ESD and Sustainability Consultants
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Wagga Wagga

Special Activation Precinct

Ecologically Sustainable Development (ESD) Plan

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01	31/10/19	First Draft Issue for comment	JP	PD
02	15/11/19	Final issue incorporating stakeholder feedback	JP	PD
03	03/07/20	Updated to suit comments from team	JP	PD

The work and input of Advanced Focus Pty Ltd and Life Cycles Pty Ltd as specialist sub-consultants to dsquared, in the preparation of the baseline analysis and options for Circular Economy, and the development of the Circular Economy Calculator, is recognised.

www.advancedfocus.com.au

www.lifecycles.com.au

The following three key ESD strategies and initiatives have been identified to provide immediate outcomes and to establish the Wagga Wagga SAP as a leader in sustainable development for industrial parks.

1st ESD Strategy - Circular Economy Model & Resource Optimisation

Key Move: employ a Circular Economy Concierge

Establish a Circular Economy (CE) both within and outside the SAP by facilitating resource flows between industries services, products and energy. The SAP will have the ability to recover resources from greater NSW, across Australia and internationally.

The key strategy to ensuring that the SAP embeds a CE model into the master plan and operations is to implement a CE concierge that will support businesses in improving efficiencies and creating synergies with immediate opportunities identified in the Bomen Industrial Estate.

2nd ESD Strategy – ESD Framework

Key Move: Development Corporation to develop precinct EMS

Develop an ESD Framework with a SAP ISO14001 Environmental Management System (EMS) embedded with the United Nations Industrial Development Organisation (UNIDO) Eco-Industrial Parks framework to create an internationally recognised system to embed ESD principles and promote the SAP.

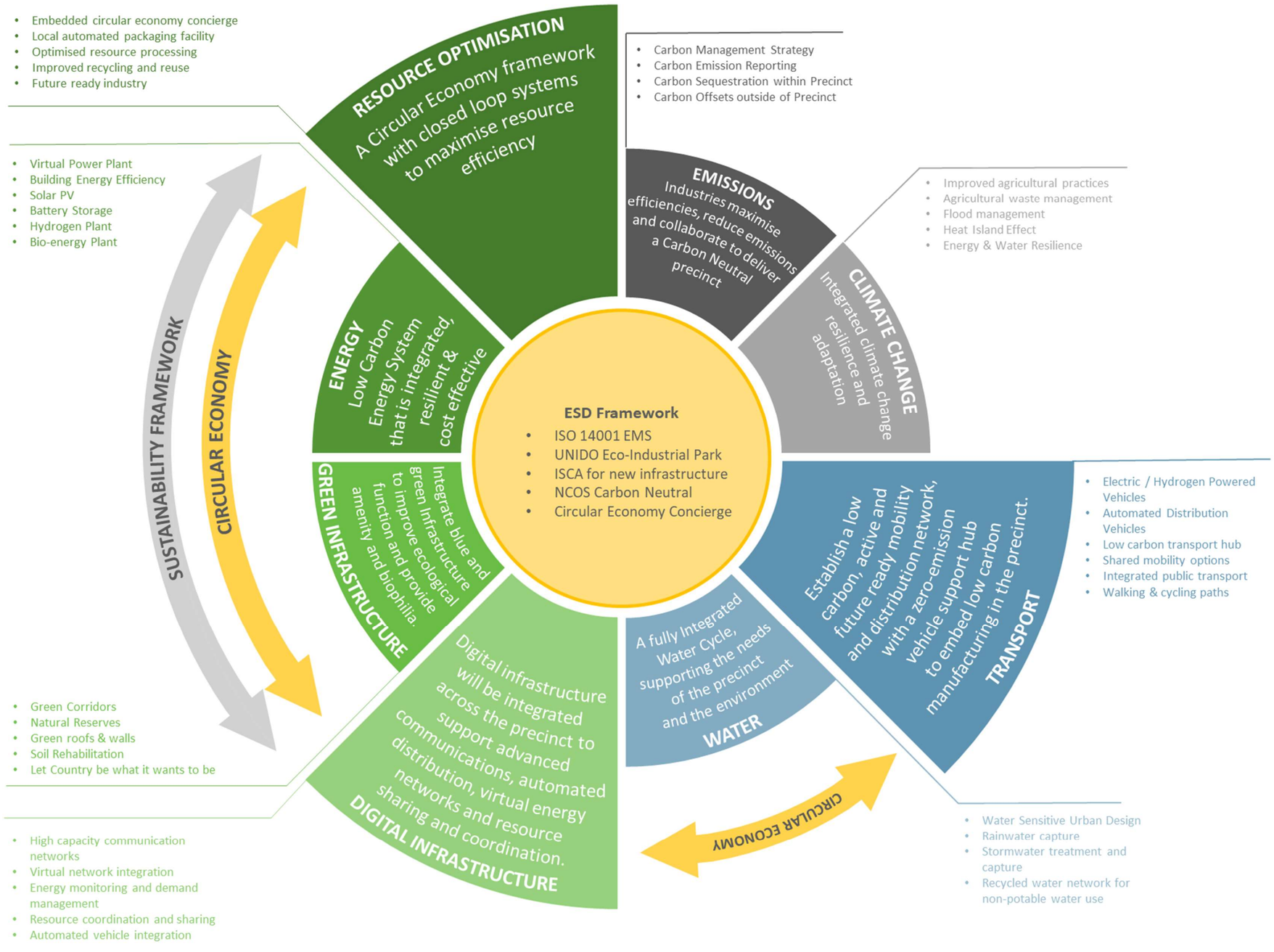
The precinct EMS can be developed immediately with existing businesses in Bomen already EMS accredited and can be incorporated into the precinct EMS structure. Businesses that are not accredited are to be supported by the Development Corporation and CE concierge.

3rd ESD Strategy – Virtual Power Plant

Key Move: Procure Virtual Power Plant (VPP)

Implement a Virtual Power Plant (VPP) model through the procurement of energy services for existing businesses and to attract new industry. Begin planning for the integration of additional renewable energy systems to maximise opportunities.

Provide support through the CE concierge to maximise the VPP potential to share renewables within the SAP, identify energy efficiency/productivity opportunities and reduce costs and emissions for the SAP.



The following strategies and initiatives have been identified to embed ESD principles in the design and implementation of the Wagga Wagga SAP.

ESD Strategy	ESD Initiatives
ESD Framework	A framework which utilises the ISO14001 Environmental Management System (EMS), UNIDO Eco-Industrial Parks Framework, UN Sustainable Development Goals, National Carbon Offset Standard (NCOS) and Infrastructure Sustainability Council of Australia (ISCA) rating system to create an industrial precinct with Ecologically Sustainable Development (ESD) at its core.
Resource Optimisation & Circular Economy	A Circular Economy (CE) model is utilised to maximise resource optimisation and sharing, build on the Bomen nucleus, embed a CE concierge, invest in shared infrastructure and create synergies with other industry, educational institutions and across government.
Energy	A Low Carbon Energy System is integrated into the SAP with a Virtual Power Plant (VPP) at its core, supplied by renewable energy sources including solar photovoltaic (PV) systems, bio-energy and hydrogen, to increase resilience, improve energy productivity and reduce emissions and costs.
Water	An integrated water cycle is implemented with multiple water supplies (potable and non-potable) to improve resilience, reduce environmental impact and reduce costs.
Climate Change	Climate change resilience and adaptation is embedded in planning frameworks with climate change risks mitigated through precinct design and management strategies including the precinct EMS.
Emissions	High priority emissions including manufacturing, energy, water, waste and transport are targeted as part of emission reduction initiatives, SAP planning and design and through NCOS carbon neutral certification.
Transport	A Zero Emission Vehicle Hub is created which supports low emission vehicle research and development, aligned with higher education institutions, facilitates sustainable and active transport and assists in transitioning the SAP to a CE model.
Green Infrastructure	Green Infrastructure supports biodiversity, the protection of natural habitats, reduces the heat island effect associated with industrial parks, and improves the health and wellbeing of people via an innate and genetically determined affinity of human beings with the natural world (known as biophilia).
Digital Infrastructure	Advanced digital infrastructure provides the backbone to implementing NCOS monitoring systems, VPP deployment, energy productivity measures and embedding a CE model.

Contents

1. Introduction

This is the Ecologically Sustainable Development (ESD) Plan for the Wagga Wagga Special Activation Precinct (SAP). The ESD Plan consolidates the work undertaken during the development of the Wagga Wagga SAP Master Plan and summarises the recommended strategies for the following ESD Themes:

- **Resource Optimisation (Circular Economy)**
- **Energy**
- **Water**
- **Climate Change**
- **Emissions**
- **Transport**
- **Green Infrastructure**
- **Digital Infrastructure**

Figure 1: Wagga Wagga SAP ESD Themes and outcomes at a glance

The ESD Plan has been developed to deliver the ESD Vision which is:

Arrive. Connect. Innovate. Thrive.

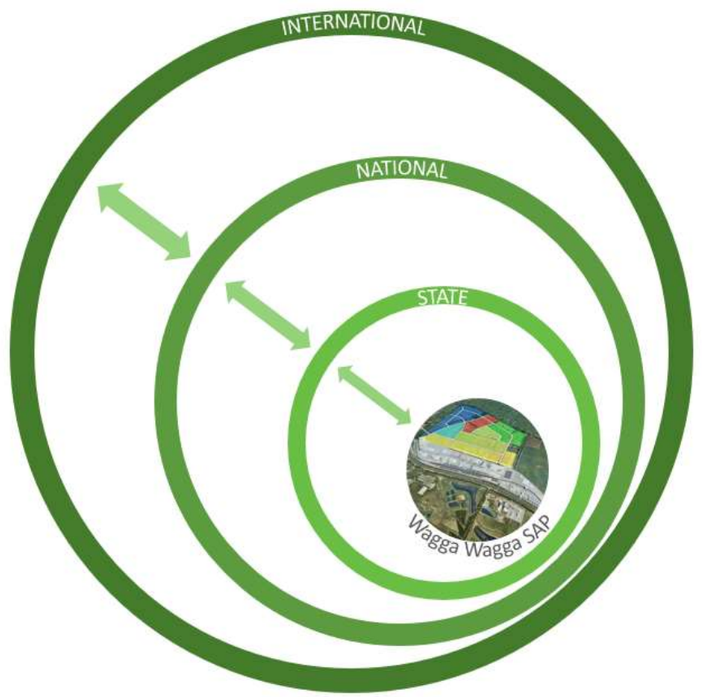


Figure 2: Wagga Wagga SAP ESD Vision

This vision recognises the already established and successful industries operating in the Wagga Wagga Bomen Business Park, to which new industries can come and thrive in the SAP environment and connect with the circular economy at a local, State, National, and global scale.

Supporting the ESD Plan is an ESD Framework which includes green building rating and internationally recognised environmental and sustainability governance systems to ensure that all stakeholders are accountable to ESD, and that the ESD outcomes are verified. This is further detailed in Section 2.

A description of the ESD Themes and how they contribute to the delivery of this vision are detailed in Sections 3 to 10 inclusive.

Precinct energy, water, and circular economy calculators have been developed as useful tools for the Regional Growth NSW Development Corporation (RGDC) to model alternative land use and industry options in the future. These are further detailed in Section 11.

Outcome: *A robust, internationally recognised framework that delivers Ecologically Sustainable Development.*

The ESD Framework structure developed for the Wagga Wagga SAP is:

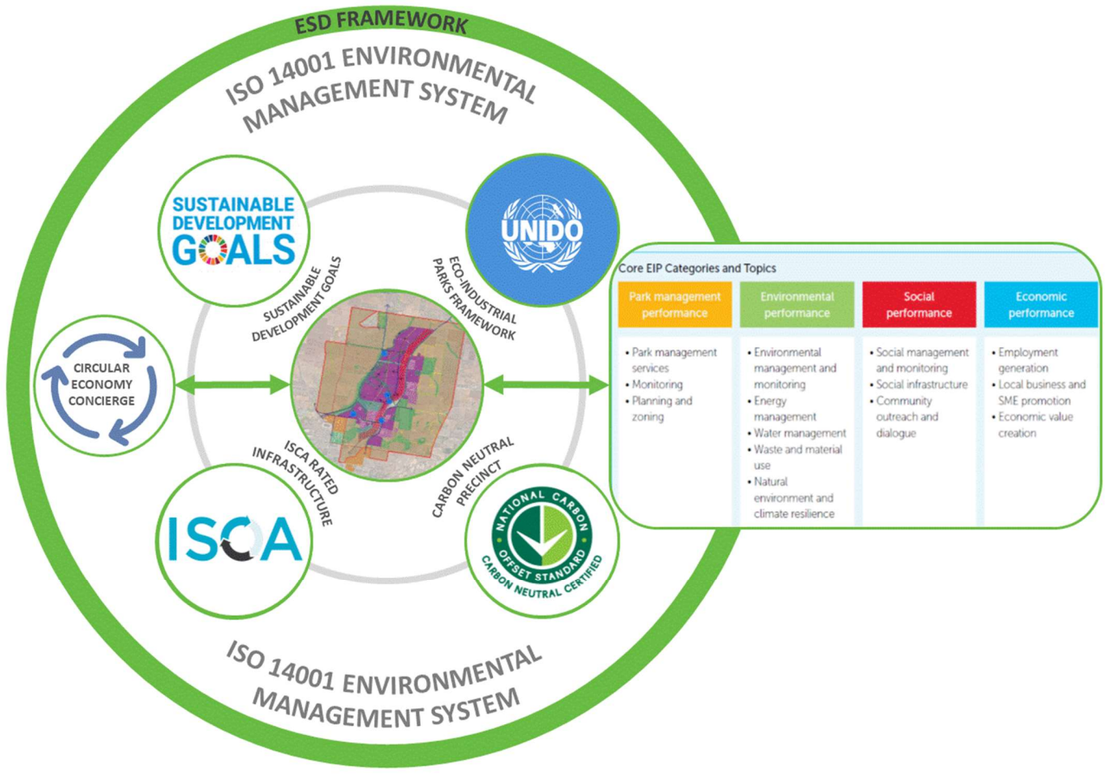


Figure 3: Wagga Wagga SAP ESD Framework

The ESD Framework has the United Nations Industrial Development Organisation (UNIDO) Eco-Industrial Parks framework as its foundation. This framework provides an internationally recognised, holistic system to promote the circular economy and industrial symbiosis approaches to industrial park development. In addition, and as an integrated part of the UNIDO Framework, the 17 UN Sustainability Goals provide a holistic set of goals and targets to be aligned to, with the aim to end poverty, improve environmental outcomes and ensuring prosperity for all. The following goals are most aligned with the ESD Framework, which have been incorporated into the ESD Plan and should be integrated into the ESD Framework:

Figure 4: SAP Sustainable Development Goals

ISO 14001 provides an internationally recognised, independently verified certification of the SAP Environmental Management System (EMS) which is the perfect structure within which to embed the UNIDO Eco-Industrial Parks framework.

The EMS provides a platform for the Circular Economy Concierge, site planning for the Circular Economy, the sustainability rating of new infrastructure projects using the Infrastructure Council of Australia (ISCA) tool, and the monitoring, management and certification of the precinct carbon footprint using the Australian Government National Carbon Offset Standard (NCOS). The EMS also provides a framework within which other rating tools and processes could be implemented if appropriate, for example Green Star or LEED rating of individual buildings.

The EMS will provide the management tool for ESD, ensuring compliance with local, State, and National sustainability goals and policies, and the setting and achieving of key performance indicators and targets for both the Wagga Wagga SAP and if appropriate for each of the companies operating within it.

Figure 5: ESD Policies and strategies supported by this framework

The Regional Growth NSW Development Corporation (RGDC) will be responsible for establishing the EMS and then maintaining it during the management of the SAP, but all stakeholders including land purchasers, developers, and businesses will have a requirement to contribute to the EMS.

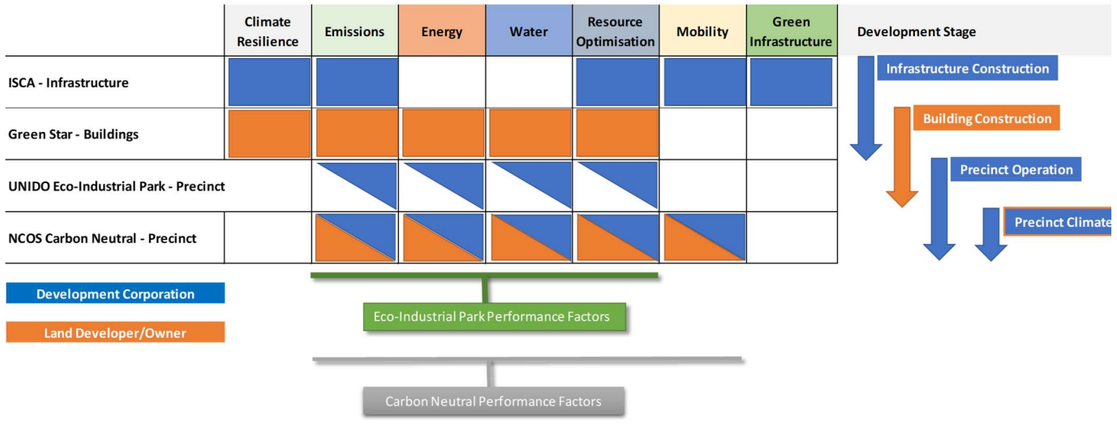


Figure 6: ESD Plan delivery responsibilities matrix

The six components of this framework are as follows.

1. ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEM

ISO140001 Environment Management Systems (EMS) have been implemented at industrial parks internationally and are a robust, third party verified and flexible way for the Wagga Wagga SAP to achieve accreditation which can be used to attract new businesses and investment.

ISO14001 accreditation for an industrial precinct is typically implemented with two EMS layers, with a high-level EMS for the precinct, managed by the precinct governing body (the RGDC), and an individual EMS for each business operating within the SAP. Several Bomen businesses already hold and operate ISO 14001 accredited EMS's and there is therefore an opportunity for early business integration.

A precinct level EMS will typically incorporate a more holistic view with an environmental policy which will align with State and Federal Government Policy, a framework and strategy for environmental management, precinct wide compliance requirements, key performance indicators (KPIs,) and monitoring systems to ensure continual improvement.

The EMS should incorporate monitoring systems to track and set targets (KPIs) for building performance (energy and water efficiency), electricity, gas, water, resource use, waste/resource generation (including hazardous waste), emissions, noise and air quality and opportunities for resource exchange. This will facilitate integrating a circular economy into the SAP, collating core data for carbon neutral certification under the National Carbon Offset Standard (NCOS) and identifying efficiencies and synergies between businesses.

The UNIDO framework provides a table of key performance indicators which should be used as a basis for the KPIs in the EMS and can be used to provide guidance to businesses on how to develop an EMS.

It is unlikely that all the existing and new businesses will have the immediate economic capacity to implement a certified EMS and it is therefore recommended that providing support to businesses in achieving EMS accreditation is embedded in the precinct EMS. EMS support for businesses could include:

- Development of draft EMS frameworks and templates for typical businesses, including a checklist for the Development Corporation or concierge to distribute and work through with individual businesses;
- Sourcing funding and resources to assist in developing an EMS including expertise and grants; and
- Embedding monitoring and reporting in the precinct EMS utilising the virtual power plant and energy monitoring systems.

As part of the EMS, it is also recommended that an Energy Management System is implemented in line with ISO15001 to ensure energy systems, such as the virtual power plant, capture and share key data, and facilitates efficiency improvements.

2. UNIDO ECO-INDUSTRIAL PARKS FRAMEWORK

It is recommended that the UNIDO Eco-industrial Park (EIP) framework is integrated into the precinct EMS by aligning the EMS structure with the four core EIP categories and topics, which are Precinct Management & Performance, Environmental Performance, Social Performance, and Economic Performance.

In particular, the Environmental and Social Performance sections are closely aligned with the ESD themes identified for the Wagga Wagga SAP and embedding the UNIDO EIP into an EMS will ensure that these topics are integrated at all stages of the SAP development and follow an internationally recognised framework. Conversely, the EIP includes a requirement for an EMS to be integrated into the precinct and provides several KPIs which will assist in the development of both the precinct and the individual business EMS's.

UNIDO have been consulted during the master planning stage and have confirmed that internationally the eco-industrial parks that have attracted the greatest investment are those that have embedded the UNIDO framework within an ISO 14001 certified EMS. https://www.unido.org/

3. PLANNING FRAMEWORK

The SAP planning framework provides a streamlined process for businesses seeking development and environmental approvals, and this framework is subject to a separate detailed plan and report. The elements of the planning framework that are associated with ESD and can therefore be included in the EMS are as follows:

- the role of the Circular Economy Concierge, including reporting and communication requirements *(see Section 3)*; and
- the way in which land planning and release is undertaken at an individual lot level. This is recommended to follow a "chequerboard" approach, in which vacant lots are left between businesses to allow them to expand and offer some future capacity for the co-location of synergistic businesses as and when they become available.

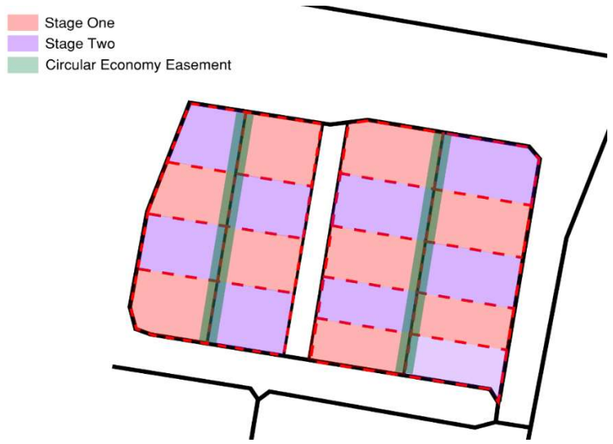


Figure 7: Chequerboard approach to land release

4. ISCA INFRASTRUCTURE SUSTAINABILITY TOOL

It is recommended that the Wagga Wagga SAP mandates that all new major infrastructure such as rail (RiFL), major roads, wastewater treatment plants (Bomen Industrial Sewage Treatment Facility) and large scale renewable deployments (solar farms) are ISCA rated aiming for a "Leading" rating. ISCA is an established rating tool already in use by the NSW Government on major projects.

Upgrades of existing minor infrastructure (e.g. access roads and public lighting) can be excluded from requiring an ISCA rating as the major impact will be in the initial development of the SAP major infrastructure.

In addition, the GBCA and ISCA released a "crosswalk" guide for projects seeking dual certification in September 2019 which facilitates projects using ISCA and Green Star. This may be an option for RiFL with ISCA used as the lead rating tool for major infrastructure and Green Star used for one or more of the main buildings. Individual building developers may elect to use Green Star as a rating tool for their buildings and as a means of demonstrating compliance with the key performance indicators of the EMS.

5. NCOS CARBON NEUTRAL CERTIFICATION

This provides a monitoring, management, and certification framework for the SAP greenhouse gas emissions and is described in more detail in Section 7.

6. SOCIAL INFRASTRUCTURE

A key component to the ESD framework is the integration of social infrastructure to support both existing businesses and attract new businesses by providing high quality community and social services and infrastructure. This is covered in detail in the Social Infrastructure technical report however key ESD considerations include:

- Embedding green and blue infrastructure in key locations to ensure all businesses and employees have access to quality outdoor areas which assists in improving health and well-being;
- Provide high quality landscaped areas with increased vegetation around social/community spaces to reduce heat island effect and increase resilience to climate change (*refer Section 6*).
- Incorporating native plantings in landscaping around public spaces to reduce irrigation requirements.
- Capitalising on existing natural flora and fauna to provide places of respite while improving biodiversity and climate change resilience;
- Aligning Water Sensitive Urban Design (WSUD) opportunities with outdoor social/community spaces;
- Incorporating Aboriginal Planning Principles to reflect the Wiradjuri people's connection to country and in particular areas of significance within the SAP;
- Providing both natural (vegetation) and fixed shade structures as part of social/community spaces to increase the likelihood of outdoor areas being used when weather conditions are not ideal.

Outcome: *A Circular Economy framework with closed loop systems to maximise resource efficiency.*

The Ellen McArthur Foundation defines a circular economy as:

"Looking beyond the current take-make-waste extractive industrial model, a circular economy aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles:

- *design out waste and pollution;*
- *keep products and materials in use (there is no waste – all materials are resources that can be re-used); and*
- *regenerate natural systems.*

Transitioning to a circular economy does not only amount to adjustments aimed at reducing the negative impacts of the linear economy. Rather, it represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits."

https://www.ellenmacarthurfoundation.org/circular-economy/concept

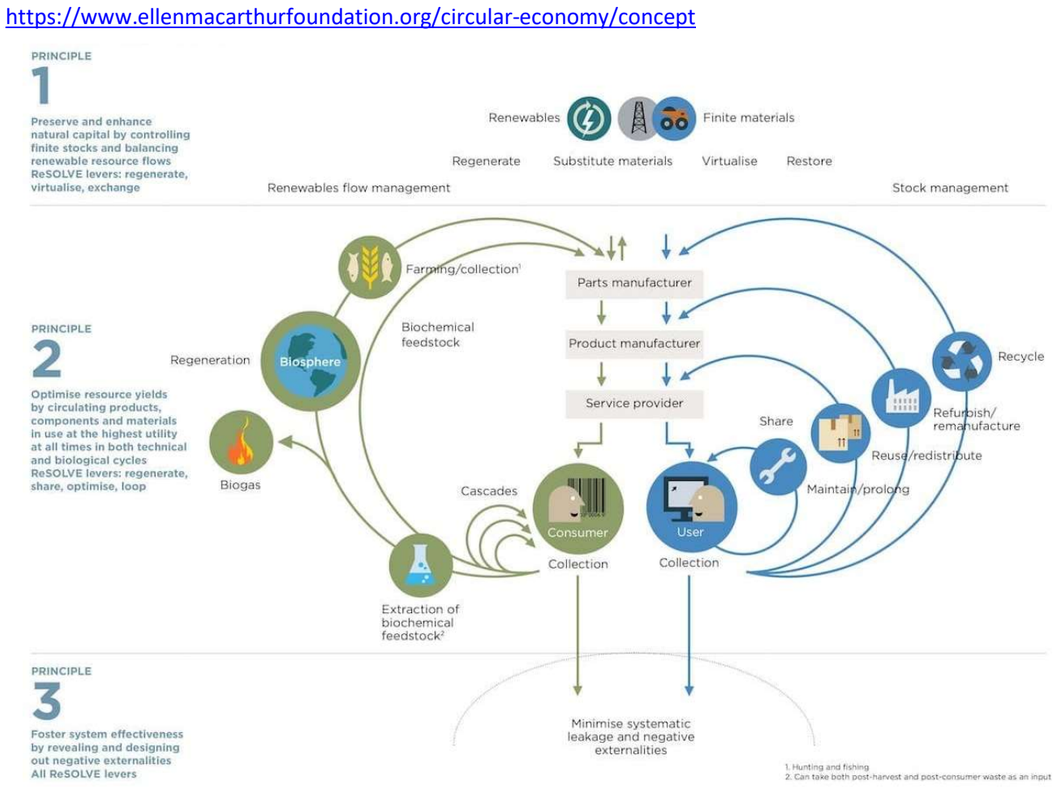


Figure 8: Ellen MacArthur Foundation – Circular Economy Concept

A circular economy model can change a linear system (take-make-waste) to a closed loop or circular system which maximises resource efficiencies, reduces waste, and saves money. Creating a circular economy within the SAP can provide benefits from an environmental, economic, and social perspective, with increased efficiencies providing greater return on investment for industry, and reduced resource consumption decreasing environmental impact. In addition, processes which historically would have aimed to minimise impact on the environment can be redesigned to regenerate or improve natural ecosystems. For example, wastewater treatment and recycled water use can reduce reliance on local waterways and aquifers while providing fit for purpose water for industry, creating a closed loop system.

Four key strategies to help create a successful Circular Economy framework have been developed:

1. BUILD ON THE BOMEN NUCLEUS

A number of industries operating in the Wagga Wagga Bomen Business Park have already made some connections to the national and global circular economies, recycling products such as oils and batteries to create new products which are used in Australia or exported overseas. Our survey of these industries identified a significant opportunity to create new local linkages and establish a Circular Economy nucleus which new industries attracted to the SAP can connect to, helping both themselves and the Bomen businesses to thrive.

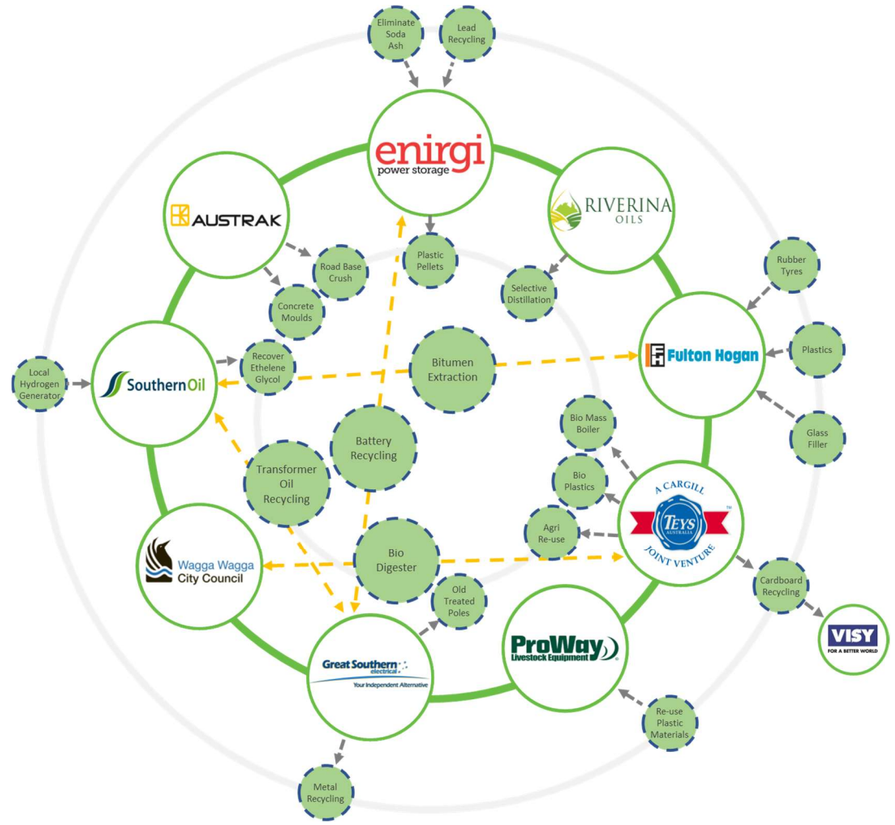
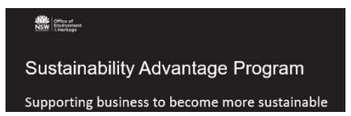


Figure 9: Circular Economy opportunities mapping at the Bomen Business Park

The Bomen businesses that already operate with a circular economy mindset can be placed in a position of leadership as ambassadors of the SAP, and their achievements celebrated and advertised as a way to encourage like-minded industries to choose the Wagga Wagga SAP as their preferred location.

Two existing programmes can be leveraged to provide support to these businesses:



The NSW Sustainability Advantage program offers opportunities for collaboration and technical support and capital funding to help businesses become more sustainable and transition to a circular economy model. Bomen businesses have previously been members of this program and should be encouraged to re-engage. The Sustainability Advantage Program manager has agreed that businesses joining in the Wagga Wagga SAP area can combine their funding, and this aggregated pool of funding used to develop the circular economy framework further.

https://www.environment.nsw.gov.au/sustainabilityadvantage/

The Committee 4 Wagga is a subscription-based membership programme which provides a forum for businesses to network, share ideas, and work together to increase their business activities in the region. As with the Sustainability Advantage Programme, some Bomen businesses are already members, but this programme would benefit from a renewed emphasis and the stimulus that the creation of the SAP can provide.

https://committee4wagga.com.au/

Working in conjunction with the Sustainability Advantage programme, and combining the funding made available both through this programme and the Committee 4 Wagga subscription payments, this could offer the opportunity for a new *Wagga Wagga SAP Circular Economy Industry Group* to be created.

2. APPOINT A CIRCULAR ECONOMY CONCIERGE

A Circular Economy Concierge is a person or team dedicated to understanding the process and resource needs of businesses and finding ways to link them together in a Circular Economy framework.

This Concierge needs both technical skills - a chemical and engineering background, with time served working in the process and manufacturing industries, and people skills - able to communicate with energy and enthusiasm – a catalyst for engagement and innovation.

The Tonsley Park innovation precinct in South Australia offers an example of a burgeoning successful circular economy framework steered by a dynamic concierge.

https://tonsley.com.au/

https://tonsley.com.au/about/vision/

During the initial site investigation stage of the master planning process, a member of the dsquared ESD team *(Mark Fusco of Advanced Focus)* met with more than 12 of the existing Bomen businesses, and in a Circular Economy Concierge role established very quickly that opportunities exist right now, the businesses are very open to working with a Concierge, and together, and if this is initiated this could be a very early quick win for the RGDC.

The Circular Economy Concierge can provide:

- Support to existing businesses and a means of connecting them together;
- A conduit to seek businesses that if co-located could support each other;
- Assistance in transitioning from a linear economy to a Deep CE model where all opportunities are maximised with the aim to create a carbon neutral precinct.
    - A Deep CE model is achieved when all CE opportunities have been maximised including optimising the mix of sector activities, the energy supply has been decarbonised, biomass and bio-energy has been integrated and waste and resource exchanges are fully embedded with shared infrastructure.
- Assistance in co-locating businesses and otherwise helping find the best location within the SAP for the business to be located based on their resource and environmental requirements. For example, co-locating businesses with energy exchange opportunities such as renewables, heat and steam;
- A conduit to Wagga Wagga Council and the NSW investment attraction team to target industries which could be well-suited to the SAP; and
- A leadership role for the Bomen nucleus programmes.

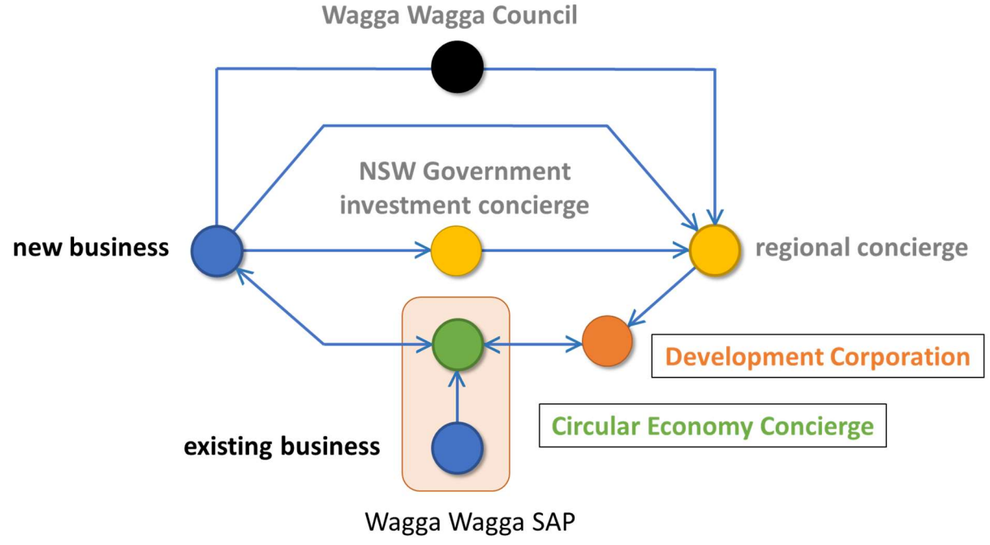


Figure 10: Where the Circular Economy Concierge fits in the communication pathways

The Circular Economy Concierge is a full-time role and as the SAP grows this may demand that this person is supplemented by a technical support team.

Without an effective full-time Concierge in place a fully developed and successful Circular Economy framework will be extremely problematical, if not impossible, to create and maintain.

3. INVEST IN INFRASTRUCTURE

A Circular Economy framework relies on the ability for industries to quickly and economically share and transfer resources and data. This resource sharing can be facilitated by infrastructure. For the Wagga Wagga SAP this should include:

- An electricity network that allows energy to be shared, both physically and virtually (often described as an inset network, embedded network, or Virtual Power Plant – VPP). A VPP can provide a platform on which energy industries can build new technologies and draw energy systems investment into the SAP. *See section 4 for more details.*
- An upgraded Wagga Wagga Council water treatment plant to accept and process all trade waste, deliver back recycled water, and generate energy. This then changes the industrial trade waste from an often costly product to pre-treat, to a valuable resource that therefore reduces both the cost and risk burden on the connected industries. *See sections 4 and 5 for more details.*
- A gas network capable of receiving and transferring hydrogen. A hydrogen blended gas supply will reduce the greenhouse gas emissions footprint of a connected business, and also opens up the SAP to investment from hydrogen generating businesses. *See section 4 for more details.*
- A high speed, high bandwidth 5G digital communications network. This will allow the transfer and sharing of resource consumption and input-output data, energy and greenhouse gas emissions inventory data, and general communications to help with the automation of resource transfer and back-haulage. *See Section 10 for more details.*
- Shared waste and resource treatment and recycling/re-purposing facilities.
- Land easements for circular economy infrastructure services. These should be dedicated zones within which private services for the transfer of resources between industries can be laid in the form of pipework or cabling. The easements could be used for the transfer of electricity, water, liquid waste such as greywater or slurries, granular products such as grain, liquids such as fuel oil, fuel, and water, or even bulk products such as hard waste using vacuum transfer pipework systems.

The proposed locations, size and general arrangements of the circular economy easements as well as circular economy related infrastructure are also further detailed in separate technical reports.

4. ENGAGE WITH OTHER AGENCIES

In addition to the Sustainability Advantage Programme and the Committee 4 Wagga, there are many other agencies providing technical and funding support for industries looking to innovate in the circular economy space, or otherwise reduce greenhouse gas emissions and other environmental impacts through the deployment of sustainable technologies.

The RGDC can work in conjunction with the SAP-based industries to seek opportunities to work with and obtain support funding from the following:

The Australian Renewable Energy Agency (ARENA) is a department of the Government of Australia, whose stated role is to connect investment, knowledge and people to deliver energy and innovation. In the 2018-2019 financial year, ARENA committed $228m of funds to 80 new Australian projects, including Australia's first utility scale waste-to-energy plant, solar and wind generation projects, four big battery systems, and projects navigating the integration of distributed energy systems into the grid. Early engagement with ARENA and with existing businesses in Bomen is recommended. https://arena.gov.au/

The Clean Energy Finance Corporation (CEFC) promotes itself as a leading investor in low carbon electricity, including bioenergy, energy storage, solar and wind generation, projects in agribusiness, green vehicles, and manufacturing, and a source of finance for cleantech start-ups through their Innovation Fund.

The CEFC often works in conjunction with ARENA to provide a low interest rate loan scheme to support the industries' provision of matching funding for ARENA grants.

https://www.cefc.com.au

The NSW Government EPA manages the *Waste Less, Recycle More* scheme, which offers a total fund of $802 million to stimulate new investment and transform waste and recycling in NSW. It offers grant programs for local government, business, industry and the community, delivered by the NSW Environment Protection Authority and the NSW Environmental Trust.

https://www.epa.nsw.gov.au/working-together/grants

Circular Economy businesses need a technically skilled work force to operate. If the business is to grow it therefore needs access to appropriately qualified staff.

At a shop floor level, skilled tradespeople can be trained by providers of vocational training such as TAFE NSW. TAFE NSW already have a presence in Wagga Wagga.

https://www.tafensw.edu.au/

At a senior technician or management level, skilled process engineers can be trained by providers of tertiary education such Charles Sturt University. Charles Sturt University already has a major campus located at Wagga Wagga with the AGRISCIENCES RESEARCH AND BUSINESS PARK (AGRIPARK) providing an ideal platform to integrate SAP industry opportunities with the agricultural sector.

https://study.csu.edu.au/life/locations/wagga-wagga

https://agripark.csu.edu.au/

These businesses are always looking to enhance their processes and develop new methods of production, and these endeavours can be well supported by both the Charles Sturt University, or a specific research and innovation hub located in the SAP itself.

This research hub could contain shared laboratories and test centres, as well as access to specialist technical staff and research support staff, for example PHD students from the University, or the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

https://www.csiro.au/

Outcome: *Low Carbon Energy System that is integrated, resilient & cost effective.*

The target industries for the Wagga Wagga SAP have high energy demands and a need for access to reliable and affordable energy. However, these needs must also be considered in the context of a changing climate, with State and National commitments to reducing emissions and improving energy productivity.

To enable energy to be managed effectively, maximise efficiencies and energy productivity and reduce costs for both existing and potential businesses in the SAP, a holistic and integrated energy model is required which supports and attracts businesses to the SAP. The intention is to create a model which is technology agnostic while supporting a range of functions including energy efficiency and productivity and maximising the integration of renewable energy systems such as solar PV, hydrogen production and bio-energy which are incorporated in this plan and future technologies that may become viable for the SAP in the future.

The SAP has access to grid electricity and high-pressure natural gas at the capacities required for its eventual ultimate development. Rather than simply connect these industries to these networks in a linear way, the energy strategy is to create an inset or embedded energy network which takes advantage of the physical assets and infrastructure in the SAP, while also taking advantage of new technologies and renewable energy systems.

Four key strategies to help deliver a low carbon, affordable energy system have been developed:

1. VIRTUAL POWER PLANT

A Virtual Power Plant (VPP) is a distributed energy management system which aggregates standalone assets (e.g. commercial buildings and industrial facilities) and distributed energy systems (e.g. ground and rooftop solar PV, battery storage and bio-energy), and connects these systems in a virtual environment. The aggregated assets, energy demand, renewable energy systems and buying power is then utilised to access existing licenced energy markets to buy, sell and share energy utilising these virtually connected assets. These assets (businesses, poles and wires, powerplants, etc.) can be physically disconnected, but operated in a virtual environment.

Figure 11: Wagga Wagga SAP Virtual Power Plant Infrastructure Example

The VPP is managed by a licenced energy company that will be able to aggregate the SAP customers' electricity account and use this collective buying power to secure and then deliver power at a cheaper rate than a normal grid supply contract, often achieving savings of up to 20-30%. The VPP is intended to promote private investment in the installation of low carbon and renewable energy technologies which support the circular economy framework, and when working together reduce the cost of energy delivery. For example, businesses with large rooftop areas but low energy demand (such as non-refrigerated warehouses) would be incentivised to oversize their solar PV array and provide excess generation to other businesses in the SAP VPP.

In summary, VPP provides the following opportunities:

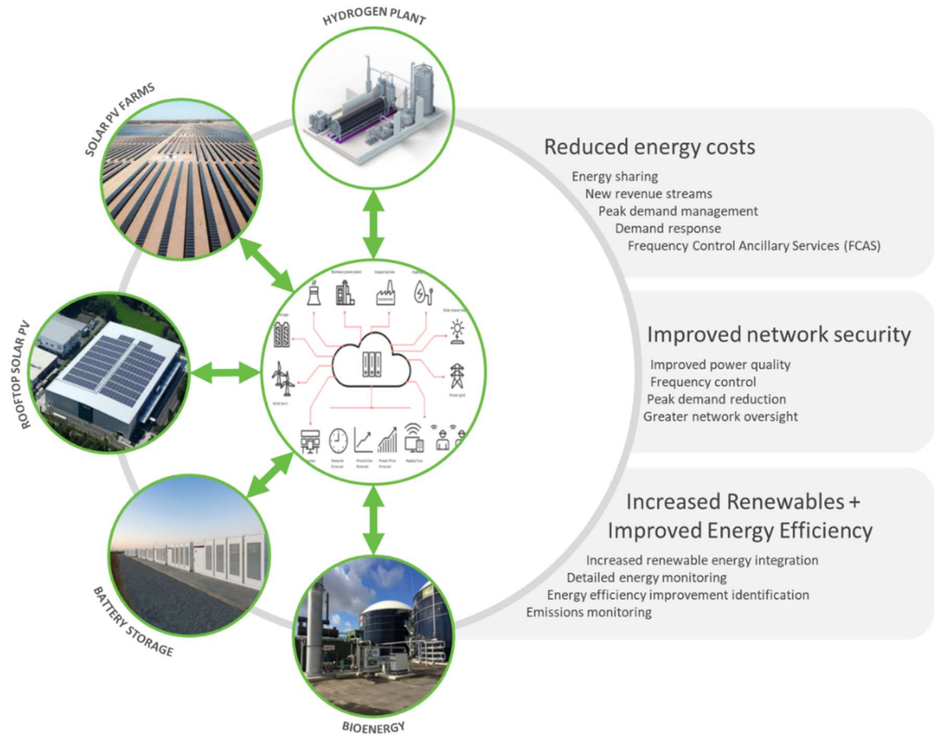


Figure 12: Wagga Wagga SAP Virtual Power Plant Opportunities

- **Increased renewable energy integration:** Renewable energy will be supported by creating a shared energy network within the SAP. For example, businesses with low usage but large rooftop areas will be able to maximise renewable energy systems and share this energy, for profit, to adjacent businesses who will access the power at a discounted rate compared to standard commercial rates.
- **Reduced Energy Costs:** Energy sharing, peak demand management, demand response and alternative markets provide new revenue streams for existing businesses;
- **Improved Network Security:** Frequency control, peak demand management and demand response can be utilised to create additional revenue streams through ancillary markets such as Frequency Control Ancillary Services (FCAS), while also improving network stability and providing greater visibility and oversight to energy systems; and

- **Improved Efficiency and Productivity:** Improved energy monitoring provides insights into consumption and demand profiles, allows identification of efficiency improvements and facilities the integration of renewable energy systems. This could be facilitated by the Circular Economy concierge and by engaging with other agencies to assist businesses in reviewing energy data and trends, identifying consumption and demand reduction opportunities and improving energy productivity. The monitoring will also provide emissions tracking and reporting in line with NCOS requirements.

A VPP provides a readily available and large customer base that can then attract energy generators to invest in the SAP and build and operate their own generation systems *(see Energy strategy 2 and 3 below)*.

Given the large scale and number of customers already consuming electricity in the SAP zone, it would be possible for a contract for a licenced energy company to be developed now, therefore initiating the creation of a VPP as an early quick win for the Regional Growth NSW Development Corporation (RGDC).

2. BIO-ENERGY GENERATION

Bio-energy generation is the generation of electricity using a biomass (organic) material, usually as a result of natural bio digestion creating fuel or heat, or direct combustion.

The following existing Bomen businesses have advised that they are currently considering the deployment of large-scale bio-energy plants at their facilities:

- TEYS – using their animal/organic waste in a biodigester to create gas and use this to generate process heat energy and electricity. TEYS have suggested this may even be enough to make their facility self-sufficient for electricity
- ROBE – contracting with Pacific Heat & Power (PH&P) to create a biomass to energy plant, initially using timber construction waste shipped from western Sydney, but capable of transitioning to running on local rice husks when available. PH&P have advised they are open to expanding the capacity of this plant to supply heat and electricity to other industries in the SAP area, facilitated by the Virtual Power Plant arrangement.

PH&P have advised that whilst there is a stock of locally available bio-mass, during periods of drought this is of limited supply and at an unaffordable price as it constitutes a high value feedstock for agri-businesses, and so the capacity of future bio-energy systems is likely to be limited by the availability of feedstock from within the SAP area itself.

This is further discussed in detail in the separate Renewable Energy Technical Report.

Wagga Wagga Council have considered an upgrade to their existing wastewater treatment plant which currently services the Bomen Business Park in order to accept trade waste from the SAP industries. Trade waste is typically high in organic material content which offers a high-quality source of feedstock for a bio-energy plant.

Dependent upon the scale, mix, and co-location of industries producing trade waste in the SAP, there may be a future business case for a second bio-energy waste water plant in the SAP area itself.

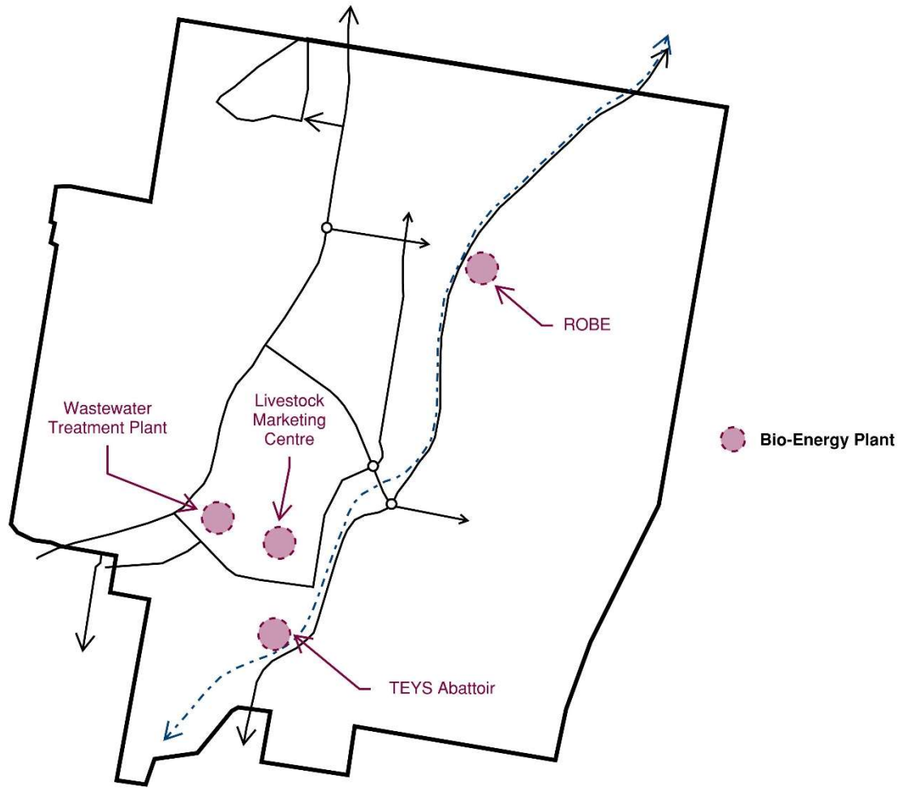


Figure 13: Wagga Wagga SAP bio-energy plant locations and opportunities

3. SOLAR ENERGY GENERATION

The Wagga Wagga SAP has adequate land capacity for the deployment of large-scale solar photovoltaic (PV) electricity generation systems, and if supported by battery energy storage could be sized to provide 100% of the SAP's electricity demand.

Two ground mounted solar PV farms are currently under development. Their energy generation capacities have already been contracted to customers outside of the SAP area, but these contracts could be adopted by the SAP licenced energy provider and connected via the VPP framework when they are due to expire (estimated to be in 2029-2030).

The rooftops of the SAP buildings provide a large platform for the deployment of solar PV systems, which if connected via the VPP can be aggregated to form a large solar power plant.

This is further discussed in detail in the separate Renewable Energy Technical Report.

4. HYDROGEN HUB

Hydrogen is a fuel that has zero carbon emissions when consumed, and if created using renewables can be a zero-emission energy resource.

Hydrogen can be stored and used when required and can be transported in liquid form in a similar manner to liquid petroleum gas (LPG), petrol, and diesel fuels, and so is a dispatchable source of base load zero carbon energy. Through the process of electrolysis, hydrogen can be created using water as the feedstock, and zero or low carbon energy such as solar PV or natural gas as the catalyst.

The development of a hydrogen-based economy, the construction of hydrogen generation systems, and the development of a hydrogen export industry is under way in Australia, with South Australia releasing the first hydrogen roadmap in 2017 and Western Australia releasing theirs in 2019.

The New South Wales Government, via the Office of the Chief Scientist, is seeking a NSW based hydrogen hub. This could be at the Wagga Wagga SAP given its access to large scale renewable solar energy and natural gas, industries that require dispatchable base load energy, and industries such as Southern Oils that require a supply of hydrogen for their own process systems.

During the stakeholder engagement stage of master plan development, Southern Oils advised that they were in the process of discussing opportunities with a hydrogen generation specialist company to co-locate a solar powered hydrogen electrolyser with their processing facilities.

Components of a Wagga Wagga SAP hydrogen hub could include:

- companies generating and selling hydrogen using renewable energy systems;
- despatching hydrogen via the existing natural gas network to de-carbonise it;
- the blending of hydrogen with ammonia to make it suitable for bulk container shipping and export nationally and overseas;
- the use of hydrogen by SAP industries in their chemical processes;
- the co-location of hydrogen compatible industries, such as the construction of hydrogen vehicles, engines, and the conversion of vehicle engines for hydrogen use; and
- the use of hydrogen as a base load energy source which can be used for heat generation, or electricity generation.

If the RGDC continues to work with the Chief Scientist on establishing the Wagga Wagga SAP as the NSW Hydrogen Hub, itself forming a part of the new circular economy, this could be an early quick win.

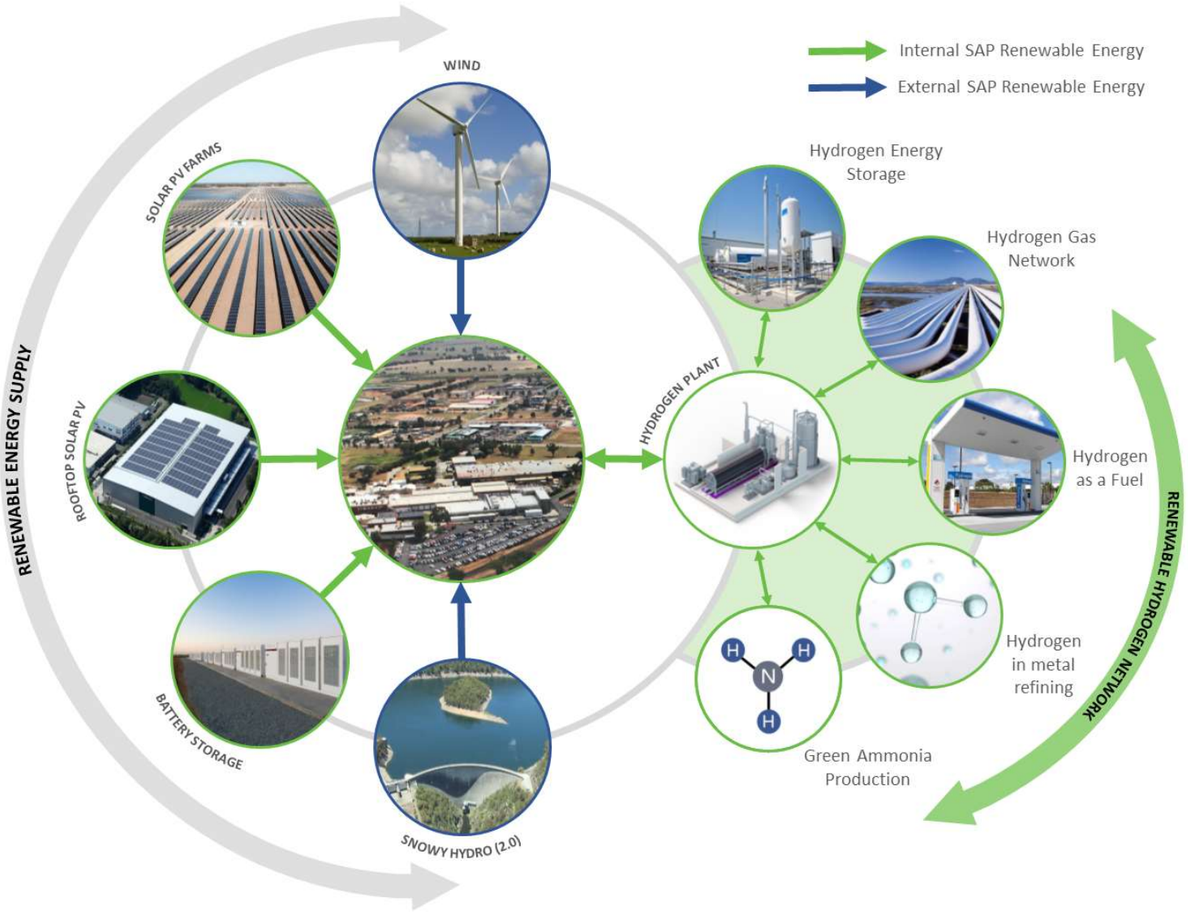


Figure 14: A vision of the Wagga Wagga SAP Hydrogen Hub

Outcome: *A fully integrated water cycle, supporting the needs of the precinct and the environment.*

Implementing an integrated water cycle supported by water sensitive urban design (WSUD) principles will be key to ensuring that the SAP has sufficient water resources (both potable and non-potable) to expand beyond current operations, while minimising its impact on the environment, and adapting to a changing climate.

The following water supplies will need to be integrated in combination to provide a balanced outcome:

1. Potable Water and Non-Potable;
2. Rainwater;
3. Stormwater; and
4. Wastewater.

1. POTABLE WATER

The Bomen precinct is currently supplied with potable water from the North Wagga mains supply, which is fed by a combination of extracted bore water/river water, and reservoir catchments. These supply sources will need to be upgraded to serve the fully developed SAP, and this is detailed further in separate technical reports.

To reduce the demand on the potable water supplies, access to alternative water supplies for non-potable water uses will be provided and these are further described below. In addition, the EMS should include design and construction guidelines and KPIs for the industries moving into the SAP that provide a focus on water use efficiency.

2. RAINWATER *(harvested from building roofs)*

All new buildings within the SAP should be required to provide on-site rainwater capture and re-use facilities. These can be grouped and shared within the SAP to increase their utilisation efficiency, and to reduce their capital cost. Rainwater is suitable for many non-potable uses including wash down, toilet and urinal flushing, process water, cooling water, and feedstock watering.

At times of peak storm events which exceed the rainwater storage tank capacities, excess rainwater can be diverted into the stormwater system and used for land and waterway regeneration (see Stormwater). Rainwater can also be supplemented with recycled wastewater in the event that the Bomen wastewater treatment plant is upgraded (see Wastewater section below).

3. STORMWATER *(harvested from the ground)*

Using the principle espoused by the traditional custodians of the land on which the Wagga Wagga SAP will be located, the Wiradjuri people, which is *"Let Country be what it wants to be",* Water Sensitive Urban Design (WSUD) will be used to manage stormwater flows by working with, and not against, natural features and flood paths to balance stormwater outflows.

Stormwater will be managed by providing opportunities for localised detention and re-use with natural filtration using vegetation (bioretention), to improve the local amenity of the SAP, increase opportunities for biodiversity, and regenerate the land.

4. WASTEWATER TREATMENT AND RE-USE

Wastewater from the Bomen precinct is currently treated by the Bomen Industrial Sewage Treatment Facility (BISTF) which is operating within capacity but will require upgrading to cater for the additional SAP demand. *This is detailed further in separate technical reports.*

The BISTF is also a pre-treatment facility only with feasibility studies by the Council identifying that the facility can be readily upgraded to become a complete wastewater treatment facility which can then treat industrial trade wastewater and provide recycled water for non-potable purposes through a dual reticulation network.

This should form a key component of the integrated water cycle, as this reduces reliance on local water systems, will provide lower cost water to businesses and also provides an opportunity to harvest bio-energy from the trade waste *(see Section 4)*.

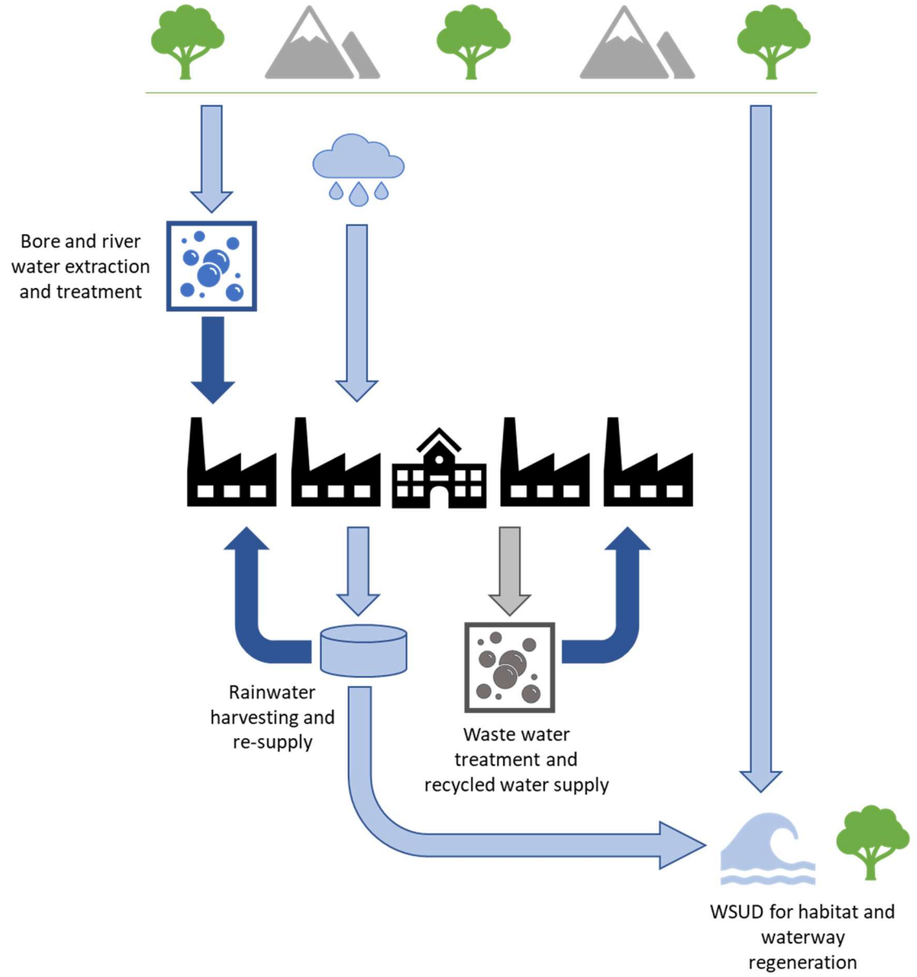


Figure 15: Wagga Wagga SAP – Integrated Water Cycle

Outcome: *Integrated climate change resilience and adaptation.*

The *National Climate Resilience and Adaptation Strategy*, *NSW Climate Change Policy Framework* and *Wagga Wagga Climate Change Risk & Adaptation Action Plan* provide a comprehensive set of strategies, frameworks and plans which are locally relevant and provide a clear summary of climate risks and opportunities which will impact on the Wagga Wagga SAP.

The following climate impacts, risks and opportunities have been identified that relate to the SAP and the larger Riverina region which in turn supports the SAP:

- **Temperature:** Increased hot weather will impact animal welfare in the Livestock Marketing Centre while animals are in and being transported to the centre. Increased hot weather will also impact farming industry with a potential downturn in agricultural production.
    - The number of days over 35°C is predicted to increase by 9 days by 2030, and 25 days by 2070;
    - Maximum temperature to increase by 2.03°C by 2030, and 3.7°C by 2070; and
    - A resultant increase in the heat island effect (the radiant heat resulting from the solar heating of roadways and other hard surfaces).
- **Rainfall:** Changes in rainfall patterns may impact growing season length and viability of certain crop types, while improving conditions for other crop types.
    - Summer rainfall will increase, and winter rainfall will decrease, with an overall reduction.; and
    - Storms and extreme/intense rainfall events will increase.
- **Flood:** Increase rainfall intensity will increase the likelihood of flooding as per the 1:200 year flood identified in the *Flooding and Water Quality Technical Report*.
- **Evaporation:** Increased evaporation which will exacerbated by seasons with lower rainfall and drought conditions.
- **Bushfire**: Increased bushfire risk with more severe fire weather and longer bushfire seasons.

Additional impacts as a result of the above include:

- increased heat load on buildings and mechanical systems;
- increased load on utility infrastructure including power and gas – for the electricity grid this could result in a network failure (brown outs or black outs);
- increased irrigation requirements for public open space;
- reduced yields from rainwater and stormwater harvesting; and
- the potential loss of threatened flora.

As a result, the SAP master plan needs to include design and planning responses that ensure the SAP is resilient to these climate change impacts.

The Climate change adaptation strategies to be adopted by the Wagga Wagga SAP include:

- Maintaining an Environmental Management System (EMS) that includes climate change adaptation and resilience, building design and performance requirements, monitoring and reporting requirements, and key performance indicators for both the SAP and the businesses/industries within it *(See Section 2)*;
- Mandating minimum energy efficiency, thermal performance and stormwater management requirements for buildings and infrastructure to ensure resilience to extreme events;
- The provision of extensive areas of blue and green space to attenuate peak stormwater events and suppress the heat island effect (the Wagga Wagga SAP building to land ratio is planned for 30%, compared to a denser 50% associated with standard industrial parks);
- The provision of an inset energy network which facilitates large scale on site renewable and alternative energy generation, with facilities for energy storage, providing a back-up supply to the grid network, and network security to minimise the risk of network failure; and
- The provision of a closed cycle water network with alternative water supply sources to mitigate drought related water supply risks.

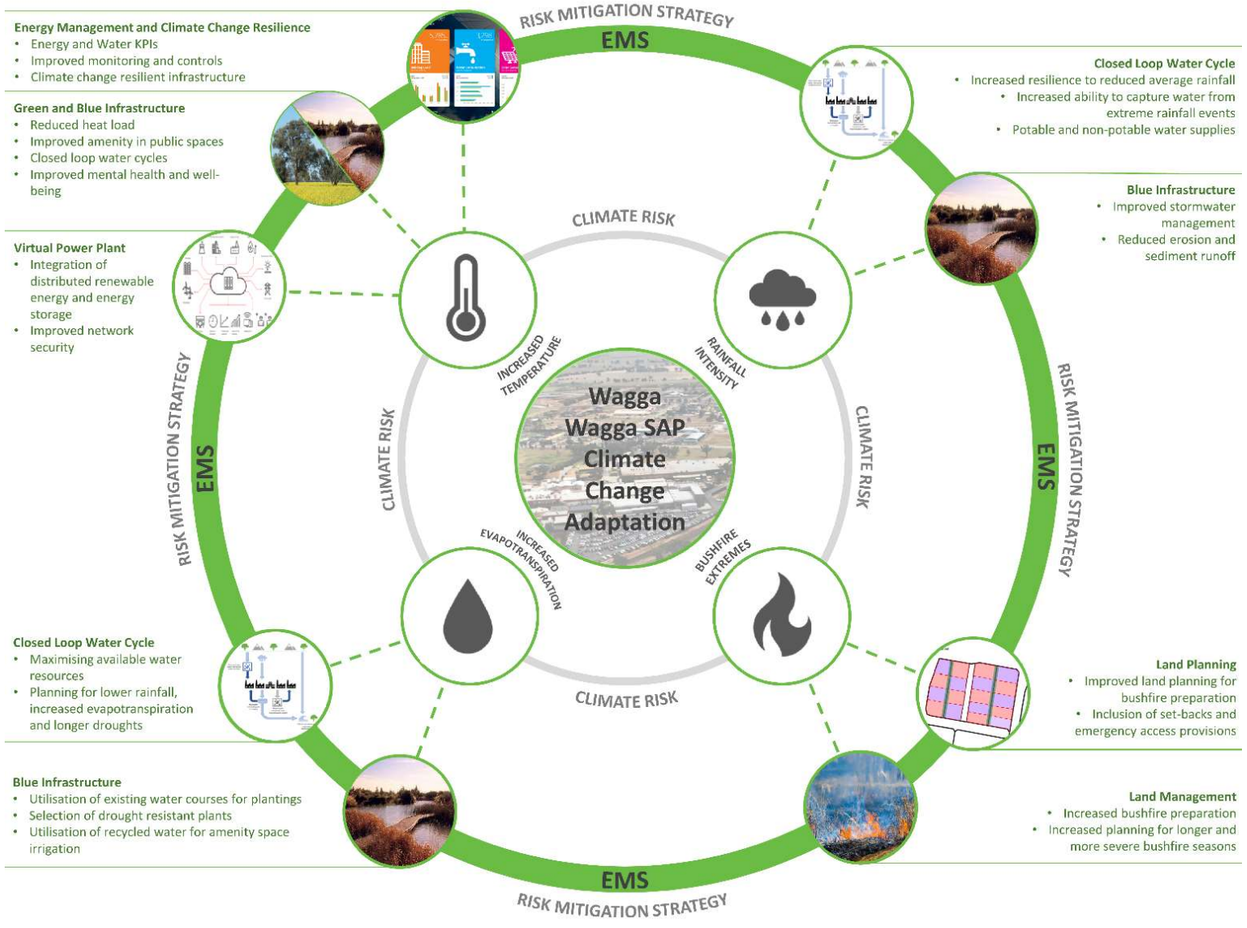


Figure 16: Wagga Wagga SAP – Climate Change Risk Mitigation

Outcome: *Industries maximise efficiencies, reduce emissions, and collaborate to deliver a Carbon Neutral precinct.*

In line with the NSW Government commitment to carbon neutrality by 2050, the SAP emissions will need to be decoupled from productivity, and support a transition to low carbon, high performing economy.

Achieving a net-zero emissions target by 2050 will only be possible with:

- Energy efficiency and productivity improvements;
- A significant increase and integration of renewable energy into NSW's electricity supply, supported by energy storage (battery storage, pumped hydro, thermal storage, etc.);
- Alternative renewable fuels (hydrogen);
- The transition to low emission transport (electric vehicles and hydrogen cell vehicles); and
- Improving industrial, manufacturing, and agricultural practices aligned with a circular economy model.

Using the Circular Economy Calculator, the greenhouse gas emissions footprint for the existing SAP area (which includes the Bomen Business Park) is as follows:

Wagga Wagga SAP CE Carbon Calculator

Scenario Name: Compact, baseline
Area: 400

Reset to 0

Change the mix of industries in Wagga Wagga North		Sector Shift	$M pa.	Wagga Wagga kt CO2e
Show sectors	2017/18 $M			
Agriculture, Forestry, Fishing	52	0%	46	32
Mining	5	-53%	2	4
Manufacturing	454	35%	541	236
Electricity, Gas, Water & Waste Services	12	37%	14	84
Construction	56	0%	50	19
Wholesale Trade	117	0%	103	24
Retail Trade	68	0%	60	16
Accommodation & Food Services	55	0%	48	23
Transport, Postal & Warehousing	121	0%	107	52
Information Media & Telecommunications	38	0%	33	5
Financial & Insurance Services	84	0%	74	2
Rental, Hiring & Real Estate Services	57	0%	50	4
Professional, Scientific & Technical Services	29	46%	38	8
Administrative & Support Services	19	0%	17	3
Public Administration & Safety	14	0%	13	3
Education & Training	12	0%	11	1
Health care & Social Assistance	55	0%	49	8
Arts & Recreation Services	8	0%	7	1
Other Services	68	0%	60	14
Hide sectors				
Total	**1323**		**1,323**	**538**

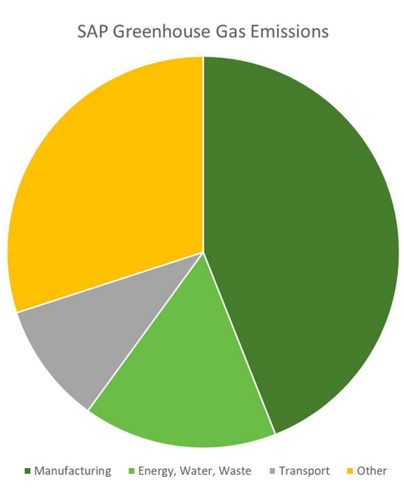


Figure 17: SAP Emissions Calculator and Greenhouse Gas Emissions

The top three most significant greenhouse gas emissions sectors are:

1. Manufacturing: 44%
2. Energy, water, and waste: 16%
3. Transport: 10%

*The remaining 30% comprise either sectors which are aligned or influenced by the industries, or sectors which individually comprise less than 2% of the total footprint.

The strategies for reducing these greenhouse gas emissions sectors and targeting a carbon neutral outcome for the precinct are as follows:

1. MANUFACTURING

The scenario testing and modelling undertaken during the master plan stage has demonstrated that regardless of the development size, the key to reducing manufacturing emissions in the SAP is to integrate Circular Economy as an integral component to the development.

This will have the greatest effect on both reducing emissions and making the SAP economically competitive by maximising resource efficiencies and reducing emissions, while also reducing operating costs. Strategies for delivering a Circular Economy in the Wagga Wagga SAP are further described in Section 3.

A SAP which has a fully integrated deep Circular Economy operating successfully, and a large scale renewable energy network with energy storage fully deployed, can have a net carbon neutral footprint, as the broader net carbon benefit has been demonstrated to be larger than the actual operating carbon footprint of the SAP.

In addition, the EMS should incorporate greenhouse gas emission (GHG) reduction targets for industry in the SAP as well as chemical and pesticide management strategies to reduce environmental impacts.

2. ENERGY

The following strategies will support a carbon neutral outcome for the SAP:

- Include minimum standards and key performance indicators for new facilities in the precinct EMS *(see Section 2)*;
- Integrate renewable energy systems into new and existing buildings, including large scale solar PV energy generation with energy storage within the precinct itself *(see Section 4 and the separate Renewable Energy technical report)*;
- Develop a virtual energy network connecting major businesses within the SAP to maximise renewable energy integration opportunities *(see Section 4 and the separate Renewable Energy technical report)*; and
- Provide opportunities to de-carbonise the natural gas network in order to support a transition away from the use of fossil fuels for energy, by facilitating the generation and use of hydrogen and other alternative energy sources *(see Section 4 and the separate Renewable Energy technical)*.

3. WATER & WASTE

The following strategies will facilitate a reduction in emissions associated with water and waste:

- An integrated water cycle based on water sensitive urban design (WSUD) principles, providing opportunities for large scale rainwater and stormwater capture and re-use, which has a lower carbon footprint than potable or recycled water sources *(see Section 5)*; and
- The capture, treatment, and re-supply of wastewater as recycled water, co-located with bio-energy plant delivering low carbon energy and lowering the emissions footprint of the overall water cycle *(see Sections 4 and 5)*.

4. TRANSPORT

With existing strategies and programs in place to improve both road and rail access to the SAP including the RiFL Hub, and the expected emission reductions that will be achieved over time as vehicle emission standards improve, a focus should be placed on improving sustainable transport options for back haulage operations between businesses, employee commuting, and supporting industries to assist in the transition to sustainable transport solutions.

The following have been identified as strategies for the SAP to increase sustainable transport options and reduce emissions:

- Implement public transport to support sustainable transport options;
- Provide cycleways from the Wagga Wagga town centre to the existing Bomen precinct, with options to extend and facilitate tourist attractions to visit the solar farms;
- Support the transition to zero emission vehicles (electric vehicles and hydrogen cell vehicles) by providing EV charging infrastructure and priority parking for low emission vehicles; and
- Support existing and new industry to expand into EV manufacturing and low or zero carbon transport industries and supporting/related industries.

These are further described in Section 8.

5. NATIONAL CARBON OFFSET STANDARD (NCOS)

The National Carbon Offset Standard (NCOS) for Precincts provides a framework for the SAP to achieve carbon neutrality.

As defined by NCOS, carbon neutrality means "reducing emissions where possible and compensating for the remainder by investing in carbon offset projects to achieve zero emissions."

The scope of the emissions boundary for the SAP will be based on the high-level summary of the emission sources that will need to be captured, shown opposite (as taken from the NCOS for Precincts guidelines).

The emissions boundary will include both the precinct greenhouse gas emissions and the emissions related to industries and businesses operating within the SAP.

It is therefore essential that the Regional Growth NSW Development Corporation (RGDC) has processes and frameworks in place, as part of the SAP Environmental Management System (EMS), to support and assist all emitters within the SAP to account for, manage, reduce, and offset their emissions.

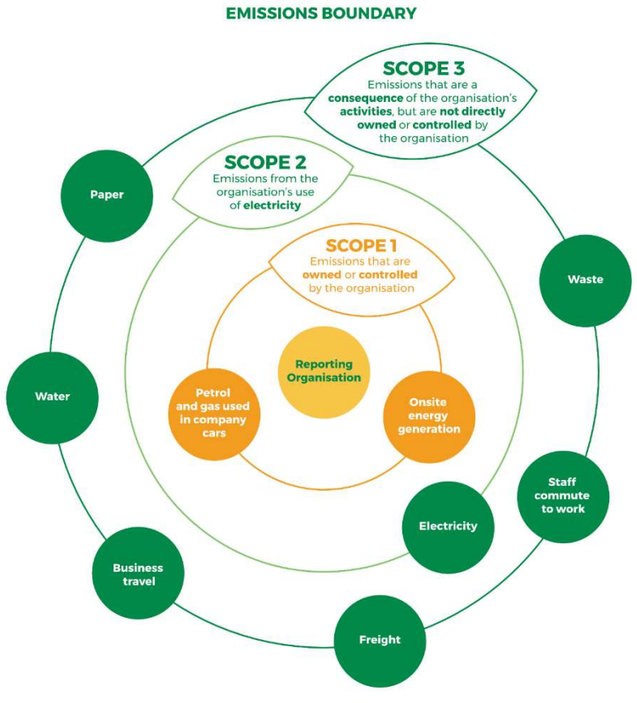


Figure 18: NCOS Precinct Emissions Boundary

In order to manage and reduce carbon emissions, it is important to understand the source of these emissions. The following diagram shows the pathway to understanding carbon emissions:

1. *Start by understanding the emissions profile, including energy, water, waste, transport, and refrigerants.*
2. *Agree on objectives and timeframes for carbon reduction.*
3. *Identify where emissions can be avoided. This is often the most cost-effective way of reducing emissions.*
4. *Implement reduction and efficiency programs for energy, water and waste.*
5. *Consider alternative energy sources, such as solar, and alternatives to transport emissions, such as electric vehicles.*
6. *Consider purchase of carbon offsets to offset any remaining emissions.*

Figure 19: Carbon management pathway

The application of NCOS and the targeting of a certified carbon neutral outcome may be considered a new challenge by industries seeking to move into the SAP and at the time of writing this ESD Plan there are no carbon neutral certified precincts as yet operating in Australia.

It is therefore critical that sufficient time and resources are committed by the RGDC in establishing a carbon neutral governance and reporting framework, including an integrated digital network platform, to support the process of carbon accounting and management *(See Section 10)*.

The integration of NCOS within the precinct Environmental Management System (EMS) and the SAP ESD Framework is included in Section 2. Carbon neutrality can be achieved through multiple pathways and will require a carbon neutral strategy and plan to be developed which follows the above pathway.

The full guidelines for NCOS for Precincts is available for download here.

Outcome: *Establish a low carbon, active and future ready mobility and distribution network, with a zero-emission vehicle support hub to embed advanced vehicle manufacturing in the SAP.*

Sustainable transport in Australia is ready for unprecedented growth as low carbon and zero emission vehicles enter the market and as individuals, businesses and government transition to new models such as Mobility-as-a-Service (MaaS), and high performing, low emission transport systems.

This transition will create new markets for advanced manufacturing, remanufacturing and resource recovery such as recycling and refurbishing lithium-ion batteries, recycling and producing specialist lubricants and oils required for both EV's and hydrogen fuel cell vehicles, manufacturing spare parts for these vehicles as they age and aligning businesses with other low carbon advanced remanufacturing opportunities. For example, both battery storage and hydrogen cell technologies are not unique to vehicles, but also have synergies to the wider SAP strategy which includes hydrogen production, alternative fuels and energy supplies and supporting existing low carbon industries.

Four key strategies to help deliver a low carbon, future ready transport system have been developed to assist businesses in the SAP thrive as the market transition:

1. ZERO EMISSION TRANSPORT HUB

Extending the "Building on the Bomen Nucleus" concept outlined in Section 3, existing industries within and around Bomen are uniquely placed to be supported in exploring and taking advantage of future low carbon transport opportunities. This includes creating a *Zero Emission Transport Hub* by maximising existing opportunities such as:

- Investigating future battery recycling opportunities at Enirgi to expand into processing lead onsite (currently shipped overseas) and lithium-ion battery recycling;
- Investigating the development and recovery of specialist oils and lubricants for EV's and hydrogen cell vehicles at Southern Oils;
- Utilising planned hydrogen production facilities for both industrial processes and for hydrogen as a fuel source;
- Supporting distribution companies to transition to alternative low carbon options such as EV distribution trucks for back haulage networks; and
- Embedding EV charging and hydrogen refuelling in planning standards e.g. all major developments should consider how to integrate low carbon support infrastructure in the design and implementation of publicly accessible infrastructure.

2. CREATE A RESEARCH AND DEVELOPMENT EDUCATION HUB

To further capitalise on this transition, and embed the SAP as a leader in low carbon industries, a research and development hub could be integrated into the education precinct and work with the CE concierge to support industry in researching and developing low and zero emission vehicle manufacturing and remanufacturing processes.

An initial focus could be placed on opportunities such as expanding Enirgi's battery recycling processes and working with local manufacturers to expand into supplying parts and services for low carbon vehicles, for example electric vehicles, or converting fossil fuel vehicles to low carbon or electric vehicles.

3. EMBED A DEEP CIRCULAR ECONOMY MODEL IN THE ZERO EMISSION TRANSPORT HUB

Following low carbon transport opportunities being maximised, a Deep CE model should be utilised to extend the Zero Emission Transport Hub to take advantage of synergies with other low carbon industries. This includes expanding existing businesses into new markets and attracting new businesses that will benefit from a CE model such as:

- Expanding EV battery recycling and servicing to incorporate home and commercial battery storage recycling for multiple battery technologies (lithium-ion, advanced lead acid, flow, etc.). With battery storage grants, incentives and programs being rolled out across Australia and existing systems already installed, in the near future (5-15 years), battery storage technologies will be reaching their end of life and expanding recycling capacity may provide future revenue streams for businesses in the SAP.
- Expanding low carbon recycling networks to capture additional end of life renewable energy components and materials such as solar PV panels, solar framing/racking and as a long term potential, wind farm turbines which are being deployed across Australia with no recycling facilities currently in operation.

Figure 20: Low Emission Vehicle Hub – Advanced Manufacturing Opportunities

4. ACTIVE AND SUSTAINABLE TRANSPORT

With minimal existing opportunities for employees and to access the Bomen Business Park, it is recommended that the following sustainable transport options are integrated into the SAP:

- Public transport routes or dedicated shuttle services for employee commutes. This could be further facilitated through low carbon options such as electric buses or transit vans which could be supported by the Zero Emission Transport Hub;
- Providing high quality, safe and accessible pedestrian pathways and bicycle lanes to, from and around the SAP to support active forms of transport (Refer *Infrastructure and Transport Technical Reports*);
- Incorporating bicycle storage and end of trip facilities into key locations such as education facilities and at the centre of development areas to support active forms of travel; and
- Investigate Mobility-as-a-Service (MaaS) models for transport to and from the SAP, focussing on low carbon or zero emission vehicles, supplied by SAP renewables and VPP.

Active transport strategies are to be aligned with the Wagga Wagga Integrated Transport Strategy and Implementation Plan and NSW Future Transport Strategy 2056.

Outcome: *Integrate blue and green infrastructure to improve ecological function, and provide amenity through biophilia.*

Green Infrastructure supports biodiversity, the protection of natural habitats, reduces the heat island effect associated with industrial parks, and improves the health and wellbeing of people via an innate and genetically determined affinity of human beings with the natural world (known as biophilia).

Biodiversity and environment studies, along with climate change projections and action plans, prepared during the master plan stage by technical consultants, have identified that high-quality vegetation is typically isolated and spread across the precinct. A number of threatened species of native vegetation are present, with sections of native vegetation (Yellow Box Woodland and Paddock Trees) identified along roadways and scattered around the site.

Waterways and water amenity are limited to winter creeks and artificial systems such as settling ponds and dams. Stormwater flow mapping and flood planning has been undertaken to create a precinct design to minimise impact on industry while supporting and aligning with the provision of green infrastructure.

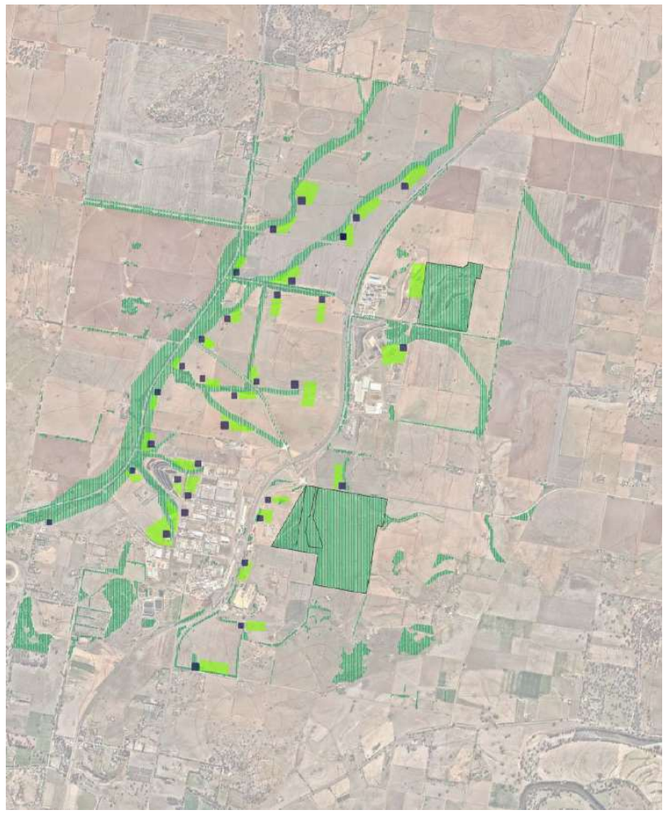


Figure 21: Location mapping of existing green and blue infrastructure

Green and blue infrastructure is to be integrated into the precinct master plan using the following key principles:

- The Aboriginal Planning Principles are embedded in planning frameworks with the traditional custodians of Country engaged with to provide design input and advice based on their history and connection to the land.
- Existing flora is retained and improved from moderate to good condition;
- Green corridors are developed to connect existing green infrastructure and provide protected areas for fauna;
- Green infrastructure is aligned with ESD initiatives such as a sustainable transport routes (e.g. cycleways) to improve amenity;
- Stormwater retention and treatment is maximised within the boundary, balanced against ecological systems, to provide blue infrastructure opportunities (e.g. stormwater harvesting wetlands and bioretention swales) that also provide public amenity *(also see Section 4)*; and
- Carbon farming (offset re-vegetation) is undertaken in areas that are unlikely to be developed due to a lack of available services (energy and water) or to align with community expectations (in particular to the East of the Eunony Valley Ridge).

The design of the green and blue infrastructure will follow the principle espoused by the traditional custodians of the land on which the Wagga Wagga SAP will be located, the Wiradjuri people, which is *"Let Country be what it wants to be"*.

This is interpreted to mean that the new interventions (roads, easements, and buildings) will be planned around the natural features of the area, with the order of importance given being to rivers first (including creeks and floodways), then to mountains (including hills and ridges), swamp, forest (including trees and other vegetation), and lastly to plains.

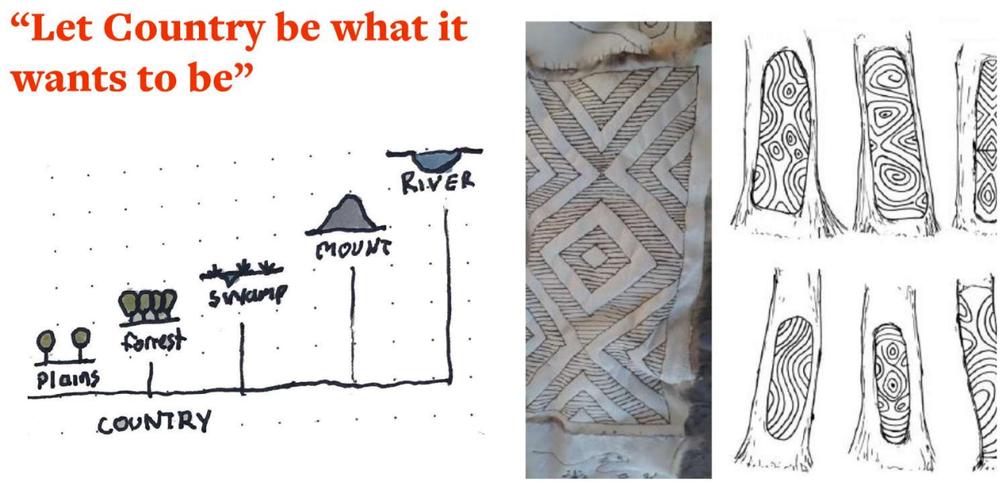


Figure 22: Wiradjuri people land stewardship principles

***Outcome:** Digital Infrastructure integrated across the precinct to support advanced communications, automated distribution, virtual networks, and resource sharing and coordination.*

Core to a circular economy model and enabling closed loop automated systems within the precinct boundary will be the provision of advanced digital infrastructure services which supports high speed, large bandwidth communication systems. By providing advanced digital infrastructure, the precinct will be able to maximise efficiencies which will in turn improve ESD outcomes and reduce environmental impact. This includes providing innovative technology opportunities such as Internet-of-Things (IoT) and automation of systems and services.

At present industry within the Bomen precinct have highlighted that digital infrastructure, in particular internet bandwidth and reliability, is a major barrier to expanding operations and enabling remote operations with impacts on labour productivity. This has led to some organisations maintaining operations in the Wagga Wagga city centre due to unreliable connections in Bomen which is an inefficient use of resources and will increase operating costs.

Improving digital infrastructure is expected to enable the following ESD opportunities to be maximised:

1. CARBON NEUTRAL CERTIFICATION *(See also Section 2)*

The effective management of the SAP Environmental Management System, including the carbon accounting and reporting required for carbon neutral certification using NCOS, is reliant on the capture, handling and movement of large volumes of data from multiple sources. An integrated digital infrastructure network with a dashboard gaining access to this data is an essential provision.

The digital infrastructure should be implemented in line with the Code for Smart Communities with the following 5 key principles:

- **Principle 1 – Strategic**

  The smart community should be guided by a strategy that identifies how investments in technology and data solutions will be made to accelerate liveability, productivity and sustainability outcomes.

- **Principle 2 – Connected**

  The smart community will have access to best-in-class and ubiquitous connectivity while ensuring interoperability of connected devices.

- **Principle 3 – Aware**

  The collection, integration, analytics and communication of data is used as a basis for awareness and optimisation of services and performance within the smart community.

- **Principle 4 – Responsive**

  A culture of ongoing positive change is afforded through the insights and intelligence gathered from data.

- **Principle 5 – Innovative**

  Creativity, equity and agility help to advance the opportunities for innovation within the smart community.

The digital infrastructure itself is further detailed with a separate technical report.

2. VIRTUAL POWER PLANT *(See also Section 3)*

A Virtual Power Plant will allow businesses to optimise energy usage, schedule peak demand events, share renewable energy resources and potentially participate in alternative markets such as FCAS and ARENA and AEMO's Demand Response Trials. This will also provide additional benefits for the electricity grid which may become less stable in the next 10 years as additional intermittent generation comes online and synchronous generation assets reach end of life. A Virtual Power Plant relies on a high speed, high bandwidth data network to monitor and manage each element of the connected energy infrastructure.

3. ENERGY PRODUCTIVITY

A key component of improving efficiency and energy productivity is the implementation of advanced monitoring, communications and automation systems which is heavily reliant on digital infrastructure. This includes energy and resource monitoring (as per the precinct EMS), automation of processes, controls and demand management (e.g. IoT opportunities), and identifying resource flows in line with the CE model.

4. CIRCULAR ECONOMY *(See also Section 4)*

Automated distribution (back haulage) is a system which automatically coordinates freight between industries, creating efficiencies and reducing duplication. Businesses can identify when resources become available and when existing freight services and destinations have been booked by businesses in the area to maximise the use of freight capacity/space. This could be integrated with existing businesses such as Rodney's Transport, supported by a digital platform for logistics.

Automated waste management is a system which analyses waste levels using advanced sensors and communication devices, to ensure waste pick-up services are optimised and bins are only serviced when required. This improves efficiencies for transport and reduces operating costs for businesses.

The planned maintenance of plant and equipment can be automated/aligned between businesses to reduce call out fees and maximise resources e.g. when a hydraulic mechanic is engaged, other businesses with hydraulic system needs are notified and can engage the mechanic at reduced rates (shared across businesses).

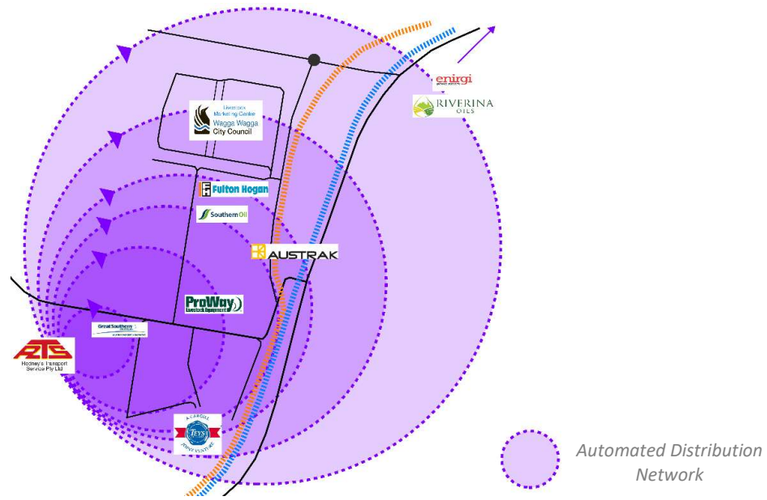


Figure 23: Circular Economy facilitated by an automated distribution network – opportunities mapping

***Outcome:** Precinct Calculators for Energy, Water, and Circular Economy that can be used for scenario testing by the Regional Growth NSW Development Corporation (RGDC).*

Energy, water and circular economy calculators have been developed to provide tools for the RGDC to determine the energy demand and consumption, water consumption (potable and non-potable), and circular economy carbon impact of alternative land use and businesses/industry scenarios.

The calculator metrics have been developed based on detailed modelling, confirmed energy and water usage from industry and research. The metrics were also cross referenced against the infrastructure technical team to ensure consistency. It should be noted that the infrastructure team have designed for peak network requirements to ensure sufficient capacity within infrastructure systems, whereas the energy and water calculators are intended to guide expected use by facility type or as sub-precincts are created.

The calculators are excel-based with embedded drop-down menus and default performance metrics that allow non-technical personnel to input land areas, building types, and business types, and generate results instantly. This is intended to provide flexible scenario testing to be undertaken from an individual land/building, through to a fully developed SAP.

There are two separate calculator tools:

1. Energy and water; and
2. Circular Economy.

A calculator user guide has been published separately. The following provides a brief overview of how the calculators work.

1. ENERGY AND WATER CALCULATOR

The energy and water calculator allows users to select various building and industry types and generate the expected energy and water consumption (potable and non-potable), electricity demand and impact of solar PV based on detailed metrics. The metrics have been developed based on previous projects and aligned with the infrastructure figures for consistency.

Name	Scenario 4 - Regional Enterprise		
Building Reference	**Building Type/Description**	**Gross Floor Area (Ha)**	**Land Utilisation Factor**
1	Warehouse & Distribution: Non-Refrigerated	108	25%
2	Warehouse & Distribution: Non-Refrigerated	108	25%
3	Warehouse & Distribution: Refrigerated	108	25%
4	Rail Freight/Intermodal Transfer	108	25%
5	Education: TAFE/University Education & Training	357	25%
6	Education: TAFE/University Laboratory	357	25%
7	Commerical: Office/Admin	43	25%
8	Commerical: Emergency Services	43	25%
9	Commercial: Retail/Shoping/Restaurant/Café	43	25%
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
	Total	**1,276**	**25%**

Figure 24: Energy and Water Calculator

Where solar PV is installed, the calculator determines how much electricity is consumed from the grid, with the balance being made up by solar PV generation. If a negative value is determined for grid consumption, this indicates that the solar PV array is likely to have a net export.

The calculator collates all results on a summary page for ease of reference.

2. CIRCULAR ECONOMY CALCULATOR

The Circular Economy Calculator is based on an environmentally extended input-output (EEIO) model which uses economic relationships between sectors of the economy combined with environmental data collected at the sector level. The underlying sector data is based on the national accounts produced by the ABS (Australian Bureau of Statistics 2017) while the greenhouse gas emission data are sourced from different reporting documents including the National Inventory Report (Commonwealth of Australia 2017).

The calculator output comprises a greenhouse gas emissions footprint for the proposed scenario being tested, compared to a reference case. The reference case is based on a linear (non-circular) economy with rooftop solar PV deployed as business as usual.

For the benchmark calculation it was not possible with available data to scale down to the SAP or Bomen Business Park specifically. The closest data set for economic activity is from the Local Government Area (LGA) of Wagga Wagga, shown inside the central black line from .id consulting (2019) and from the industrial ecology lab (Bontinck 2019) for the five SA2 areas covering North Wagga Wagga which includes the Bomen Business Park.

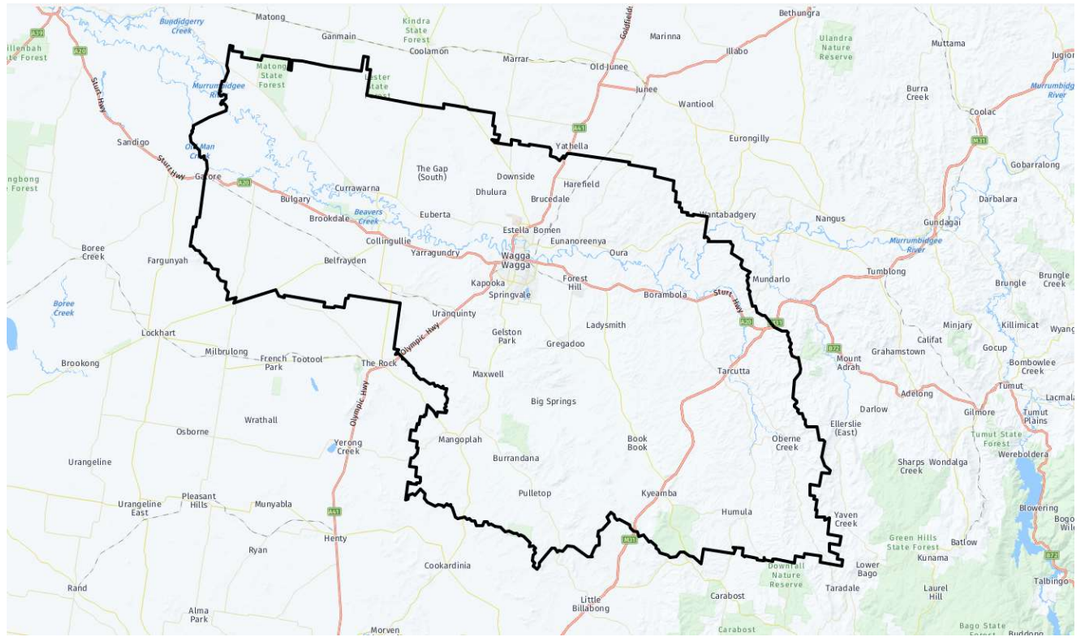


Figure 25: Circular Economy Calculator benchmark data area