investment is required. The advantages of this approach are that, if you contract for the renewable energy certificates, you can point to a particular project and claim that this is your source of renewable energy. Also, with the renewable energy project developer owning the generation asset, the performance risk sits with the developer.

Offsite PPAs can also use GreenPower® or the business specific product GreenPower Connect®. This can add flexibility to the PPA and the fact that GreenPower® audits both the generation and retirement of renewable energy certificates means that a GreenPower PPA has a high amount of credibility.

The vast majority of corporate PPAs have been based on utility-scale solar and wind energy. In future, it is likely that more technologies will be included in PPAs, such as pumped hydro and battery storage.

Over time, customer-focused models may enable local governments to receive renewable energy supply offers that are comparable to 'regular' retailer offers that are sourced from the mix of energy sources supplying the grid.

> ***Tip:***
>
> *A limiting factor for councils in NSW is a ministerial order that prevents local governments from entering into "contracts for difference", a contracting method that underpins many 'corporate PPAs' in the market.*
>
> *What this means is that a Power Purchase Agreement must consider your electricity load and timing of energy demand. The PPA needs to match your demand, while at the same time manage differences between renewable energy generation and demand via load balancing strategies.*

Experience to date for councils in NSW has included the aggregation of demand by close to 20 councils via Southern Sydney Regional Organisation of Councils (SSROC) and the procurement of cost-effective 20-30% renewable energy for these councils for 11 years from July 2019.

In the current market, these bulk purchases are integral to making the price for renewables competitive with 'regular' power prices. PPA offers for smaller businesses are emerging, but without the same likelihood of cost savings at this time.

A renewable energy PPA represents a very new way to source electricity, and the market continues to rapidly evolve even as more corporate PPAs are being developed. A range of factors need to be considered before entering into a PPA, and it is highly advisable at this stage in the market's development to seek expert advice. Some of the major factors that are relevant include:

- The policy and political environment provides a degree of uncertainty about future renewable energy goals and required investment, beyond the Renewable Energy Target. Some jurisdictions have legislated their own higher renewable energy targets.
- With PPAs tending to be for longer periods than regular contracts, predictions of the future wholesale price of electricity are required in order to predict whether a contract will save or cost money over its term. Future market predictions are inherently subject to potentially sizeable changes, due to factors such as generators exiting the market, the timing and scale of new supply and interconnections, generator outages, bidding behaviour, gas prices and weather trends, for example.
- Council's sites and their current energy demand: it may be feasible to include large sites but not all sites in a renewable energy PPA.
- In the current market better pricing is seen with larger-volume renewable energy purchases. For example the SSROC PPA will see close to 39,000 MWh of solar energy purchased each year to meet 20-30% of the electricity demand of participating councils. This amount of electricity is equal to the total electricity use of 3 to 8 regional councils depending on their size. So for a comparable price to be achieved it is likely in the current market that several councils should work together to source renewable energy.
- Alignment of contract end and start dates: if multiple organisations are to work together to procure a PPA, then their existing contract end dates will need to align, and this may

require a high degree of collaboration and management of short-term price risks to get all parties to commence a renewable energy PPA at the same time. This process by its nature can take a couple of years.

- Within a PPA contract negotiation there will be many factors to be negotiated to ensure the best deal can be secured. This will include things such as price, escalation, meet-market or re-set options, novation to other retailers (since the regular portion of an electricity agreement will be much shorter than the PPA duration), minimum volumes, firming prices, and many other factors.

While this is a complex opportunity that requires expert input, collaboration and time from multiple stakeholders, the size of the abatement potential is also very high. Fortunately, resources in the market are emerging that aim to make PPAs more accessible and risk-managed. This includes the Business Renewables Centre – Australia (BRC-A).

3.6 Build your own midscale solar

Many councils have property roof space, infrastructure or land that is ideally suited to the development of mid-scale solar farms in front of the meter, or 'grid-side'. If not, buying or leasing land for this purpose may be feasible. Sites that other councils have assessed for solar farms, and in some cases developed, include wastewater treatment land, landfill sites, airports and dams.

3.6.1 What are mid-scale renewable energy projects?

There is no official definition of the size of such a system, and size will typically depend on a council's own demand and the types of contracts they can enter into. A mid-scale is sometimes referred to as a customer-scale project. For example a small council may have aggregate daytime demand of say 500 kW and cannot enter into a contract for difference. A 500 kW solar farm may represent the largest feasible project they could consider developing. On the other hand, Sunshine Coast Council in Queensland developed a 15 MW solar farm to meet all of its electricity needs (night and day).

So 500 kW to 15 MW may be a typical midscale range for councils. Among the factors to consider if developing such a project is how it will be classified by the Australian Energy Market Operator AEMO. From an AEMO perspective, renewable energy plants are classified as a *scheduled generating unit (>30MW)*, *non-scheduled generating unit (>5 MW and <30MW)* or *semi-scheduled generating unit (>30MW)* depending on the extent to which they will be participating in central dispatch. At less than 5 MW in size a renewable energy project will not fall under this AEMO classification and won't have to register. At more than 5MW and up to 30MW registration costs and AEMO limitations may apply.

Difference between behind and in-front-of-the-meter

When you install solar PV behind your meter, every kWh that your system produces displaces energy consumption from the grid. There is no need to 'sell' the produced energy to yourself. The situation is different when you run a grid-connected solar farm that does not serve any behind-the-meter load and instead is connected to the grid. If your renewable energy project is in front of the meter, you must sell the generated electricity into the market, like any other generator.

Under National Electricity Market (NEM) rules, all energy projects must have a retailer to sell the energy to the market. The retailer will balance your load when your renewable energy plant

is not generating or not generating at full capacity and will provide other risk management services for you.

3.6.2 Why should councils consider midscale solar farms?

The generated energy from such a solar farm can be used to make your electricity supply renewable. Subject to available space, the system could be sized large enough to meet a significant proportion of the electricity consumption of all your sites. By generating locally a council is also employing additional local people, and is further signalling its commitment to renewables and emissions reduction to the community.

3.6.3 Costs and benefits of a midscale solar farm

You will need to invest capital and directly or indirectly manage the construction of a renewable energy asset, typically through an Engineer, Procure, Construct contract. Once your solar farm is operating, ownership is transferred to you, and you will take on the management and risk of the ongoing solar farm performance.

The three main factors that influence the business case for a mid-scale solar farm are

1. Market pricing for electricity
2. Large Scale Generation Certificate pricing
3. Engineering Procurement Construction costs

Engineering Procurement Construction costs will vary depending on the size and location of a potential project and the amount of generation produced, as well as the costs of connecting to the grid, acquiring land, obtaining finance and project development.

The major aspects that an assessment will evaluate include the unsubsidised cost of energy generation, treatment of renewable energy certificates consistent with your carbon reduction or renewable energy goals, and retailer engagement and negotiation to facilitate this additional supply source.

If you have access to cheap, suitable land and if your cost of capital is low, this will improve your business case. Adding a shadow carbon price into your business case further improves it.

Your benefits will largely depend on what price you can sell (and purchase) your generated electricity for, whether you will sell your Large-Scale Generation Certificates (LGCs) which will generate additional income but reduce the environmental claims that can be made and the difference between this and your regular grid cost for electricity.

Please note that there is a future risk (within the 30-year life of a solar project) that the grid may become saturated with solar energy during peak production times and that there will be constraints placed on generators (i.e. your solar farm) or negative pricing.

3.6.4 Steps involved in establishing a mid-scale solar farm

- Look for suitable land via your GIS system
- Developing and defining the project objectives and project vision
- Approval processes
- Feasibility study
- Grid connection
- Stakeholder engagement
- Economic viability
- Preparation of business case

- Project plan
- Going to market
- Selecting an offer
- Implement and commission the solar farm

Selecting suitable land

You can use your Council's Geographic Information System (GIS) to look for suitable land that meets the following criteria:

- Flat or near-flat land (e.g.<5% slope) or water body
- Council-owned that currently has no other committed future use
- A north-facing aspect but N-E to N-W can also be included
- Buffer to residents
- Not in a flood-affected zone
- Areas not subject to a vegetation management plan or similar constraint
- Proximity to the electricity grid

As a rough estimate, 2-4 hectares are required per MW capacity for a mid-scale solar farm.

Achieving a connection agreement

For larger-scale power generation plants, networks are currently being swamped by applications to connect. This can result in the connection process being drawn out for many months or in some cases, for example in some regions of the Essential Energy Network in country NSW, a refusal to connect where the network is at capacity. If you are considering building a mid-scale solar farm, you need to initiate contact with your network provider as early as possible.

3.7 A note on LGCs and credible claims

An important factor to consider if building your own renewable energy project or entering into a renewable energy PPA is your intended treatment of renewable energy certificates, particularly Large-scale Generation Certificates (LGCs) associated with all projects greater than 100 kW in scale.

Simply put, all environmental claims related to renewable energy projects are attached to the LGC only. So, if a council sells or holds back for future sale the LGCs it generates from say an on site solar project, it therefore foregoes the abatement claim for the project and should account for the electricity it generates and consumes the same way it would account for regular grid power.

If a council builds a midscale solar farm and sells the LGCs to generate income for the project, then when it buys back the power to part-meet its energy needs the renewable energy claim does not come attached to this energy.

Similarly if a council enters into a PPA for say 30% renewable energy that delivers both the electricity and the LGCs, in order to claim this energy as renewable on top of its pass-through obligation amount of renewables via the RET, it would need to voluntarily surrender the LGCs.

3.8 Case study: Heat pumps (mixture of behind-the-meter energy efficiency and renewable energy)

A heat pump uses a renewable source of energy to heat water and works similar to a refrigerator. It extracts heat from the surrounding air and transfers it into your storage tank to heat water.

In North Sydney Council's Crows Nest Community Centre (CNCC) water for the building used to be heated with three gas boilers. As the gas boilers were aging and becoming unreliable, an electric boiler was installed to replace a gas boiler to ensure hot water continuity. After a second boiler showed signs of leaking, it was decided to replace the system and upgrade to a renewable energy solution if it was cost-effective. CNCC went to market and selected four 7.2 kilowatt heat pumps with two 420- litre storage tanks.

Electric heat pump systems run on electricity and are typically three or more times more efficient than electric water heaters. This means that for the same energy input, at least three times more heat output can be achieved. A further benefit of the installed heat pumps is that they can run on solar electricity generated by panels on CNCC's roof.

For more information, please contact the Accounts Manager of CNCC at 02 9439 5122. Alternatively, you can contact North Sydney Council's Sustainability Projects Officer at 02 9936 8100.

3.9 Case study: Tweed Shire Council – solar PV implementation (behind-the-meter implementation)

In May 2013 Council adopted the aspirational goal of becoming self-sufficient in renewable energy. Inspired by other local governments and organisations in Australia, Tweed Shire Council indicated its commitment to using renewable energy, which has subsequently been adopted in the Community Strategic Plan 2017 – 2027.

Council developed a Renewable Energy Action Plan (REAP) and based on the findings, selected a staged approach to pursue its aspirations to be self-sufficient in renewable energy.

1. 25% of Council's electricity self-generated from solar by 2022, compared to 2016/2017 use.
2. 50% of Council's electricity self-generated from solar, incorporating storage, by 2025, compared to 2016/2017 use.

For phase 1 to 2022, costs and savings estimates for 20 energy efficiency and renewable electricity projects were calculated. The project costs to Council are $5.2 million with a payback of 5.2 years. The projects will reduce Council's consumption of electricity from the grid by an estimated 5,000 MWh per year, or 25% of Council's electricity use compared to 2016/2017.

At the time of the development of the REAP, five of Council's facilities had solar installations, generating almost 1% of Council's electricity use from a renewable source. Since the development of the REAP, Council has put a great focus on improving its energy efficiency performance and installing solar PV at its facilities. In addition to several small-scale solar PV systems, Council is also installing large-scale systems.

In 2019, Council implemented a 165 kW solar array atop the Tweed Regional Aquatic Centre (TRAC) in Murwillumbah. The council will also install a 604 kW ground-mount solar power system at the Banora Point Wastewater Treatment Plant, which will expand on the already existing 781kW of solar PV systems across Council's facilities.

The Banora Point plant is Council's biggest energy consuming asset. Council will fund the $880,000 installation, which will pay for itself in energy savings over six years. The solar system is expected to provide one-fifth of the plant's power needs and save more than 730 tonnes of greenhouse gas emissions a year.

Contact the Sustainability Program Leader for more details at tsc@tweed.nsw.gov.au or 02 6670 2400.

3.10 Case study: City of Newcastle 5 MW plant (mid-scale solar plant)

In recent years, the City of Newcastle's electricity bill of $4m p.a. doubled, which led the city to consider its options to reduce these costs. The Council also committed to generate 30% of its electricity needs from low-carbon sources and cut overall electricity usage by 30% by 2020. While the Council already has several onsite solar PV generation, it recognised that 30% renewables could not come from onsite solar PV installation alone.

FIGURE 3: THE CITY OF NEWCASTLE'S 5 MW SOLAR FARM[1]

Council went to EOI and subsequent tender in November 2018 for the construction of a 5 MW solar farm. Council estimates that the solar farm will save the city around $9 million over its 30-year life after construction and operational costs are factored in. The project is valued at $8.2 million.

The 5 MW solar farm is located on an eight-hectare capped landfill site at Summerhill Waste Management Centre. The farm will produce sufficient energy to run the City of Newcastle's facilities during the day and save ratepayers around $9 million over its 25-year lifespan. It will also substantially assist the City of Newcastle in achieving its 2020 target for 30% renewable energy generation.

To build the solar farm, the city secured a $6.5m loan from Australia's Clean Energy Finance Corporation (CEFC). For further information, please contact smartcity@ncc.nsw.gov.au or call 02 4974 2000.

[1] Picture sourced from http://newcastle.nsw.gov.au/Council/News/Projects-Works/Summerhill-solar-farm

3.11 Case study - SSROC PPA[2] (offsite Power Purchase Agreement)

Southern Sydney Regional Organisation of Councils Inc (SSROC) completed the first phase of its Program of Energy and Environmental Risk Solutions (PEERS). Working with consultants from Sourced Energy and Next Energy, SSROC has signed a landmark agreement on behalf of 18 councils that will result in up to 35% of their retail electricity being supplied by a renewable energy generator from 1 July 2019.

This innovative approach, achieved through a renewable energy Power Purchase Agreement (PPA), allows councils to purchase renewable electricity without exposure to the volatility of the National Electricity Market (NEM).

The risk-managed renewable energy PPA will provide councils with significant cost savings compared to the current market while also reducing their carbon emissions, and involves a new form of PPA that complies with the Ministerial Order that prevents councils entering into a contract for difference.

The award-winning contract will provide councils with renewable energy from the Moree Solar Farm project until the end of 2030, with the balance of their retail electricity needs being supplied as regular grid electricity by Origin Energy for at least the next three years.

One benefit highlighted in the SSROC approach was the value of aggregating the demand of multiple end users to achieve a better price for renewable energy supply.

This first phase of PEERS won the Local Government Professionals 2019 Award for Innovative Leadership and Management.

For further information, please contact ssroc@ssroc.nsw.gov.au.

3.12 Case study -Tamworth Regional Council – EOI for large-scale solar PV installation/arrangement (midscale versus offsite PPA)

In 2018, Tamworth Regional Council issued an expression of interest to source offers from the market for a Large Scale Solar Photovoltaic (PV) Installation/Arrangement. Council's main objectives for the project were to:

- Secure financially competitive pricing for all, or a large portion of, its operational energy costs;
- Reduce exposure to potential rising energy costs; and
- Supply its electricity demand with renewable energy, with associated carbon reductions

In the current market, there was a range of factors relating to the sourcing of renewable energy that Council needed to consider to appropriately evaluate and mitigate risk, meet renewable energy and emissions reduction goals, and achieve cost-competitive electricity supply over the long term.

Factors that Council considered were:

- Electricity and Large-Scale Generation Certificate (LGC) market factors
- Connection and potential restrictions
- Virtual PPAs and contracts for difference
- Offtake pricing

[2] Text sourced from http://ssroc.nsw.gov.au/18-nsw-councils-sign-39gwh-per-year-landmark-renewable-energy-agreement-to-cut-emissions-and-costs/

- Contract duration and flexibility
- Cost-benefit outcomes for similar Council project evaluations
- Energy market disruption
- Lack of retail competition and take up

After careful evaluation of these factors, Council decided against building its own mid-scale power plant as renewable PPA offers appeared to offer lower risk and potential cost savings compared with mid-scale build options in the current market. Going forward, Council will consider incorporating the purchase of renewable energy in its next electricity contract period.

For further information, please contact the Sustainability Officer Energy at trc@tamworth.nsw.gov.au, or call 02 6767 5555.

4 Renewable energy in the community

While the previous chapter focused on increasing renewables in your operations, this chapter focuses on renewable energy in the *community*. This chapter highlights a range of renewable energy approaches from bulk-buy to utility-scale projects and:

- Describes what they are,
- Highlights a couple of relevant case studies,
- Points to leading resources for further information, and
- Identifies what Council's role in aiding or facilitating these approaches might be.

4.1 Education and information

One of the main ways in which Councils can help and encourage their communities to act to reduce their emissions and save money is through the range of education and information programs they run in their communities. Education and information are a really important part of Council's sustainability efforts, and increasingly important as the urgency to act on climate change grows. Councils' cannot make all the necessary changes in their communities themselves; a community that is educated, informed and literate regarding climate change, renewables and other abatement measures can make these changes.

4.1.1 Social license and community support

Having the support and license from your community to develop and implement the initiatives that will make a real difference within your local area is a key factor that will underpin the scope and scale of actions that councils can undertake to educate, inform, facilitate and potentially incentivise households and local businesses to implement renewables and other abatement measures.

Having a clear social license to act can also provide your Council with a mandate to be ambitious in your own operations and to demonstrate to your community what can be achieved.

Opportunities to engage with the community and seek a license to act on climate change can happen in a number of ways. Firstly, councils existing initiatives already help to make their communities better educated on climate and renewables, so continuing to deliver these initiatives is straightforward.

One prominent way is to engage on climate as part of the development of your Council's Community Strategic Plan, a 10-year vision for how your community will develop and improve over this time. A clear message that the community wants action on climate change provides

a powerful signal that your council should work with the community over the long term to make real change happen.

Also, CSPs are generally supported by strategies that then inform your Delivery Programs and Operational Plans. Whereas a CSP may be a high-level strategic document, a renewable energy or climate change strategy arising from this may provide further opportunities to engage more deeply with the community, and to ask them to help shape the solutions that will help them to implement the changes they want to see.

4.1.2 Activities that councils can run in the community

Some of the initiatives that councils can run to facilitate change and uptake of renewables and abatement action in the community are:

- Information campaigns and web-based resources
- Workshops and expos that bring suppliers, technical know-how and community together
- Programs to provide audit and information to homeowners, strata committees, business chambers, and other organisations
- Education sessions in schools
- Phone service to provide local residents and businesses with access to energy advice (Please note that service providers like 'Our Energy Future' can help with this)
- Partner with not-for-profits or community energy groups to provide information about energy efficiency or renewables
- Run programs that provide sustainability audits and advice to businesses
- Facilitate or expand non-council programs (e.g., Joint Organisation, state, federal programs) to update the community (e.g. on Greenpower, Community Energy Hubs, etc.)

4.1.3 Case example - Solar my School

Solar my School was jointly founded by Randwick, Waverley and Woollahra Councils, and is offered to Councils around Australia under license. The program supports community organisations and public facilities to install rooftop solar PV and understand how they are using their energy. The program also helps identifying financing solutions and takes out complex technical and contractual considerations.

How Solar my School works for organisations interested in participating:

1) Free solar feasibility report
   - Analyses electricity consumption and usage patterns
   - Shows right sized system and location, estimates costs and savings
   - Done by independent expert
2) Financing the system
   - Information and support in accessing grants and funding
   - Help with fundraising activities
3) Installation of the project

   Public schools:

   - Assistance working with the Department of Education, post-installation inspection report

   Private and Catholic schools

- Tender and contractual documentation to seek quotes
- Independent evaluation to choose quality supplier and system
- Support in seeking planning approvals where required, post-installation inspection report

4.2 Renewable energy bulk-buy

Renewable energy bulk buys have been an effective way to increase the level of solar PV, solar hot water and air-sourced heat pumps in communities. Bulk buys can be led by councils or not-for-profits.

The benefits to the local community are that the community can

- Get access to cheaper renewable energy installations (bulk-buys may enable the negotiation of a discounted price)
- Trust installers that have been pre-vetted
- Improve their understanding of renewable energy technologies
- Increase the uptake of renewables

4.2.1 Steps that councils and not-for-profits need to undertake to enable bulk-buy

The following list shows the most important steps involved in setting up a bulk-buy program.

1. Set up the vision and technologies that are procured (e.g., solar PV, inverters, battery storage systems, solar hot water, heat pumps)
2. Negotiate discounts for top-tier quality technologies
3. Establish a panel of preferred suppliers (for further help with this step, please see section 3.4.4
4. Negotiate standard pricing across preferred suppliers
5. Develop a communications plan on how to advise your community about the opportunity

Additionally, you could also implement the following measures to help address some installation barriers:

- Provide clear definitions of PV systems which do not require Council consent
- Provide a simple guide to the processes required for approval of PV systems which require DAs
- Potentially waive DA fees
- Consider pre-approved PV types for heritage areas
- Better define elevations from which PV should not be visible in heritage areas, for instance, to allow installations which may be visible from little-used back lanes

4.2.2 Case study: New England solar bulk-buy

The New England solar bulk-buy was run by *Farming the Sun* in 2016 across the local government areas of Tamworth, Armidale, Liverpool Plains, Gunnedah, Uralla and Walcha. It offered a bulk discount for high-quality solar PV systems for residents and businesses.

Farming the Sun's work was undertaken by a large-scale collaboration of many organisations under the legal auspices of Starfish Initiatives. The organisation negotiated a partnership with Eco Energy & Solar Solutions (EESS) for the solar power bulk-buy taking into account their demonstrated track record of installing a large number of residential, business and commercial solar power systems.

For more information, please visit http://farmingthesun.net/bulk-buys/

Contact details for this project can be found at https://farmingthesun.net/contact-us/.

4.3 Mid-scale renewable energy projects that benefit the community

Following on from mid-scale plants we introduced in section 3.6; this section focuses on how the community can benefit from mid-scale renewable energy projects. The community can buy renewable electricity from such a plant, via a (community energy) retailer, or potentially as part-owners (also refer to next section).

4.3.1 Why should councils consider community participation in mid-scale renewables projects?

There are numerous benefits in having the community participate in mid-scale renewable energy projects, with the most important ones being

- To engage the community in local energy generation
- To increase literacy in renewable energy
- To potentially support low-income residents via subsidised electricity bills

4.3.2 Theoretical case study - community energy retailer

A council with a goal to achieve 100% renewable energy has determined that one of the options available is to build their own mid-scale power plant. Upon investigation of their GIS system, they found a suitable land that met all necessary criteria.

The land is big enough to not only generate as much electricity as Council needs for its assets but also serve energy needs of the community. A retailer emerges that is owned by the community and that is focused on returning all benefits to the local community.

A campaign is run and 80% of the local residents sign up to the scheme and contribute money to be invested in building the renewable energy plant. The plant is built, and the council, as well as the community, are offtakers of the produced electricity.

4.3.3 Case study - Newstead 2 MW solar farm

Newstead, a small Victorian town, is planning to achieve 100% renewable energy by 2020. One way it wants to achieve this status is through a local solar farm. Currently, standardised network charges make it costly to distribute the energy output of a shared renewable energy plant with local users.

However, in 2018, Newstead managed to successfully negotiate new network charges with the distributor Powercor for locally produced and shared renewable energy. This is a significant milestone, which will help Newstead reach its goal of 100% renewable energy, including local power-sharing and may pave the way for similar arrangements in other networks.

For further information, please contact info@renewablenewstead.com.au.

4.4 Community energy projects

Community energy projects are renewable energy projects initiated and developed by the community to deliver broad benefits to the local community. There are a number of ways to deliver and finance renewable energy projects.

An organisation with a suitable roof space hosts a renewable energy project, and the community can participate by financing this project. The host agrees to buy the power at an agreed price that is lower than grid electricity, but high enough to repay the capital cost and

deliver a return to investors. Lots of community energy projects exist now, from early Hepburn and Denmark wind farms to the new Sydney Convention Centre.

4.4.1 How can councils get involved with community energy projects?

There are many ways that you can participate in community energy projects.

Council as advisor/facilitator

You can support existing groups and provide in-kind and grant support to existing community energy groups. The City of Sydney, for instance, provided a grant to Pingala, an already established community energy group.

Council as investor

You could invest in a renewable energy project that is developed, financed and managed by a third party. A commercial example of this is Sapphire Wind Farm, which is a utility-scale wind farm that allowed this type of community co-investment.

Council as off-taker

You could purchase the electricity output from a community energy project.

Council as host

You could provide roof or land space for a behind-the-meter community energy project. The project supplies electricity to you and the community funds the installation. An example of this is the floating solar on East Lismore Sewerage Treatment plant, in which 40 members from the community invested.

4.4.2 Typical structures for community energy projects

Community ownership is typically structured as a PPA or a community loan.

PPA

Renewable energy is developed and owned by the community, whereas Council contributes as a host and buyers/users of the energy (example: Repower Shoalhaven).

Loan

Funds are raised from investors, then lent to Council which builds and operates renewable energy projects. Council needs to repay the loan (example: Farming the Sun, Lismore City Council).

4.4.3 Benefits and challenges of community energy projects

Community energy projects have multiple benefits:

- Emissions reduction
- Increase in environmental values and behaviour
- Regional development and income diversification
- Provision of a community asset
- Provision of local jobs
- Shareholder income, community income
- Renewable energy education and training
- Renewable energy industry development
- Energy self-sufficiency

- Local ownership and decision making
- Community building
- Community empowerment

There are also challenges with setting up community renewables projects:

- If your council hosts community energy projects and gets funding from the community, the funding is more expensive than equity or loan financing
- It can take a long time to set up community renewable energy projects
- There is uncertainty about the price for renewable electricity that is exported to the grid (feed-in-tariff needs to be negotiated, a retailer may agree to a fixed or spot price for electricity that is exported)

The following list provides a number of case studies for community energy projects

- www.farmingthesun.net
- https://www.hepburnwind.com.au/
- www.repower.net.au
- www.sydneyrenewable.com.au
- www.pingala.org.au
    - http://www.smh.com.au/environment/pingala-communityowned-solar-project-to-hit-the-roof-of-young-henrys-brewery-20151029-gkltqu.html
- http://www.abc.net.au/news/2016-12-08/stucco-student-housing-installs-shared-solar-battery-system/8103298
- http://www.serree.org.au/knowledge/news/article/?id=australian-first-community-controlled-solar-installation-for-apartments

The Community Power Agency has developed a Guide for Community Energy, which can be found at the following link: https://www.environment.nsw.gov.au/resources/communities/cpa-community-energy-how-to.pdf.

The Frontier Impact Group has developed a Community Renewable Energy Financing Kit, which can be found at https://www.frontierimpact.com.au/toolkit.

4.4.4 Case study: Lismore City Council

Lismore City Council collaborated with Starfish Initiatives, a local solar installer, OEH and community investors to build two community-owned solar farms. The project received funding for its development from the OEH *Growing Community Energy Grants* program.

The purpose of the project was to install two solar farms on two of councils high-use sites funded with a community loan. A community group of investors raised the capital for the solar farms; they then loaned this money to Council to install the solar farm. Council repays the loan with interest, and the community shareholders get a franked dividend.

FIGURE 4: LISMORE CITY COUNCIL'S 100 KW SOLAR ON GSAC

Council will repay the investors with interest to the community companies

for a period of seven years, followed by a 'bullet' repayment of capital in full at the end of the loan.

The first of the two solar farms switched on in July 2017. The 99 kW solar array was installed on the roof of the Goonellabah Sports & Aquatic Centre.

FIGURE 5: LISMORE CITY COUNCIL'S FLOATING 100 KW SOLAR

The second 99 kW was installed at the East Lismore Sewerage Treatment Plant. Due to spatial constraints at the sewerage treatment plant, the solar farm was installed as a floating solar on a tertiary treatment pond. At the time of its construction, it was the largest floating solar farm in Australia.

One of the advantages of the floating system is that Lismore City Council will be able to expand the system. The initial 99 kW system only meets around 20% of the site's daytime electricity usage, making the scope for expansion highly valuable.

According to Lismore City Council, the project has the following benefits:

- Leadership Council & community
- Affordable RE for Council
- Fair ROI for community investors
- New community partnerships
- Energy education and literacy
- Local sustainable investment
- Sustainable asset for council
- Showcase model for further community energy projects

You can find out more information at https://farmingthesun.net/lismore/business-model/

For further information, please contact Lismore's Environmental Strategies Officer at 1300 878 387.

4.5 Microgrids, embedded networks and Virtual Power Plants

There are two main problems with the traditional grid. Firstly, the energy mix of the grid is a combination of fossil fuels and renewables, heavily leaning to generation based on coal. The second problem is that if the grid goes down, everyone in the area will be without power.

This is where microgrids can provide a solution. Microgrids can help communities with transitioning to renewables cost effectively. They can also provide local, reliable and affordable energy security. They can support various forms of distributed generation such as solar, wind, micro-hydro, combined heat and power, and others.

4.5.1 What is a microgrid?

A microgrid is a discrete energy system consisting of distributed energy sources and energy demand response capable of operating in parallel with, or independently from, the main power grid.

The intent of microgrids is to provide local, reliable and affordable security. If there is a blackout, solar panels will shut down, but in a microgrid, the microgrid can disconnect from the main grid, and the community serviced by the microgrid still has electricity. Traditionally, gas and diesel have provided energy in a microgrid (as standby generation), typically in the context of a discrete building rather than in a community.

4.5.2 Benefits and challenges of microgrids

A benefit of microgrids is that there are lower energy transmission losses, as the electricity is consumed closer to where it is generated. As a result, there should be reduced network costs. Microgrids may allow a community to be more energy-independent, and it can be a source of income where excess power is sold back to the main grid. If the generation is based on renewables, a microgrid will also be more sustainable than the main grid. Microgrids will enable increased customer participation in both energy consumption (or the reduction thereof) and the energy supply (through solar panels on the roof, for instance).

While the benefits of microgrids are manifold, there are also several challenges that need to be overcome. Firstly, if the microgrids is based on renewables like wind and solar, the energy generation will be variable. This means that battery storage will need to be implemented to balance energy consumption and production. Secondly, to make a microgrid cost-effective, discounted tariffs or generation credits would need to be agreed and applied within the microgrid. Thirdly, additional solutions must be put in place for microgrids serving a community, so that locally generated electricity can be shared amongst its users.

4.5.3 What is an embedded network?

An embedded network (EN) helps landlords and tenants to share the benefits of locally produced energy. ENs are common at airports, shopping centres, caravan parks and apartment buildings. Anyone can be the owner of an EN, the building owner, a developer, or a retailer. Some restrictions apply, and more information can be found on the Australian Energy Regulator site. Exemption rules can be found at the following link https://www.aer.gov.au/networks-pipelines/network-exemptions/classes-of-network-exemption-applicable-conditions.

Embedded networks are important so that energy can be on-sold from landlords to tenants to share the benefits of locally produced energy. ENs aggregate energy consumed within a complex to a single metered point connected to the main electricity network.

4.5.4 What are Virtual Power Plants?

Virtual Power Plants (VPPs) harness the power of decentralised energy resources like solar PV installations and batteries, but also smart energy appliances and electric vehicle chargers. During supply squeezes in the grid and during price spikes, these decentralised resourced can be used to send energy back into the grid. People and businesses that participate in VPPs get financially reimbursed.

AGL performed a virtual power plant trial with 1,000 households in Adelaide. Tesla is progressively implementing a 250 MW virtual power plant in South Australia, whereas Powershop and Reposit have partnered to offer a ‘Grid Impact’ plan. Under this plan, Powershop will dispatch surplus solar battery capacity from participating households and

business premises to the grid during demand peaks. Grid Impact customers will get guaranteed quarterly payments for letting Powershop activate their solar batteries at these times.

4.5.5 What is the case for a local council to become involved?

Communities can be part of a microgrid which is fully based on renewable energy technology and share energy amongst each other. Maintaining the connection to the main grid may help with income generation, as the community can sell any excess electricity to the market.

A council can be a participant in a microgrid like any other member of the community and benefit from the same opportunities. Council can also help to facilitate the setting up of a microgrid by providing in-kind and grant support to the community.

To encourage the uptake of a microgrid, you can provide information to residents by using your communication channels to disseminate information, or you could provide your facilities to host workshops and meetings.

4.5.6 Case study – Enova's microgrid in Byron Bay

The Byron Bay Arts & Industry Estate Microgrid is a pilot project led by Byron Bay-based community-owned energy company Enova Energy in collaboration with Essential Energy. The ultimate aim is to reduce costs through sharing renewable energy that is locally generated, stored and distributed.

This project aims to:

- Reduce carbon emissions through increased use of renewables
- Lower power bills
- Keep money local.

Businesses in the estate generate energy from renewable sources such as rooftop solar panels to power their own buildings and supply excess electricity to others in the industrial estate who may not have the roof space or capital to buy panels. When supply exceeds demand, excess will be stored in a centralised battery for reuse within the estate or sold externally. The industrial estate is part of an existing distribution network operated by Essential Energy and will remain connected to the main electricity grid to ensure continuity of energy supply.

The pilot will take place over approximately two years. When finalised in October 2020 it is hoped that it leads to the formation of a wider, self-sufficient microgrid for the entire estate. Participants in the pilot will have individual metering devices installed to measure power inputs and outputs – this data will help work out a new pricing structure based on sharing locally generated power.

The project is a partnership between community-owned energy retailer Enova Energy, electricity network distributor Essential Energy, energy marketplace platform provider LO3 Energy, digital energy technology company Wattwatchers, and the University of NSW. It is also supported by the NSW Department of Planning, Industry and Environment (DPIE).

FIGURE 6: ENOVA MICROGRID TRIAL IN BYRON BAY[3]

For further information, please contact Enova's Manager, Regulation and Compliance by calling 02 5622 1700.

4.5.7 More case studies

The NSW Government is in the process of publishing case studies on microgrids on its knowledge sharing site. Please check in regularly to see updates as they are published.

4.6 Edge-of and offgrid

Communities such as Tyalgum have committed to going offgrid. Going offgrid can be a suitable solution for edge-of-grid communities that are struggling with grid reliability issues. Renewable energy projects (ideally with battery storage) can provide a way to improve supply security in a way that does not increase greenhouse gas emissions, as occurs with diesel generators.

Communities can first try temporary islanding in a resilient local microgrid, and disconnect fully from the grid once the community has adequate and secure supply from renewable energy and storage.

However, for communities seeking energy independence, going offgrid comes with a variety of challenges. Firstly, all energy comes from the local energy generation and battery storage. If there is an outage, there may not be a readily available backup power source. There are also significant upfront and replacement costs involved in setting up an offgrid infrastructure. On the plus side, once everything is set up, there may be low costs to deliver and maintain electricity supply if it is based on renewable energy sources that replenish themselves.

Where a household or business seeks energy independence or needs power during blackouts or that are not connected to the main grid, they can acquire a RAPS (Remote Area Power Supply). RAPS is a combination of renewable energy installations like solar PV arrays and a battery storage system that can operate even when the grid is down.

4.6.1 What can Council do to support edge-of-grid communities with renewables?

Local councils have a range of obligations that help to ensure that essential services – roads, public lighting, water & wastewater – are provided across their communities. Hence any

[3] Sourced from https://enovaenergy.com.au/microgrid/

proposal to go offgrid will require analysis of existing policies, planning and approval processes to determine what a pathway towards this scenario looks like. Changes to existing planning and approval processes may be required, and council would need to be a key stakeholder with a community that wanted to move to this outcome. The role of the electricity network would also be key, in terms of their obligations, management of existing infrastructure, approvals and the like.

Council can also provide support to edge of grid communities by:

- Helping with grant applications
- Providing information resources that may help with the assessment and selection of technologies
- Liaise/facilitate with the network and the community members on an ongoing basis
- Provide training for staff likely to have to manage enquiries

4.6.2 Case study – King Island Renewable Energy Integration Project[4]

King Island was previously powered with diesel fuel via a 6 MW generator station. Energy demand on the island was 12 GWh per year, and peak demand was measured at 2.5 MW.

The King Island Renewable Integration Project (KIREIP), developed by Hydro Tasmania with support from ARENA, was established to supply 65% of King Island's energy needs using renewable energy, and up to 100%. The solution includes 2.45 MW of wind energy, 470 kW of solar PV, a 3 MW/1.5 MWh battery, two 1 MVA flywheels for system security and stability, a 1.5 MW dynamic resistor to manage surplus renewable generation, and customer demand response.

Key differences to many Northern NSW communities may be that King Island was already off-grid and power from diesel is typically more costly than grid power, and that the hybrid solution is heavily supported with wind energy. Going from a grid-connected situation with relatively low cost power to an offgrid solution with a different technology mix will present different challenges. Nonetheless the King Island example (along with hybrid renewable systems on Flinders Island and Rottnest Island) show what can be done to provide reliable and affordable power off the main grid.

4.7 Utility-scale renewable energy projects in the LGA

Utility-scale renewable energy projects are large wind or solar power generators that are connected to the grid. While they are located in a local government area, their intent is not to provide electricity to local residents and businesses. Instead, they feed the produced electricity into the network, just like any other power generator.

Councils play an important role as they need to approve projects before they can go ahead. You need to consider concerns by residents like impact on visual amenity, flora and fauna impact, traffic and land value impacts, loss of privacy and security and noise implications. However, in NSW, there is limited scope for veto by the community, as utility-scale renewable energy projects that are deemed 'critical infrastructure' exclude all merit appeals.

To avoid social conflict, you could encourage the renewable energy project developers to consult and engage with the local community from an early stage and listen to their concerns. A 'social licence to operate' provides a useful framework for developers to engage local

[4] Sourced from https://www.hydro.com.au/clean-energy/hybrid-energy-solutions/success-stories/king-island

communities in a way that enhances transparency and local support and complement formal approval processes.

Social conflict can also arise where utility-scale wind projects provide additional income for farmers that the infrastructure is located on, but where closeby communities that are visually affected, do not benefit from an income stream. This can lead to inequality issues and division in the community between the 'haves' and 'have-nots'.

A way to address this problem could be community benefit funds whereby the developer agrees to put money in a fund to be used to improve community infrastructure. Another option is to allow community ownership of the development, whereby a certain percentage of ownership is offered to the local community.

4.7.1 Roles for Council that benefit the community

- Planning approvals
- Consultation – eliminating 'winners & losers' outcomes
- Construction management/planning/coordination
- Income streams and other co-benefits into the community
- Local employment – construction and ongoing, training, etc.

4.7.2 Case example - Sapphire Wind Farm

The Sapphire Wind Farm is located in the New England region of northern NSW. At 270 MW it is the largest wind farm in New South Wales. 100 MW of the project's output is helping the ACT Government to meet its target of 100% renewables by 2020, and further project output has been contracted to the Commonwealth Bank of Australia. The project commenced construction in December 2016 and was commissioned in November 2018.

The development of the Sapphire Wind Farm is special because it is the first time that the community can co-invest in a large scale wind farm. In 2017, Sapphire Wind Farm hosted a series of discovery sessions across the New England North West and undertook a survey to gauge interest in investing directly into a large-scale commercial wind farm. The result was overwhelming support, which resulted in the community investment going ahead. Registrations of interest closed on 30 June 2019.

For more information, please visit https://www.sapphirewindfarm.com.au/community-investment/.

4.8 Collaboration with others to bulk-buy renewable energy

When it comes to buying renewable electricity, there are advantages in going to market with a bigger electricity load than just the electricity demand of one council. If the size of the electricity that is contracted for is bigger, it increases the attractiveness of the opportunity to retailers, potentially leading to lower cost outcomes.

When going to market, you should consider forming a buying group or partnering with other councils in the region or state. The partnership can even be extended to businesses in the area. The cooperation could happen at a JO or ROC level. While there are opportunities to save cost by going to market as a group, there are also challenges involved, like coordinating the energy purchase and making sure that each individual council's needs are met.

If you are interested in bulk purchases, you should consider engaging an expert in energy markets to help ensure that the best outcome is achieved.

4.8.1 Case example - Melbourne Renewable Energy Project[5]

The Melbourne Renewable Energy Project (MREP) marks the first time in Australia that a group of local governments, cultural institutions, universities and corporations have collectively purchased renewable energy from a newly built facility.

MREP supports the construction of a new 39-turbine 80 MW capacity wind farm at Crowlands, a small agricultural community 2.5 hours from Melbourne. The wind farm will be owned and operated by Melbourne-based clean energy company Pacific Hydro, and the power will be supplied by its retail arm, Tango Energy.

Under this project, members have committed to purchase 88 GWh of electricity per year from the wind farm under a long-term power purchase agreement. The agreement has enabled Pacific Hydro to proceed with the project, and because the wind farm is bigger than the purchasing group's needs, it will generate additional renewable energy and dispatch it to the grid.

The long-term contract also provides price certainty for MREP participants, which mitigates the risk of increased energy costs in a volatile market. It will also be critical to cities such as Melbourne achieving their CO_2 reduction targets. The Crowlands Wind Farm creates more than 140 jobs during construction and eight ongoing operation and maintenance jobs.

[5] Text sourced from https://www.melbourne.vic.gov.au/business/sustainable-business/mrep/Pages/renewable-energy-procurement-guide.aspx


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