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DEPARTMENT OF PLANNING, INDUSTRY AND ENVIRONMENT

WAGGA WAGGA SPECIAL ACTIVATION PRECINCT

RENEWABLE ENERGY OPPORTUNITIES AND CONSTRAINTS ANALYSIS - DELIVERY CONSIDERATIONS PAPER

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Renewable Energy Opportunities and Constraints Analysis - Delivery Considerations Paper

DEPARTMENT OF PLANNING, INDUSTRY AND ENVIRONMENT

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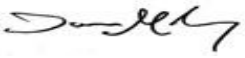
Prepared by:	E. Horner D. Moloney	19/11/2019	
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1 INTRODUCTION

Following a series of targeted workshops with stakeholders an approach and strategy has been devised for achieving 100% renewable electricity supply for the Wagga Wagga Special Activation Precinct (SAP). This paper provides discussion of the key issues and considerations in delivering the proposed suite of renewable energy supplies in Wagga Wagga.

1.1 TARGETED TECHNOLOGIES

Through an extensive iterative consultation and evaluation process, key renewable energy technologies have been identified for the Wagga Wagga SAP, forming the core of the renewable energy strategy. The energy strategy has investigated options to meet 100% of the SAP annual electricity demand through locally based renewable energy generation, which have been included among the proposed solutions in the Structure Plan.

Existing documentation discussing the renewable energy proposals include:

Stage 1 - Site inception report (Refined Vision Statement)
Stage 2 – Baseline Analysis Summary Report
Stage 3 – Short Enquiry by Design workshop, technologies shortlisting and Refined Scenario Options
Stage 4 – Full Enquiry by Design Reporting – strategy for 100% renewable energy supply

Through this appraisal process, WSP provided a high-level mix of technology options based on the iterative analysis of the resources and constraints available in the Wagga Wagga SAP. This Delivery Considerations Paper has been prepared firstly to provide guidance on opportunities to attract the renewable energy industries that have been identified through the extensive master planning process. Secondly, to identify opportunities to attract suitable renewable energy prospects and development into the Precinct. Thirdly, to provide advice on how renewable energy industries may be targeted, and makes recommendations that could be implemented, across the precinct to allow these businesses to establish and develop. And finally, to provide discussion on the considerations necessary to respond to new or emerging technologies or industries in the renewable energy sector.

The renewable energy technologies considered are shown below:

	TECHNOLOGY TYPE	ADOPTION STRATEGY
	Commercial solar	Adopted as part of the strategy
	Energy from waste (bio-solids)	Adopted as part of the strategy
	Virtual power plant	Adopted as part of the strategy
	Energy from waste (municipal waste)	Not targeted
	Utility scale solar	Not pursued further due to presence of large existing solar farm and existing complimentary developments

	Hydrogen	Considered as part of the future proofing strategy
	Battery Energy Storage	Considered as part of the future proofing strategy, considered as part of the Virtual Power Plant solution

1.2 PROJECT DRIVERS

The energy strategy for the Wagga Wagga SAP aims to meet 100% of SAP annual electricity demand through localized renewable energy generation.

Throughout the Wagga Wagga SAP project there have been several key objectives identified which will influence the scope and implementation strategy for renewable energy across the Precinct, these are discussed below.

1.2.1 ATTRACT INVESTMENT IN RENEWABLES

A key part of the Precinct sustainable growth strategy is to attract new investment in renewable energy initiatives across a targeted range of technologies and implementation opportunities. The master planning process will identify land uses and areas of opportunity to attract the renewable energy industries and to realise the potential of Wagga Wagga's points of difference. In addition, other opportunities to attract a broad range of suitable renewable energy development in the precinct have been investigated as part of the overall strategy.

1.2.2 RESPOND TO NEW OR EMERGING TECHNOLOGIES

While a renewable energy adoption strategy has been identified in response to Wagga Wagga's identified natural strengths and opportunities, there are also a range of emerging technologies which may influence the short to medium term implementation strategy. Some emerging technologies have been discussed in this report and issues raised to ensure the Wagga Wagga SAP is adaptable to these emerging trends.

1.3 CONTEXT: RENEWABLE ENERGY TARGETS

1.3.1 AUSTRALIA

Australia's Renewable Energy Target (RET) is a Federal Government policy designed to ensure that at least 33,000 gigawatt-hours (GWh) of Australia's electricity (23.5%) comes from renewable sources by 2020. The RET scheme operates through two key mechanisms - the Small-scale Renewable Energy Scheme (SRES) and the Large-scale Renewable Energy Target (LRET).

The LRET creates a financial incentive for the establishment or expansion of renewable energy power stations, such as wind and solar farms or hydro-electric power stations by legislating demand for Large-scale Generation Certificates (LGCs). One LGC can be created for each megawatt-hour of eligible renewable electricity produced by an accredited renewable power station. LGCs can be bought and sold on the market as individual entities (mainly electricity retailers) seek to meet their compliance obligations under the RET legislation.

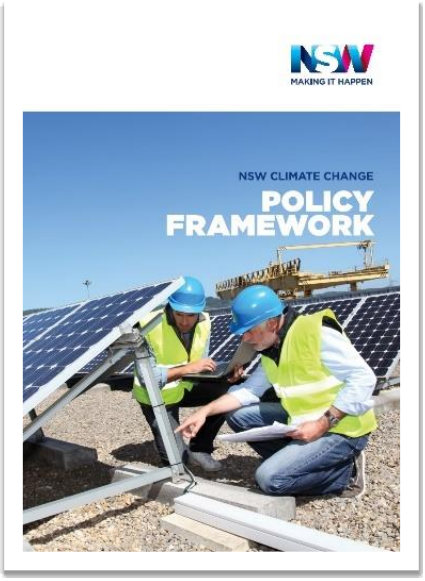
The SRES creates a financial incentive for households, small businesses and community groups to install eligible small-scale renewable energy systems such as solar water heaters, heat pumps, solar photovoltaic (PV) systems, small-scale wind systems, or small-scale hydro systems by legislating demand for Small-scale Technology Certificates (STCs). STCs are created for these systems at the time of installation, according to the amount of electricity they are expected to produce or displace in the future.

Renewable energy accounts for 16% of Australia's electricity generation[1], the equivalent of 40,455GWh, meaning that Australia is currently exceeding its renewable energy target.

1.3.2 NSW

The state of NSW does not have its own state based renewable energy target and currently follows the Federal renewable energy target. The rate of growth of renewable energy installations in NSW is significant with total installed capacity among the highest in the country. The drive for renewable energy in the state is guided by several policy frameworks and strategies.

The State policy framework for considering broader sustainability outcomes influencing renewable energy includes the following:



1. *NSW Climate Change Policy Framework,* which seeks to achieve net zero emissions by 2050 and for NSW to be more resilient to a changing climate;
2. *NSW EPA Circular Economy Policy Statement: Too Good to Waste*, which seeks to change the way we produce, assemble, sell and use products to minimise waste and to reduce our environmental impact;
3. *NSW Office of Environment and Heritage (Adapt NSW) Central West and Orange Climate Change Snapshot, November 2014*;
4. *Smart Cities Plan*, which calls for us to become smarter investors in out cities' infrastructure through the coordination and driving of smarter city policy and smart technology to improve the sustainability of our cities and to drive innovation; and
5. *Future Transport Strategy,* which sets the framework to working towards environmental sustainability, securing energy reliability and affordability and managing a resilient transport system.

The ***NSW Climate Change Policy Framework*** identifies an aspirational emissions reduction objective of net-zero emissions by 2050 as well as making NSW more resilient to a changing climate. The ***NSW Climate Change Plan (draft)*** identifies several strategies aligned with the policy framework and relevant to Parkes:

- Accelerating investment under the Renewable Energy Target (RET);
- Accelerating advanced energy technologies;
- Accelerating the transition to a 21st century transport fleet;
- Drive innovation and build confidence about energy efficiency;
- Managing the risks of climate change to public assets and services;
- Strengthen natural eco-systems to respond to a changing climate.

[1] Source: Australia Energy Update 2018, Australian Government Dept. of Environment & Energy, August 2018

1.3.3 WAGGA WAGGA

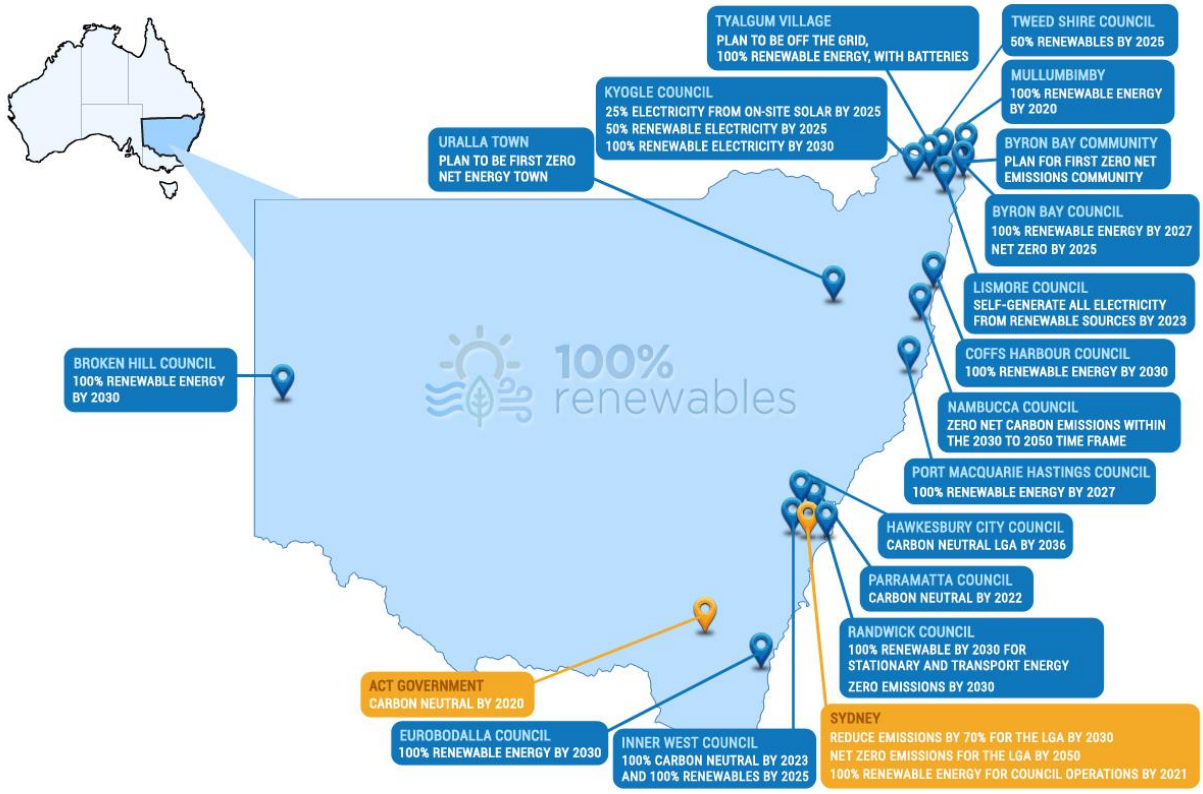
For the Wagga Wagga SAP it has been proposed to achieve a 100% net supply of electrical energy from renewable energy sources completion of Stage-1 of the SAP development, and then continue with the target for Stage-2 and Stage-3. The strategy is to deploy renewable energy across the Precinct through targeted and sufficiently diverse technology types.

2 STRATEGY DELIVERY PRECEDENTS

There is strong precedent for local government precincts with exemplary renewable energy goals across Australia, some of these are discussed below and are provided as a means of precedent in delivery considerations for Wagga Wagga SAP.

2.1 ZERO EMISSION COUNCILS

A number of Councils in NSW have announced a 100% renewable energy trajectory for the short-term future as a means of delivering cost effective energy to rate payers and attracting investment in renewables within their region. These set key precedents for Wagga Wagga to emulate and these will likely influence the extent of deployment of renewable energy in the State. The quantity of local councils setting this renewable energy target in NSW provides strong delivery precedent for Wagga Wagga SAP.



Infographic from 100% Renewables[2]

2.2 RELEVANT PRECEDENTS

2.2.1 COUNCIL LED RENEWABLES AT GANAWARRA SHIRE

The Shire of Ganawarra in Victoria undertook a significant strategic action to develop their Shire as a renewable energy hub in the State of Victoria with the intent to attract investment into the community, provide a source of clean energy for

2 https://100percentrenewables.com.au

local businesses and to create opportunities for local jobs growth. The Shire has been successful in driving the investment of a 200MW solar farm. This project is heavily backed by the Shire of Ganawarra who have sought to attract investment in locally based renewable energy power plants by facilitating the access to available land and linking interested project developers with land holders who are seeking a secondary source of income. This plant also includes a large-scale Tesla battery. The project is delivered by Solar Choice, Edify Energy and Wirsol.

A long-term energy off-take agreement is set in place with Energy Australia to take the energy from the existing Ganawarra Solar farm which is used to charge the battery for dispatchable supply. The project leverages off the region's strong grid infrastructure. This project is an example of a local Council working as one of the key protagonists to drive investment in renewable generation within their region, promoting the shire as "investment ready", the Council developed a prospectus to showcase the key project features. Part of the learnings from this project was the need to engage the energy minister, the Victorian State Government and AEMO to help facilitate network upgrades in support of the renewable energy installation works.

2.2.2 CITY COUNCIL POWER PURCHASE AGREEMENTS

The Sydney City Council has committed to a power purchase agreement worth $60million for procurement of wind and solar power to meet its energy needs over the next 10 years. The commitment is the biggest of its kind in Australia and sets a strong precedent for demand for renewable energy in the State of NSW. The energy contract includes supply from the 120MW Boman Solar farm near Wagga Wagga as well as the 270MW Sapphire wind farm near Glenn Innes and a not-for-profit community owned solar scheme near Nowra. The procurement process provides a useful reference when considering the acquisition of large scale energy take-off agreements from both major solar farms or aggregated virtual solar farms.

Similarly, the City of Melbourne instigated a market-wide request for offers from renewable energy generators and "shovel ready" projects for the supply of 88,000MWh of renewable energy to supply a consortium including Melbourne City Council and businesses within the City of Melbourne. An additional example of this type of large scale procurement of renewable energy has been undertaken by a consortium of 13 Victorian water Authorities.

These examples of large scale energy supply procurement by local government and infrastructure authorities show the opportunities that will be available for Wagga Wagga. In order to attract this type of investment it may be necessary to develop mechanisms of aggregating smaller scale solar PV installations into a Virtual Power plant supply so that larger scale supply agreements can be met.

3 BIO ENERGY

The opportunity for energy generation from waste or biomass[3] has held long promise across Australia but is yet to achieve its full potential other than in the production of energy from bagasse in the sugar industry. Internationally, waste to energy represents a much stronger part of the energy and heat generation sector compared to Australia.

In 2015 the Clean Energy Finance Council (CEFC) released a report on the Australian Bioenergy and Energy from Waste market[4]. The report showed that the market for bioenergy in Australia is underdeveloped but has potential. The report estimates the investment opportunity at between $3.5 to $5 billion out to 2020. One of the key opportunities identified is energy generation from plantation forest residues. According to the report there were already 124 MW of installed energy plants deriving energy from forest waste residue in Australia.

The SAP will consider biogas based electricity generation from Wagga Sale Yard and proposed Waste Water Treatment Plant (WWTP), the proposed 8MW Biomass project, the Teys Australia 8MW hybrid biogas Wagga Low Emission Energy Hub Project and the development of new small scale biomass plant.

3.1 RELEVANT PRECEDENT

3.1.1 TEYS AUSTRALIA

Teys Australia[5] is installing 8MW of biogas based electricity generation plant in Wagga Wagga (Section 3.8.3 of the Final Baseline Report) and is shortlisted for capital funding under stream two of the NSW Government's Capital Projects plan. The proposed project includes a multipronged approach using a range of technologies including solar, storage, solid waste digestion and biomass boilers, to make the facility completely energy self-sufficient. Together these technologies will provide stable baseload power that integrates with the grid, improving energy security, and reducing emissions.

Teys are investing $42 million for its Wagga processing plant[6], and sourcing government funding for the other half of the project. Beyond making the site energy self-sufficient, Teys see benefit for local farms who could increase their income by supplying farming waste[7] to Teys for use in energy generation, and they also believe it will supports 4000 direct and indirect jobs.

3.1.2 MURRAY GOULBURN COOPERATIVE

A system installed by the Murray Goulburn Cooperative[8] in Leongatha, generates biogas and electricity from dairy waste and provides significant reduction to an effluent waste issue and a GHG emissions issue for this facility. The digester can produce around 9600m^3 of biogas per day and can run two engines with capacities of 760 kW each. The system cost an estimated $1.8M and is expected to have a 3-year payback. The company received support from the Renewable Energy Support Fund) and SP Ausnet. The implementation of this plant serves as a precedent for proposed plants in Wagga Wagga.

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3 https://www.dpi.nsw.gov.au/climate-and-emergencies/climate-change-research-strategy/biomass-for-bioenergy

4 Source: CEFC - www.cefc.com.au/media/107567/the-australian-bioenergy-and-energy-from-waste-market-cefc-market-report.pdf

5 Source *https://www.teysaust.com.au/responsibility/environmental-protection-and-sustainability/*

6 Source *http://biomassproducer.com.au/project/meat-producer-teys-australia-invests-in-wastewater-treatment-plants-at-wagga-wagga-nsw/#.Xbk-ypozaUk*

7 *https://onestepoffthegrid.com.au/major-australian-beef-farmer-shifts-second-facility-to-clean-energy-this-time-100/*

8 http://biomassproducer.com.au/case_study/power-from-dairy-manufacturing-waste/#cost

3.2 POTENTIAL KEY PARTNERSHIPS

3.2.1 RIVERRINA OILS

The Riverina Oils plant[9] in Wagga Wagga produces plant based oils through a crushing and refining process and produces very low carbon emissions due to the efficiency of the plant and the techniques deployed. The system produces very little liquid effluent discharge. This plant already produces canola oil for the food industry however further investigation could be undertaken for utilizing the plant's waste bio-solids in an energy from waste process. This manufacturing process provides good precedent for the treatment, handling and efficient use of biomass and presents a potential opportunity to aggregate waste product of further energy harvest.

Many of the raw materials processed by the plant are grown locally, further encouraging partnerships with local producers and supply chains.

3.2.2 SOUTHERN OILS BIOFUEL

Southern Oil[10] collects waste oil from the Hunter Valley mines, car and truck service centres and other commercial generators for processing at its Wagga Wagga re-refinery. Some key partnerships from this organization also include:

- CSIRO – who have teamed up to develop a new process that will improve the quality of Southern Oil's products, with industrial-scale trials scheduled to commence soon.
- Australian Council of Recycling - ACOR works closely with Federal and State Governments to develop policies and programs that improve resource recovery and support investment in and growth of the recycling industry. Southern Oil Refining is a member of ACOR.
- Australian Organics Recycling Association - works to raise awareness of the benefits of recycling organic resources, and advocate for policy change, and Southern Oil Refining is a member of AORA.

3.2.3 PACIFIC HEAT AND POWER

Pacific Heat and Power[11] is a developer of quality clean energy assets based on a 'build, own operate' model. Key partnerships include:

- Northmore Gordon – an energy consultancy focused on reducing energy costs for industrial and large commercial businesses. They are the preferred service provider for Pacific Heat and Power.
- Wattly – this company is one of Australia's leading Aggregators of Environmental and Energy Certificates, helping businesses access funding for energy and carbon projects from government schemes. Wattly are a preferred partner of Northmore Gordon.

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9 http://www.riverinaoils.com.au/plant-technology-1

10 http://www.sor.com.au/our-community/partnerships

11 https://www.pacificheatandpower.com/

3.3 DELIVERY CONSIDERATIONS

Biomass power plant technology is one of the energy generation technologies considered in this study, which has limited exploration in Australian energy market. However, biomass power plant has several key advantages that more developed technologies such as wind and solar do not, including the potential to generate base load power and power on-demand, as well as the ability to solve waste management issues.

Where an anaerobic digestion energy from waste facility operates as a standalone energy provider, it will require a central energy centre to house the co-generation plant, thermal storage tanks, flue etc. along with the digesters. The location of waste to energy plants with respect to other buildings and infrastructure is crucial to enable the harvested energy to be fully utilized. The proximity to local demand for heat or to the gas network infrastructure as well as the waste feed supply routes are key determinants in the citing of biomass to energy plants.

The major considerations in the successful delivery of the proposed energy from waste strategy include the following:

- Where individual waste feedstock quantities do not support the use of onsite waste to energy processes, consideration should be given to the potential for the aggregation of organic waste from multiple sources into a larger energy production facility where economies of scale can be harnessed.
- Further consideration needs to be given to the business case for transporting organic waste for energy harvest. There is likely to be a maximum distance that waste supplies can be transported economically.
- Biomass processing facilities are innovative and present an opportunity for Wagga Wagga to demonstration national leadership in this technology, as they are proven internationally but still in relative infancy in Australia.
- Establishing and promoting markets for the products of green waste processing facilities such as biochar and wood vinegar and harnessing the opportunity for improved land management and fertility using biochar.
- There is opportunity to develop the ability to showcase innovative technology that may support a new jobs industry.
- There are numerous community sensitivities to the issue of energy from waste that need to be addressed including the role of food waste, the use of fossil fuels in transporting the feedstock and the treatment and disposal of any residual products. It may be necessary to address pollution or contamination issues around the use of biomass in combustion or pyrolysis processes. Many of these issues are addressed in NSW guideline documents relating to Energy from Waste plants.
- Participation in the Australian Methane to Market in Agriculture (AM2MA) program represents a delivery opportunity for Wagga Wagga SAP. This program aims to meet Australia's research and development needs for the development of sustainable and profitable bioenergy and bioproducts industries.
- The effects of climate change could affect the supply chains for biomass production across the region. To help mitigate these effects is will be beneficial have strong diversity in the biomass supply chain
- Undertake further studies to quantify and validate the supply and quantity of dairy and biomass waste within and around the SAP. This will confirm if there is scope for an additional small scale biomass facility, or potential for expansion of the proposed Teys facility[12].
- There are likely to be further funding support mechanisms for energy from waste facilities. Opportunities through funding support mechanisms such as the New Energy Jobs Fund $20M, Sustainability Fund Partnership Program, CEFC and $30M AEIP grants for the development and commercialisation of energy generation. As well as other

[12] https://www.mla.com.au/research-and-development/search-rd-reports/final-report-details/Investigation-into-alternative-wastewater-treatments-options-for-a-large-beef-processing-facility/3711#

state and federal funding. The NSW Primary Industries Climate Change Research Strategy will invest in projects and program areas that could support the primary industries sector to adapt to climate change.

4 COMMERCIAL AND UTILITY SCALE SOLAR

As discussed in section 1.3 of this report, solar PV accounts for around 20% of Australia's renewable energy generation and 3% of Australia's total electricity generation[1]. As of September 2019, there are over 2.2 million solar PV installations in Australia accounting for a capacity of more than 13.9GW. The bulk of these installations are from residential and small commercial systems.

Commercial systems, which may be installed on rooftops or ground areas serving nearby building loads, are typically considered in the sizes from 10kW – 5MW. Utility-scale systems[13] are those with capacities in excess of 5 MW to 100's of MW.

The small to medium scale solar generation opportunities at Wagga Wagga SAP range from small systems to commercial range installations of 100's of kW. Presently, solar PV is considered among one of the most financially viable technologies of renewable energy, rapidly approaching in the range of $1.10/Wp installed cost, at the larger scale for fully installed functional systems.

4.1 RELEVANT PRECEDENTS

4.1.1 SUNRAYSIA SOLAR FARM AND UNSW

In Balranald NSW, Sunraysia will be the largest solar farm in Australia generating 530,000MWh of electricity annually and supplying the University of NSW through a 15-year power purchase agreement in which UNSW takes one quarter of the total generated power supply. The farm commenced construction in February 2019 and will include a large battery storage facility. This power plant is developed by an Australian-Chinese consortium Maoneng.

In this example UNSW undertook a standard RFP process seeking offers from both generators and energy retailers for the supply of 150,000MWh and were specifically hoping for a joint venture offering between these two types of respondents. The RFP process was relatively ground breaking in the Australian market as there was little precedent for the desired deal. In the end, UNSW negotiated directly with a power producer Maoneng but brought along a preferred energy retailer Origin Energy to establish a supply joint venture to deliver the deal for energy. UNSW's RFP process highlighted the large number of respondents the Australian market but also highlighted gaps between energy generators and retailers, necessitating direct negotiation with the generator.

4.1.2 BOMEN SOLAR FARM

Bomen Solar Farm[14] (242 Ha) was developed by Renew Estate Pty Ltd, the development organisation co-founded and funded by WIRSOL Energy Pty Ltd. The solar farm is a 120WM capacity expected to produce over 230 GWh of renewable energy each year. In April 2019, Spark Infrastructure acquired 100% of Bomen Solar Farm and the construction contract was awarded to Beon Energy Solutions.

Bomen Solar Farm signed a Power Purchase Agreement (PPA) with Westpac[15]. Under the PPA, Westpac has committed to purchase just over a quarter of the solar farm's output under a 10-year agreement. Additionally, Bomen Solar Farm has an off-take arrangement in place with Flow Power, a leading business energy retailer in Australia, to purchase a portion

[13] The threshold level above which solar generating stations are counted as 'utility-scale' is 4MW.

[14] https://wirsol.com.au/portfolio/bomen-solar-farm/

[15] https://wirsol.com.au/bomen-solar-farm-acquired-by-spark-infrastructure-and-signs-ppa-with-westpac/

of the power that will be generated by Bomen Solar Farm for up to 10 years. This will enable Flow Power to deliver low-cost, reliable sustainable energy to Australian business customers.

Westpac, in partnership with Spark Infrastructure[16] is also committing $1 million to support the community over the term of the contract. This includes STEM scholarships as well as providing support for youth facilities, local biodiversity and vegetation regeneration programs.

4.2 DELIVERY CONSIDERATIONS

The following delivery considerations are identified for commercial and utility scale solar PV installations in the Wagga Wagga SAP.

- Grid connectivity can be an issue for commercial and utility scale solar – it is necessary to work with the Distribution Network Service Provider(s) to identify limitations in the grid and to increase the minimum pre-approved connected quantity. Engage with local utilities to discuss any grid / economic constraints for connection and to assist businesses in understanding the connection application process.
- Creating opportunities for diverse investment in commercial scale solar by community groups or third party investors.
- The Federal Government provides a subsidy for large-scale renewable systems (>100 kW) through the Large-Scale Renewable Energy Target (LRET) legislated to 2030. However, Large-scale generation certificates are created for eligible renewable energy power stations installations (<100 kW) based on the amount of electricity they produce and can be on sold to entities with liabilities under the LRET (mainly electricity retailers) to meet their compliance obligations.
- A solar power feed-in tariff is a payment that is available from electricity retailers for each unit of electricity a PV solar system exports to the grid (usually <100 kW). For systems >100 kW it may be necessary to negotiate a feed-in tariff with a retailer however it is expected a similar figure to the standard feed-in tariff would be provided for systems of 100-300 kW.
- Marginal loss factors for exporting solar have been declining in recent times making the return on investment less attractive for utility scale solar farms delivering power via the grid infrastructure. For smaller scale systems where exports are a necessary part of the system sizing there may also be marginal loss factors applied to specific parts of the grid. The Wagga Wagga SAP governance authority would need to work with local network authorizes to ensure grid infrastructure does not suffer loss factor, which inhibits the transmission economics of solar power in the region.
- Commercial scale solar energy offers significant opportunity for the SAP to expand the jobs market as these types of solar PV installations can require a degree of consulting, equipment suppliers, logistics, installers, electricians, certifiers, and ongoing jobs in system maintenance.
- Solar PV systems don't generate electricity all the time, so battery storage is required for constant energy supply.
- An abundance of solar PV systems will result in lower production in winter months.
- Undertake high level engagement with energy retailers located near the SAP to provide assistance to negotiate favourable feed-in tariffs, if needed.

[16] https://www.pv-magazine-australia.com/2019/04/17/bomen-solar-farm-acquired-by-spark-infrastructure-inks-ppa-with-westpac-towards-its-100-renewables-goal/

- Identify any local banking organisations providing low cost loans for solar power installations for commercial businesses.

5 VIRTUAL POWER PLANT

The renewable technology mix needs to be integrated and controlled through Virtual Power Plan (VPP) network along with suitable size of energy storage for the efficient management intermittent energy sources to meet the power demand.

5.1 RELEVANT PRECEDENTS

5.1.1 ENERGY QUEENSLAND VIRTUAL POWER PLANT

Australia's largest Virtual Power Plant[17] (VPP) has been developed through a partnership between Energy Queensland and GreenSync. It is a cloud-based, load control system created to manage extreme electricity demand during severe temperature events. This VPP offers 150MW of power that can be tapped into at peak times. The value of a VPP, compared to a regular power plant, is the cost of acquisition and that it utilises assets that have already been purchased and deployed. Energy Queensland's energy services division launched to lead new technology deployment[18], with the hope of increasing affordability, reliability and sustainability of electricity supply during these severe events.

5.1.2 MONASH MICROGRID TRIALS

Monash University's Clayton campus functions like a stand-alone city, and accommodates the needs of more than 50,000 people by partnering with ARENA[19] and Indra Australia on the Smart Energy City project the University is harnessing the collective power of a 1 MW array of solar panels, 20 buildings with automated energy management systems, electric vehicle chargers and a 1 MW battery. The project will create a new microgrid at the university's 57-year-old Clayton campus.

Connected to the main electricity grid and controlled by software from Indra Australia, the smart network aims to demonstrate that a 100% renewable electricity system can operate reliably and affordably, while reducing strain on the broader energy system. ARENA is providing $2.97 million towards the $7.1 million trial, which will back up the university's behind the meter assets with energy from a power purchase agreement with a renewable generator.

5.1.3 ENOVA COMMUNITY-BASED MICROGRID TRIALS

Enova[20] is Australia's first community-owned power company and has developed a microgrid project in Byron Bay. The model shows the consumer also being a producer, rather than the traditional model of large scale generation and long distance distribution. Enova encourages microgrids and solar gardens, where communities generate, distribute and share their renewable energy at a lower cost. The self-described social enterprise is owned by more than 1,600 Australian community shareholders and invests 50% of profits (after tax and reinvestment) back into the community, by way of renewable energy projects, energy education and energy efficiency services.

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17 https://www.esdnews.com.au/energy-queensland-delivers-australias-biggest-virtual-power-plant/

18 https://reneweconomy.com.au/sun-metals-msf-sugar-sign-up-to-queensland-virtual-power-plant-37218/

19 https://arena.gov.au/blog/microgrid-trial-a-step-toward-100-renewable-university/

20 https://enovaenergy.com.au/

Enova intends to also eventually facilitate VPPs which involve the installation of solar PV and batteries on a targeted number of households[21]. The householder outlays no money, is not involved in maintenance and receives all energy at a fixed price over a 15-year term. Supply charges will be increased by CPI after the first 5 years. Enova will have the ability to use the stored energy to offset demand at peak times so that Enova has virtual generating capacity.

5.1.4 AGL'S 1,000 HOME VIRTUAL POWER PLANT TRIAL

In 2016 the world's largest (at the time) planned virtual power plant of its kind[22] with 1,000 residential home batteries was installed and connected in Adelaide. These demonstrated how connected battery storage can help manage grid stability when it's needed. The battery is charged and discharged using sophisticated algorithms to maximise the benefits to the consumer, while ensuring that the network and retailer can also realise value from the battery during specific network or wholesale events. The ability of the VPP to realise multiple benefit streams can ultimately reduce the costs of the system to the end customer, while reducing the energy charges off all grid uses by making the most efficient use of the battery as Distributed Energy Resource (DER).

5.1.5 POWERSHOP AND REPOSIT'S 'GRID IMPACT' VPP

Anyone with a (Reposit-equipped) battery storage system living in New South Wales, Victoria or Queensland can sign up for the Grid Impact program[23] to become part of a massive, distributed VPP and get paid accordingly.

The program enables Powershop[24] to dispatch surplus solar capacity to the grid, through batteries installed in participating homes and business premises, to alleviate peak demand. By activating the VPP, Grid Impact participants can help our entire electricity system by taking pressure off the grid. Powershop pays battery owners a monthly tariff to participate in the program.

The program differs from other virtual power plant programs in that it is not a pilot project, not government sponsored and enables customers to bring their own batteries and opt out of the program at any time.

5.1.6 ACT VIRTUAL POWER PLANT

The ACT currently operates Australia's largest VPP[25], which has already demonstrated how it benefits consumers and helps the network avoid extreme peak demands. Next Generation Energy Storage Program is installing battery storage in more than 5,000 Canberra homes and creating VPP capability of 36MW. This will then help solve problems in the wholesale electricity market and distribution network.

5.2 DELIVERY CONSIDERATIONS

A host of third party providers offer the ability to aggregate energy supplies from disparate sources according to the real-time and planned load requirement within a certain virtual boundary. One of the key requirements for this type of system

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21 *https://www.waggawaggaaustralia.com.au/news/enova-community-energy-part-of-australias-renewable-energy-solution/*

22 https://arena.gov.au/projects/agl-virtual-power-plant/

23 https://www.solarchoice.net.au/blog/powershop-to-pay-battery-owners-under-new-grid-impact-plan-whats-the-go/

24 https://www.powershop.com.au/join-grid-impact/

25 *https://www.energymatters.com.au/renewable-news/canberra-virtual-power-plant-award/*

however, is the ability to provide dispatchable power to consumers through the optimization of available energy sources and storage systems.

A commercial scale VPP can be established by aggregating solar PV systems in varying sizes typically from 2kW to any Mega Watts (MW). It is most common to aggregate power generating systems that may have integrated battery storage to enable the distribution of reliable dispatchable supply. In the precedents, citied VPPs have been established by third party operators with a distributed battery energy storage model and platform throughout the network. VPP can be established using distributed battery energy storage technologies or a variety of technologies throughout the network, as long as the individual generation and/or storage system meets certain technical and communications criteria.

The enabling infrastructure necessary for VPP is mostly a reliable grid network infrastructure as well as high speed internet. It is necessary to provide a pathway to enable export and to seek to raise export limits where possible. The elimination of barriers to exporting will enable VPPs to be established using larger scale commercial systems, which are likely to improve the financial viability for the aggregators. Support and facilitation of the liaison with the SAP based businesses and any possible financial support for the establishment of pilot project will foster the further development of VPP.

Currently economic viability of VPP network is limited, primarily due to the limited deployment of VPP's at a commercial scale, as well as the current payback for small scale energy storage systems (in the case where the energy storage system is owned by VPP network developer). However, prices of energy storage systems are generally expected to drop by approximately 50% over the next five years, which would support VPPs becoming commercially viable without subsidy and provide consumers with commercially rational purchasing decision when investing in a battery.

A key consideration for the application of VPP networks is maintaining the option for participants to have contestability of suppliers and retailers in the market, without being locked in to a supply agreement either contractually or technically.

6 BATTERY ENERGY STORAGE

The adoption of on-site energy storage systems provides the opportunities for a range of new energy management initiatives. Embedded battery energy storage systems can be used to provide demand response support and are a key component in managing peak electricity demand, providing storage for excess renewable energy generation, and the use of smart tariffs and power purchase agreements through the connection with the site-wide electricity grid.

6.1 RELEVANT PRECEDENTS

6.1.1 HORNSDALE WIND FARM BATTERY STORAGE SYSTEM

The 100MW Hornsdale Battery Energy Storage System is, at the time of installation, the world's largest lithium ion battery installation. Installed adjacent to the Hornsdale Wind Farm in the mid-north of South Australia, the battery energy storage system is charged using renewable energy from the Hornsdale Wind Farm and then delivers electricity during peak hours to help maintain the reliable operation of South Australia's electrical infrastructure. The delivery of this project serves as an exemplar for Wagga Wagga SAP for a centrally located energy storage system to manage SAP load demand.

6.1.2 BALLARAT BATTERY ENERGY STORAGE

As one of the first projects of this size, the Ballarat Battery project hopes to demonstrate the value of battery services and assist to bridge the current gap to commercial viability, allowing other similar battery storage projects to progress without subsidy.

The lead organisations involved are Spotless, Nuvo Group and AusNet Services[26], with the Victorian Government as the project partner. Partial funding of $2.26M was provided by the ARENA Program, for Advancing Renewables.
The project consists of a 30 megawatt (MW) / 30 megawatt-hour (MWh) large-scale, grid-connected battery located at the Ballarat electricity station, Ballarat Area Terminal Station (BATS)

The benefit the battery energy storage will provide is grid stability and support on a congested transmission terminal, at a critical location, reducing the need to expand the local substation. The battery will be capable of powering 20,000 homes for an hour. It can both relieve congestion on Victoria's transmission grid and store lower-cost energy that might otherwise have been curtailed. It will help ensure a secure energy supply for Melbourne when transmission capacity is limited during high-demand periods. And it will provide important grid stability services that will help reduce energy bills for Victorians.

6.2 DELIVERY CONSIDERATIONS

Large scale on-grid battery energy storage is capable of being delivered by private development consortia, however recent precedents have been delivered through the assistance of government funding. Distributed on-grid battery energy storage can be privately owned by the generation system owner, VPP owner or a third party.

Large scale energy storage is a crucial element of grid system management and will likely rely on the local network operators to drive the installation of this infrastructure utilizing investment partners who can profit from the storage and

[26] https://arena.gov.au/projects/ballarat-energy-storage-system/

on-demand supply of energy. A major element of the economics of battery storage is the ability to deliver supply during peak periods when energy pool prices are high.

Electrical energy storage can be delivered through a variety of mechanisms including large scale battery deployment and the aggregation of multiple smaller batteries being managed through a VPP network. It is likely that both solutions will form part of the strategy for Wagga Wagga and both require market support and testing.

The emergence and increased use of electric vehicles and associated charging infrastructure could represent a significant change to the energy usage profile for the Wagga Wagga SAP. Ongoing evaluation of the take-up of electric vehicles in the region is necessary to adequately respond and develop the required changes to the SAP renewable energy strategy.

7 EMERGING TECHNOLOGIES AND ISSUES

7.1 HYDROGEN

Electricity generation from wind and solar present significant challenges to grid operators, including intermittent outputs and often a mismatch between peak output and peak demand, which can result in grid instability, negative power pricing (where renewable generators are paid to shut down), and wasteful curtailment of supply. Grid-scale energy storage in the form of hydrogen production combined with regenerative hydrogen fuel cells enables further growth of these renewable energy sources by levelling out the supply peaks, increasing the capacity factors of wind and solar installations, and transforming these intermittent generators into grid-dispatchable resources.

Australia is still in its infancy in terms of the development of effective policy and regulatory frameworks for the widespread, safe and efficient adoption of hydrogen and associated technologies.

Energy storage in hydrogen is a technically feasible option for grid-scale storage and is already in pilot demonstrations. Because of its low overall efficiency from storage to recovery, it may be overlooked despite its potential advantages, such as high energy storage density and low rate of self-discharge when compared to existing battery technologies. Hydrogen is therefore much more viable as a seasonal energy store making it suitable for technologies such as solar to be generated in summer and used in winter. Furthermore, hydrogen offers advantages as a transport fuel and as a fuel for export.

7.1.1 RELEVANT PRECEDENT: HEYWOOD HYDROGEN PROJECT

A business case and preliminary design is being developed for Victoria's first large scale hydrogen generation project powered by renewable energy in the form of an 80 MW solar farm. The solar farm will enable electrical energy to be used to produce hydrogen gas in a large-scale electrolyser. The intent is for the hydrogen gas to be exported for domestic or off-shore use or used on site to power gas turbine or hydrogen fuel cell electrical generators at times of peak grid demand or poor solar performance. A project consortium has been assembled to progress the Hydrogen Project which consists of Glenelg Shire, Countywide Renewable Energy, Deakin University, CSIRO, ITM Power, Port of Portland and Ausnet Services. The proposed project location is Homerton, approximately 17km east of Heywood.

7.1.2 RELEVANT PRECEDENT: HYDROGEN VEHICLE TRIALS

Moreland Council undertook detailed investigations of the business case for implementing hydrogen-powered garbage trucks across the region. The $9.37 million budget project was intended to establish Australia's first commercial-scale hydrogen refueling station, which would produce hydrogen from 100% renewable energy using a 1 MW on-site solar plant and grid-sourced wind power. The project was intended to enable the council's heavy vehicle fleet to begin to transition to zero-emission Fuel Cell Electric Vehicles. However due failure to reach favorable commercial terms the project has not proceeded. This council has since proceeded with trials of two hydrogen powered passenger vehicles with refueling provided through a plant in Altona.

7.1.3 RELEVANT PRECEDENT: HYDROGEN FUEL CELL BUSES

In Japan, Toyota has released approximately 100 hydrogen fuel cell buses for use in Tokyo for the 2020 Olympic games. Japan[27] is strongly committed to the use of hydrogen as a future fuel for transport across their country in lieu of purely electric vehicles. The Japanese government and industry are also participating in hydrogen reformation (from coal) trials in Gippsland Victoria, providing indication that Japan could represent a significant part of the short term future demand or hydrogen internationally.

Figure 7.1 – Toyota Sora hydrogen fuel cell bus

7.1.4 DELIVERY CONSIDERATIONS

In order to be considered a renewable energy resource, hydrogen fuel cell technology would have to be coupled with a renewable energy power source such as solar PV to provide the energy required to power an electrolyser to split water into its component elements, oxygen and hydrogen.

Hydrogen storage will complement the highly intermittent energy generating capabilities associated with solar PV generation and will ensure that there are minimal GHG emissions over the life cycle, as compared with conventional storage options such as lithium batteries. Hydrogen production has a small GHG impact associated with the fugitive loss of hydrogen from the plant into the atmosphere which can increase the content of methane and ozone in the atmosphere.

When comparing hydrogen fuel cells as a method of energy storage to the more conventional lithium ion battery technology, for the same quantity of manufacturing energy input, hydrogen storage provides more energy dispatched from storage than a typical lithium ion battery over the lifetime of the facility. On the other hand, energy storage in hydrogen has a much lower overall efficiency than batteries (30% vs 75-90%), resulting in significant energy losses during operation. The round-trip efficiency of hydrogen fuel cell energy storage must improve dramatically before it can offer the same overall energy efficiency as batteries.

Some of the key considerations in allowing for the future development of hydrogen in Wagga Wagga include the following:

- The economic viability of large scale hydrogen production is likely to be contingent upon the supply of sufficiently sized renewable energy systems including additional large scale solar farms in the SAP.
- Locally produced hydrogen could enable the transition to a clean vehicle fleet within the SAP serving the transport logistics network.
- A hydrogen production plant could enable major research and development opportunities, creating jobs growth in the SAP.
- Hydrogen technology is highly scalable and could initially be implemented as a small-scale trial.

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27 https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/1182145/Japan-Hydrogen-Society-Roadmap-Neil-Thompson.pdf

- Access to technical and financial support from state and federal government is likely to be necessary to progress the prospects for hydrogen in the SAP.
- Hydrogen power plants offer significant jobs growth potential as the industry is in its infancy in Australia. The design, construction and maintenance of a plant would be a significant undertaking involving a large stakeholder and design team.
- This technology provides significant environmental advantages over other forms of long term energy storage such as batteries which use precious resources in limited supply.
- Likely strong support from all renewable energy sectors including solar and biomass.
- Electrolysis and steam reforming, the two main processes of hydrogen extraction, are currently relatively expensive. This is a key reason it's not heavily used across the world. Presently, hydrogen storage is primarily used to power hybrid fuel cell vehicles.
- The development of a hydrogen fuel production plant in the SAP represents longer term proposal for which a significant amount of work is still required to realise the potential in the region, to become a major hydrogen generation hub supporting the transport logistics industry.
- The interest in hydrogen technology around the country is very strong and Wagga Wagga SAP would be in competition with other major cities around the Country.

7.2 ENERGY MARKET AND GRID DYNAMICS

The most significant barrier to the adoption of renewable energy in Australia now is in the ability of the network infrastructure to support the connection of renewable energy generators into the grid. By many reports, the electricity network infrastructure is nearing its capacity in a number of locations within the National Grid and the integration of renewable energy is posing increasing challenges for network operators in managing the grid, dispatching supply, controlling power quality and in the ability of the network infrastructure to transmit the supply capacity that is required.

The pipeline of renewable energy projects is currently very healthy in Australia however there remains a major challenge for many projects in gaining network connection approval. There is also an increasing likelihood that renewable energy projects will need to pay higher costs for network upgrades or pay for additional network protection and control equipment.

Recently renewable energy generators have experienced a decline in the value of the energy generated recently due to the adjustment of mandated network marginal loss factors (MLF). These have, in some cases, reduced from 100% to 75%, meaning generators have to suffer lost saleable product through energy distribution losses, placing some upward pressure on renewable energy power prices for end consumers. The issue of declining marginal loss factors is causing some generators to deploy battery technology to improve the control of supply to the grid, reduce the occurrence of zero cost power and improve the supply of power at peak times.

7.2.1 DELIVERY CONSIDERATIONS

When planning for the development of renewable energy projects across the Wagga Wagga SAP the following energy market and grid connection issues will need to be considered:

- Declining marginal loss factors may affect the financial viability of merchant solar plants and those exporting to contracted consumers.
- Commercial scale solar power systems will require certainty around grid connection agreements. Early engagement with network authorities serving the SAP is necessary to verify the process and methodology for securing connection.

8 KEY ACTIONS

8.1 ESTABLISH A GOVERNANCE STRUCTURE

A key element of successfully delivering the proposed renewable energy strategy at Wagga Wagga SAP will be to establish a strong governance structure to drive the investment program and oversee the pathway towards implementation.

As SAPs are a new way of planning and delivering infrastructure projects in strategic regional locations in NSW they require a clear governance structure which extends beyond the traditional role of local council. In order to manage the fast-tracked planning process, and to drive effective and sustainable growth in these regions it is necessary to establish a specific regional governance authority that has a clear view of the overarching precinct strategies as well as the pathway guiding the strategy. The participants in the governance authority will be required to drive and promote investment in specific renewable energy programs, and work with key constituents to unlock the barriers to implementation.

The roles and objectives of the SAP Governance framework will likely be to:

- Establish clear precinct renewable energy installation targets
- Establish sources of information for end users to assist them in installing renewable energy
- Unlock funding mechanisms and alleviate financial barriers for individual investors

  Address other barriers to implementation such as network connection issues

Participants in the Governance structure are likely to be:

- The NSW Government Department of Planning, Industry and Environment
- Wagga Wagga City Council
- Regional Growth NSW Development Corporation
- Distributed network service provider
- A transformation and steering group
- A renewable energy development authority

8.2 ESTABLISH KEY PARTNERSHIPS

A number of key specific partnerships have been identified within this report with interests in specific technology types. There are likely to be key local partnerships developed utilizing parties with specialist experience in specific technology types. In the case of bio-energy for example there will be important project partners who can unlock opportunities in the fuel supply chain. For this technology type, it will be necessary to thoroughly evaluate the existing opportunities and to investigate potential participants in the process.

8.3 ESTABLISH SHORT AND MEDIUM TERM TARGETS

The renewable energy target for the Wagga Wagga SAP is to meet 100% of its annual electricity demand through SAP based renewable energy generation. In addition, The NSW Government is committed to achieving net zero by 2050 and this is outlined in the NSW Climate Change Policy Framework.

For the Wagga Wagga SAP to achieve outcomes consistent with the NSW Policy and those identified within previous stages of this investigation, it is vital to ensure there is a clear pathway towards full implementation of the Wagga Wagga

renewable energy strategy. It is necessary to establish short term, easily identifiable and measurable targets for each of the technology solutions being pursued.

It is necessary to divide the larger scale end goals for each technology into smaller manageable targets over a year-on-year basis at least till the substantial completion of Stage-1. In order to ensure the targets are measurable and provide clear direction, the targets should be stipulated using identifiable metrics such as:

- For commercial scale solar, the goal should be by number of projects as well as a total capacity figure.
- For the commercial scale projects the short-term goals should include the establishment of flagship projects and projects open for knowledge sharing.
- For bio-energy projects, the short-term goals are likely to be around completion of the identified target projects

8.4 SUPPORT THE BUSINESS CASE FOR RENEWABLE ENERGY

Some key aspects of the business case for local renewable energy need to be established in further detail to alleviate some barriers to implementation.

The business case for solar PV is strongly established in both the residential sector and commercial sector however some uncertainty and misinformation persists among households and businesses. A key role of the SAP delivery strategy will be to demystify the business case for solar PV at the small to medium scale and to assist small businesses in the deployment of these systems.

Often a major challenge for small business owners in proceeding with the installation of onsite solar PV is in sifting through the abundance of often conflicting information available to them regarding the return on investment for medium scale solar and the pathway towards proceeding with the investment. With supporting access to information, the uptake could be significantly improved with clear, independent advice on the investment cost, returns, operation and maintenance of the system.

The delivery of solar PV and battery installations could be enhanced by the following approaches to demystifying the business case:

- Establishing exemplar projects that can be opened to interested parties. These projects would include detail of implementation costs and lessons learned.
- Implementation of the NSW Clean Energy Knowledge sharing initiative
- The provision of financial evaluation tools online
- Working with local suppliers to establish standard installation packages and pricing.
- Providing independent advice documents on selecting PV providers and specifying solar PV systems

8.5 ASSIST IN DEVELOPING VIRTUAL POWER PLANT MECHANISMS

It has been identified that the mechanism of a VPP will be a likely method of aggregating smaller scale solar PV systems for the purpose of managing energy supply and demand balance of the Wagga Wagga SAP. Support will be required to develop these opportunities and create a regulatory framework which allows third parties to trade in multiple parcels of distributed solar PV. It is necessary for the development corporation to provide an initial bridge between the VPP network provider, businesses, large scale energy storage developers (if needed) and other stake holders to effective implementation of VPP network in the SAP.

8.6 ESTABLISH CASE STUDY MATERIAL

Some of the precedents discussed in this report serve as valuable case studies for the implantation of similar technologies and solutions for Wagga Wagga. To unlock the key learning outcomes from these projects it would be advantageous to create detailed case study material from these projects to assist local projects in Wagga Wagga. Knowledge sharing can be enabled through participation in the NSW Clean Energy Knowledge Sharing Program.

8.7 ESTABLISH RESOURCE NETWORKS

A key element of the implementation strategy will be to provide access to information regarding the opportunities for individuals and businesses to participate in the drive towards a clean energy supply. This is particularly important when implementing commercial scale solar across the wider precinct. One of the key limitations in deploying commercial scale solar power is the lack of knowledge of end users regarding he business case for solar and the process for proceeding with a moderate size solar installation on their premises.

In support of commercial scale solar installations, it would be beneficial to establish a resource network to provide interested installers with access to resources that enables them to proceed with their own insulations. The resource network should include:

- Identified commercial scale solar PV providers
- Example installations with owners available for discussion
- Structural engineers capable of assessing rooftops
  geotechnical surveyors capable of assessing proposed ground installations
- Independent consultants or advisors
- Access to assessment tools

8.8 UNDERTAKE STAKEHOLDER ENGAGEMENT

A key recommendation of this review is to establish a robust case for stakeholder engagement. The objective of this would be to identify key concerns and barriers to implementation and to the reposition the deployment strategy and resource allocation as necessary.

From bio-energy projects there will likely be a degree of community concern and consultation that is required to be addressed to enable these projects to proceed. Community consultation and engagement is a key part of the NSW Energy Recovery Facility Guidelines.

The key parties for engagement should include:

- Local businesses with opportunity to utilize commercial scale solar on site including businesses with large free roof areas.
- Local business with relatively high energy demands compared to other local businesses
- Third parties capable of establishing roof leasing arrangements

8.9 SOURCING LOCAL AND INDIGENOUS LABOUR

When undertaking larger scale projects there is opportunity to specify the requirement to utilize a percentage of local or indigenous community investment and a local or indigenous labour requirement in the construction of such projects. This

provides a crucial mechanism for disadvantaged or disenfranchised members of the community to participate in the growth of renewables in Wagga Wagga.

8.10 CONSIDERATION OF LIFECYCLE IMPACTS

An important component in the deployment of solar PV systems and battery systems is to plan for the end of life treatment of these systems. There are already some organizations capable of recycling or repurposing solar PV panels at the end of their life. The deployment strategy should include a strong understanding and strong policy on the end of life treatment of all renewable energy solutions. Further the policy should include an issues consideration on the lifecycle impacts of key components such as batteries which may have adverse environmental impacts beyond their application as part of a renewable energy system.

For energy from waste projects, a full environmental impact assessment is required.

8.11 SUPPORT EARLY ADOPTION PROJECTS FOR ENERGY FROM BIOMASS

Projects seeking to harvest energy from waste are likely to be relatively industry leading as there is far less precedent for these types of projects and the detail of the fuel feedstock can vary greatly and impact the business case and the end result. The harvest of energy from waste is a specialized activity that is strongly application specific and largely customized to each application. It is not yet a dispatchable off-the shelf solution. The reclaim of energy from waste is inextricably tied to the strategy for regional waste management and the associated economics. Further, the process for establishing energy from waste processing plants is highly regulated and scrutinized.

As result, the deployment of energy from waste facilities in Wagga Wagga requires a degree of dedicated specialist support, likely from a dedicated resource.

Some of the major supporting works required for these projects to succeed can include:

- Business case for transporting biomass fuel
- Assistance to develop a circular economy for the sharing of waste fuels
- Support from a State based advisory body on energy from waste.
- Engagement and leadership from local council

8.12 ESTABLISH BEST PRACTICE STANDARDS

Across the proposed suite of renewable energy technologies identified for development in Wagga Wagga it is necessary to establish strong standards for quality control in the installations. Under a fast-paced implementation strategy it is possible to suffer quality and safety degradation in the execution. It is recommended to establish strong guidelines regarding the expectations on quality for commercial solar PV installations in Wagga Wagga.

In the case of energy from waste projects there is significant opportunity to incorporate international best practice standards in local or state based guideline documentation covering these technologies.

8.13 FURTHER INITIATIVES

For the Wagga Wagga SAP to be a leader in renewable energy deployment, individual energy users can be encouraged to adopt energy consumption reduction strategies to maximize the contribution that renewable energy supplies can make to the region.

Consideration can be given to precinct certification against the NCOS standard. To achieve NCOS precinct certification the reporting from individual developments, through either an NCOS building or organisation certification, can form part of the overall precinct certification. Promoting the use of carbon accounting to track organizational environmental performance can be a strong complimentary measure toward the goal of 100% renewable energy supply. Undertaking an NCOS building or organisation certification will also help individual developments understand their progress over time and see where they have room for improvement.

- Business and organisations encouraged to undertake energy performance ratings such as NABERS or Green Star Performance in order to drive improved energy efficiency across the precinct
- Involvement from a governance level to promote the renewable energy and carbon reduction achievements across the SAP and provide a positive marketing platform for both the suppliers and customers of the clean electricity.
- Developments for industries that require industrial heat processes explore the potential for their industry to generate heat differently, through the smart use of renewable energy. There are many industrial heat processes that can be electrified saving energy and money as well as reducing emissions.
- Use carbon neutral services in the development and operation of the development.

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