dsquared

Department of Planning, Industry and Environment

Snowy Mountains Special Activation Precinct

Ecologically Sustainable Development (ESD)

Technical Report

FINAL

D Squared Consulting Pty Ltd
Trading as dsquared
ACN 159 612 067
ABN 38 159 612 067

Suite 5, 241 Pirie Street
Adelaide SA 5000
T: 0425 870 289
E: deborah@dsquaredconsulting.com.au
W: www.dsquaredconsulting.com.au

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Contents

The following key ESD themes and strategies have been identified to provide immediate outcomes and to establish the Snowy Mountains SAP as an international leader in sustainable development for tourism-based communities.

CLIMATE RESILIENCE

An adaptable community resilient to climate change

_Transition resorts to year-round tourism
_Implement improved urban design, infrastructure and building standards to increase resilience

SOCIETY

Mind, body and soul rejuvenated

_Design buildings and community spaces for wellbeing
_Create social infrastructure focussed on equity
_Recognise and celebrate history and heritage

ENERGY

Powered by renewables

_Develop a PPA with Snowy Hydro
_Build new renewable energy systems
_ Build new energy storage systems

MOBILITY

Experience the future of efficient mobility

_Provide flexible rapid transit systems
_Develop Jindabyne as a 20-minute town by foot or bike
_Maximise Mobility as a Service (MaaS) provisions

EMISSIONS

A carbon negative framework

_Develop an emissions boundary and inventory
_Implement emission reduction initiatives
_Develop a carbon neutral certification plan

CIRCULAR ECONOMY

Collaborating to share resources and knowledge

_Build waste management and recycling infrastructure
_Develop circular economy education and skills programs
_Develop local partnerships

ENVIRONMENT

Touch the ground lightly

_Identify and prioritise previously developed sites
_Green infrastructure is embedded in urban design
_Offset 100% of development footprint

WATER

Celebrating Snowy's Founding Natural Resource

_Incorporate water sensitive urban design
_Build water capture and reuse infrastructure
_Upgrade wastewater treatment systems to closed loop

Key ESD Moves

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

Topic	Key ESD Moves
Climate Resilience	• Transition resorts most vulnerable to climate change to alternatives to snow-based tourism, by developing year-round growth scenarios for the resorts. • Implement urban design, infrastructure and building standards to increase climate resilience.
Emissions	• A framework for reducing emissions is developed with options for energy efficiency, renewable energy and circular economy opportunities incorporated to meet the carbon negative target. • Emissions calculators are used to test development scenario's to plan zero emissions pathways to development.
Energy	• Develop a renewable Power Purchase Agreement (PPA) with Snowy Hydro to supply 100% renewable energy to the Snowy Mountains SAP. • Support solar PV and battery storage systems on a smaller scale to support individual developments where viable. • Integrate energy efficiency and productivity into development design guidelines, with both embodied energy and lifecycle emissions considered.
Environment	• Touch the ground lightly is the overarching development strategy for new buildings and infrastructure. • Green Infrastructure to be embedded in urban design. • Develop existing buildings and previously developed sites, including the old Snowy village and previously developed areas around Jindabyne. • Consider the environmental impacts of all proposed new infrastructure and building development, and develop sustainable design principles and benchmarks for the region.
Society	• Prioritise community and visitor health and wellbeing through inclusion of wellbeing principles in all development. • Develop opportunities for 'wellness' tourism and eco-tourism. • Create opportunities for social infrastructure. • Celebrate heritage, inclusion and diversity.

Topic	Key ESD Moves
Mobility	• A fully integrated transport model is developed which provides a seamless transport service across the Snowy Mountains SAP. • Develop zero emission transport and infrastructure, prioritising public transport options within the Snowy Mountains SAP. • Prioritise walking and cycling infrastructure to create a 20-minute connected Jindabyne town.
Circular Economy	• Support waste management and recycling infrastructure. • Develop circular economy relationships between Snowy Mountains SAP businesses.
Water	• An integrated water cycle is establised based on water sensitive urban design (WSUD) principles, including better management of stormwater quality and quantity. • New water infrastructure and urban planning to incorporate water sensitive urban design. • Wastewater treatment systems in the alpine areas to be upgraded to closed loop systems with no pollution to alpine streams.. • Build water capture and reuse infrastructure for all new developments.
Leadership	• Develop a precinct scale Environmental Management System (EMS), drawing on the sustainability principles of One Planet Living, and is integrated with the Snowy Mountains SAP Carrying Capacity Framework, Kosciuszko National Park (KNP) Plan of Management (PoM)and resort EMS's. • Achieve a 6 Star Green Star Communities Rating to demonstrate leadership in the development of sustainable communities.

The following diagram summarises the ESD Plan for the Snowy Mountains SAP:

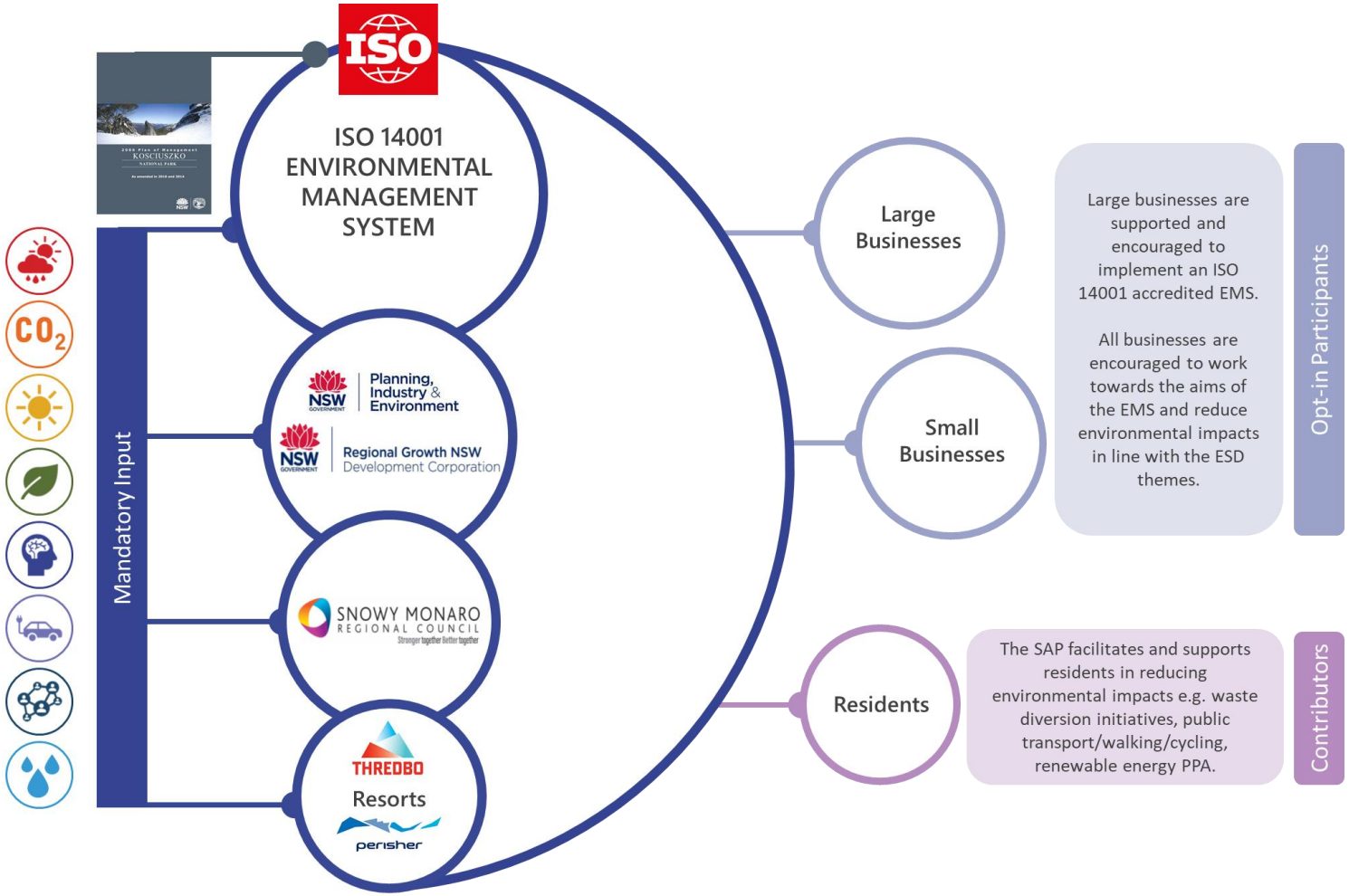
A detailed analysis of ESD frameworks and rating tools has been undertaken to identify opportunities for the Snowy Mountains SAP to achieve an internationally recognised accreditation that can be used to celebrate the strong ESD focus, while also attracting investment and driving growth. As a result of this assessment, the following precinct frameworks and rating tools are recommended for the Snowy Mountains SAP:

A precinct 6 Star Green Star Communities rating which demonstrates world leadership.

The One Planet Living framework is embedded in the accredited ISO 14001 Environmental Management System (EMS). This is in line with the Parkes and Wagga Wagga SAP which have embedded the UNIDO Eco-Industrial Framework, but has the potential for gaining a One Planet Living designation once in operation.

The EMS will also be aligned with and support the Kosciuszko National Park Plan of Management, Snowy Mountains SAP Carrying Capacity Framework and resort Environmental Management Systems.

The following image illustrates how the various aspects of the Snowy community will be required to engage with the EMS framework. This ranges from mandatory organisations, including Government, Council and the larger resorts, to differing scales for businesses, residents and tourists. The aim is to apply this framework in a sensible and robust manner, without placing undue reporting requirements on the smaller businesses and residents, who can benefit from and contribute to the framework, but are less able to influence the larger scale environmental outcomes.



A key driver of the Snowy Mountains SAP is to increase economic growth to the Snowy region through increased visitation, creating 'Australia's Alpine Capital': a destination of choice for sporting and adventure activities, and a year-round destination.

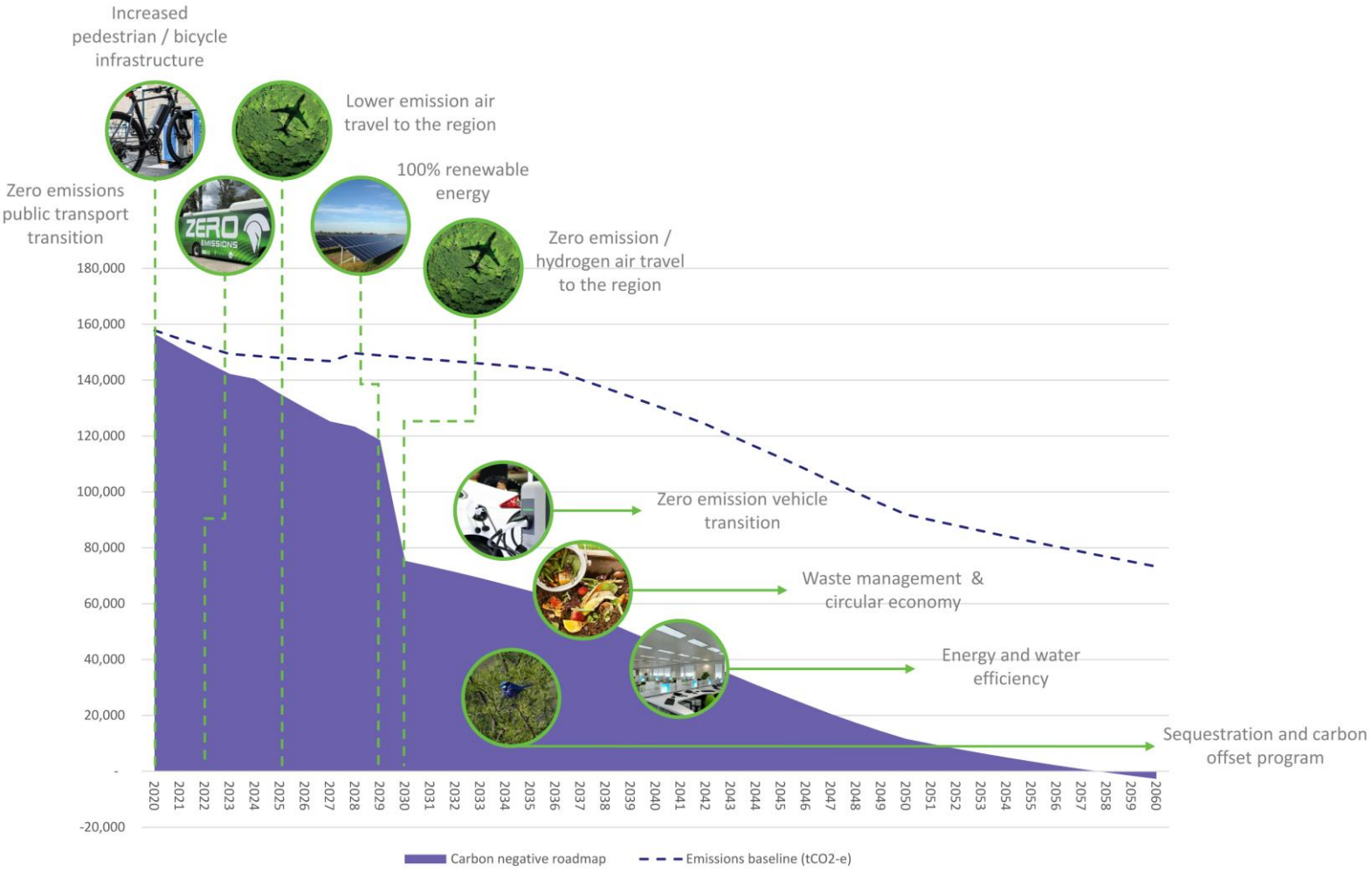
To support this, a number of ESD destination opportunities have been identified for consideration to support growth in ecotourism and therefore visitation to the region as shown in the adjacent diagram.

The majority of these ESD destination ideas have been integrated into the Snowy Mountains SAP Structure Plan, which includes:

- Increased physical connection, open space, views and enhancement of the natural environment in the Jindabyne area. A 20-minute town with walking and cycling infrastructure prioritised.
- Focus on year-round outdoor activities, sports and wellbeing.
- Tourism opportunities in eco and wellbeing opportunities, including increased camping, multi-day walking routes and mountain biking activities.
- Transitioning to public transport and zero emissions options over time.

Carbon Negative Pathway

A central part of the Snowy Mountains SAP vision is to provide a carbon negative community, which offsets more carbon emissions than is used in its operation. The following diagram shows the proposed pathway to carbon negative operations with emission reduction initiatives and a carbon sequestration and offset program bringing the emissions to below zero prior to 2060. This will require ongoing investments into low and zero emission infrastructure and services, supporting resources and integration into the Snowy Mountains SAP's EMS for ongoing monitoring and tracking.



The following table summarises the ESD aims, performance criteria and provisions to be considered in the development of the Snowy Mountains SAP Masterplan, Activation Precinct SEPP and Delivery Plan:

ESD Themes	Recommended Aims and Performance Criteria – Masterplan	Recommended Objectives and Controls – AP SEPP	Recommended Provisions – Delivery Plan and operational considerations
Climate resilience	The precinct is adaptable and resilient to climate change impacts. Current climate change projections are used to inform the development growth scenario's and ensure sustainable development can occur to align with the UN Sustainable Development Goals. Prioritise developments that focus on alternatives to snow-based tourism.	Ensure the development land uses are permitted under the SEPP.	• Provide development controls that encourage alternatives to snow-based tourism. • Implement urban design, infrastructure and building design guidelines to increase climate resilience. • Consider infrastructure upgrades and funding opportunities to ensure the provision of climate resilient infrastructure. • Ensure economic resilience and the role of business continuity planning with regards to considering climate resilience.
Emissions	The precinct's greenhouse gas (GHG) emissions are monitored and reduced in line with the Climate Active Precinct Standard. This includes precinct wide emission reduction programs focussed on a carbon negative outcome, which will create investment opportunities for low carbon industries.	None identified	• An emissions reduction strategy is developed and initiatives are integrated into the Delivery Plan. • The development is carbon neutral certified in line with the Climate Active Precinct Standard (or equivalent). • GHG emissions data is reported annually.
Energy	The precinct is powered by renewable energy, taking advantage of the natural resources of the region and proximity to the Snowy Hydro development.	Ensure renewable energy land uses are permitted.	• Develop a renewable Power Purchase Agreement (PPA) with Snowy Hydro to supply 100% renewable energy to the Snowy Mountains SAP. • Integrate energy efficiency and productivity into development design guidelines, with both

ESD Themes	Recommended Aims and Performance Criteria – Masterplan	Recommended Objectives and Controls – AP SEPP	Recommended Provisions – Delivery Plan and operational considerations
			embodied energy and lifecycle emissions considered. • Energy consumption is reported annually.
Environment	The precinct allows for growth and economic activity to thrive whilst minimising environmental impact, through initiatives that 'touch the ground lightly'. Development within KNP is controlled by the Snowy Carrying Capacity framework, which is integrated into the precinct's ISO14001 Environmental Management System (EMS).	The precinct's environmental impacts are effectively managed and reduced in line with the Precinct ISO14001 Environmental Management System (EMS).	• All development is assessed against the Snowy SAP Mountains EMS prior to approval. • The Snowy Carrying Capacity framework is applied to all development within KNP. • Implement urban design, infrastructure and building design guidelines to maximise environmental conservation. • Environmental impacts are reviewed annually, with performance improvement mechanisms identified. These impacts will be publicly reported annually.
Society	Development in the precinct expands on the regions focus on the outdoors and physical activity, to ensure the health and wellbeing of the community. The unique culture and history of the region is celebrated.	None identified	• Implement design guidelines for buildings and community spaces that focus on wellbeing. • Create social infrastructure focussed on equity. • Recognise and celebrate history and heritage in developments, including the Snowy Discovery Centre. • Track health and wellbeing outcomes for tourists and community via annual survey and engagement program. Survey to cover a range of health/wellbeing topics.
Mobility	A fully integrated transport model is developed which provides a seamless transport service	None identified	• Prioritise walking and cycling infrastructure to create a 20-minute connected Jindabyne town.

ESD Themes	Recommended Aims and Performance Criteria – Masterplan	Recommended Objectives and Controls – AP SEPP	Recommended Provisions – Delivery Plan and operational considerations
	across the precinct. Develop zero emission transport and infrastructure, prioritising public transport options within the Snowy Mountains SAP.		• Redesign streetscapes to facilitate walking and riding including reduced speed limits and narrower streets. • Provide park and ride facilities to travel to and from ski resorts and tourist attractions. • Create southern connector road to reduce congestion and vehicle numbers in main town centre, facilitating a pedestrian and bike friendly environment. • Implement supporting infrastructure for zero emission vehicles (electric vehicle charging) and Mobility as a Service (MaaS) provisions. • Implement new gondola to provide mass transport experience to mountain bike park.
Circular economy	The precinct supports the expansion of resource recovery and recycling industries and embeds circular economy principles into planning and operations. This includes precinct wide resource sharing networks such as waste and recovery centres.	None identified	• The development has identified resource flows, both within and outside the precinct, that will contribute to reducing waste to landfill and increase resource productivity. • Waste management is effectively managed throughout the precinct in accordance with the SMRC Waste Management Strategy. • Council to report total landfill waste and diversion rates for waste generated in the SAP. Landfill diversion are reviewed annually, with performance improvement mechanisms identified. These results will be publicly reported annually.

ESD Themes	Recommended Aims and Performance Criteria – Masterplan	Recommended Objectives and Controls – AP SEPP	Recommended Provisions – Delivery Plan and operational considerations
Water	The precinct celebrates the abundant natural water resources of the area, with all development focussed on water quality and stormwater management, through capture, reuse and water sensitive urban design (WSUD).	Ensure water infrastructure is permitted.	• New water infrastructure and urban planning to incorporate water sensitive urban design. • Wastewater treatment systems in the alpine areas to be upgraded to closed loop systems with no pollution to alpine streams. • Build water capture and reuse infrastructure for all new developments. • Ensure water quality of the lake is maintained and improved where possible.
Leadership	Leadership in sustainable development is demonstrated through a Green Star Communities rating from the Green Building Council of Australia (GBCA). The precinct's environmental impacts are effectively managed and reduced in line with the Precinct ISO14001 Environmental Management System (EMS).	None identified	• All development is monitored against its ability to contribute to the Green Star rating and EMS outcomes. Reporting and implementation of these frameworks is applied at mandatory, voluntary and opt-in scales depending on scale of development and impact. • EMS controls are reported annually and report is made available to the public.

1 Introduction

1.1 Purpose

The purpose of this report is to summarise the ecologically sustainable development (ESD) opportunities that have been identified for the Snowy Mountains Special Activation Precinct, so that they can be considered and integrated throughout the planning stages. This includes understanding trends, policy directions and the site-specific context to ensure all opportunities are identified and benefits for the environment, residents, businesses and the broader community are considered.

This document summarises the research undertaken to date to identify ESD opportunities and constraints for the region, which have been used to inform ESD initiatives identified in this report. It encompasses feedback on the draft Technical Report from the client group, and feedback from the Strategic Framework sessions. It sets the ESD vision and summarises the key moves explored during the Enquiry by Design (EbD) workshops, to be incorporated into the Snowy Mountains SAP Structure Plan.

1.2 How to read this report

The content of this report includes the following key sections:

<table>
<tr><th>Section</th><th colspan="2">Topic</th></tr>
<tr><td>1</td><td colspan="2">Introduction and background</td></tr>
<tr><td>2</td><td colspan="2">An overview of policy and UN SDG alignment</td></tr>
<tr><td>3</td><td>ESD Theme: Climate Resilience</td><td rowspan="9">Details of each of the key ESD themes.

Each theme includes an introduction, context analysis, opportunities, vision alignment and next steps.</td></tr>
<tr><td>4</td><td>ESD Theme: Emissions</td></tr>
<tr><td>5</td><td>ESD Theme: Energy</td></tr>
<tr><td>6</td><td>ESD Theme: Society</td></tr>
<tr><td>7</td><td>ESD Theme: Mobility</td></tr>
<tr><td>8</td><td>ESD Theme: Environment</td></tr>
<tr><td>9</td><td>ESD Theme: Circular Economy</td></tr>
<tr><td>10</td><td>ESD Theme: Water</td></tr>
<tr><td>11</td><td>ESD Theme: Leadership</td></tr>
<tr><td>12</td><td>ESD Destinations</td><td>Explores the overarching theme of ESD destinations</td></tr>
<tr><td>13</td><td>Calculators</td><td>Description of ESD calculators</td></tr>
</table>

1.3 Background

The NSW Government has identified the Snowy Mountains as a dedicated regional location for a Special Activation Precinct (SAP). The intent of these precincts is to create jobs, attract investment, support locals and fuel development through infrastructure and economic mechanisms.

The Snowy Mountains SAP will focus on ecotourism, resilience and circular economies, with an ambition to becoming carbon and climate positive. The vision for the region is for an environmentally resilient, economically strong and socially inclusive future.

The aspirations of the Snowy Mountains SAP underpin the goal of becoming Australia's Alpine Capital, offering:

- Adventure and ecotourism
- Sport and education
- Sustainability and wellness
- Design and culture
- Infrastructure and connections

Opportunities identified by the NSW Government for the Snowy Mountains SAP include:

- Promote the development of year-round attractions and improve amenities of the area
- Improve regional access to enable more visitors to reach the area
- Remove capacity constraints to enable growth in winter tourism
- Grow the region into the national training base for Australian winter Olympic and Paralympic athletes, building on the NSW Government's $5 million commitment to a new National Snowsports Training Centre in Jindabyne.

1.4 Study area

The Snowy Mountains are located in the South East tableland region of NSW, approximately 580km north east of Melbourne, 490km south of Sydney and 100km south west of Canberra. The Snowy Mountains SAP is located in the Snowy Monaro Local Government Area (refer Figure 1).

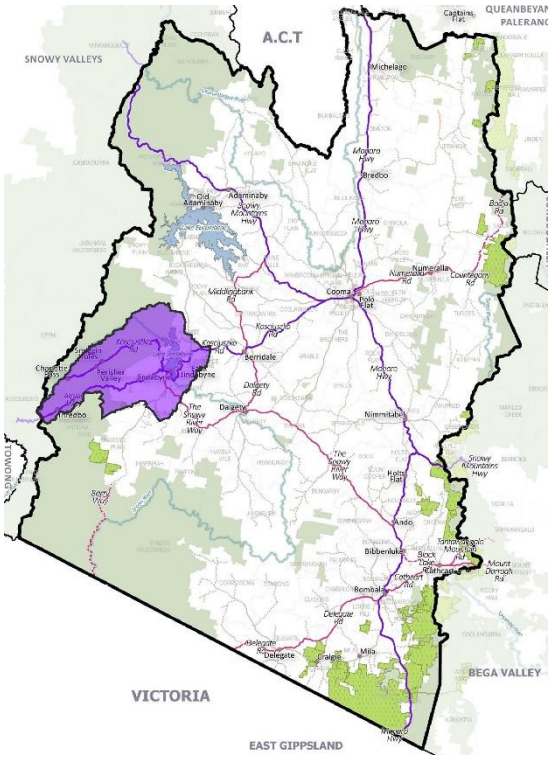


Figure 1: Snowy Monaro LGA and Snowy Mountains SAP

The study area covers 722 square kilometres. Refer to Figure 2 for a summary of the Snowy Mountains SAP boundary and main centres.

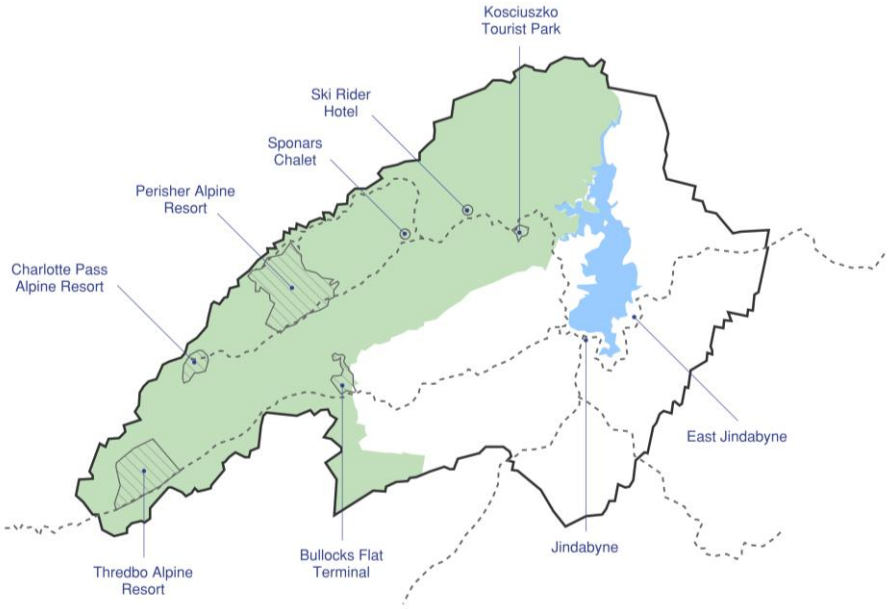


Figure 2: Snowy Mountains SAP Study Area

1.5 Regional appreciation

A context analysis has been undertaken which has identified the following key ESD strengths and opportunities in the area (refer Figure 3 and full Context Analysis in Appendix A).

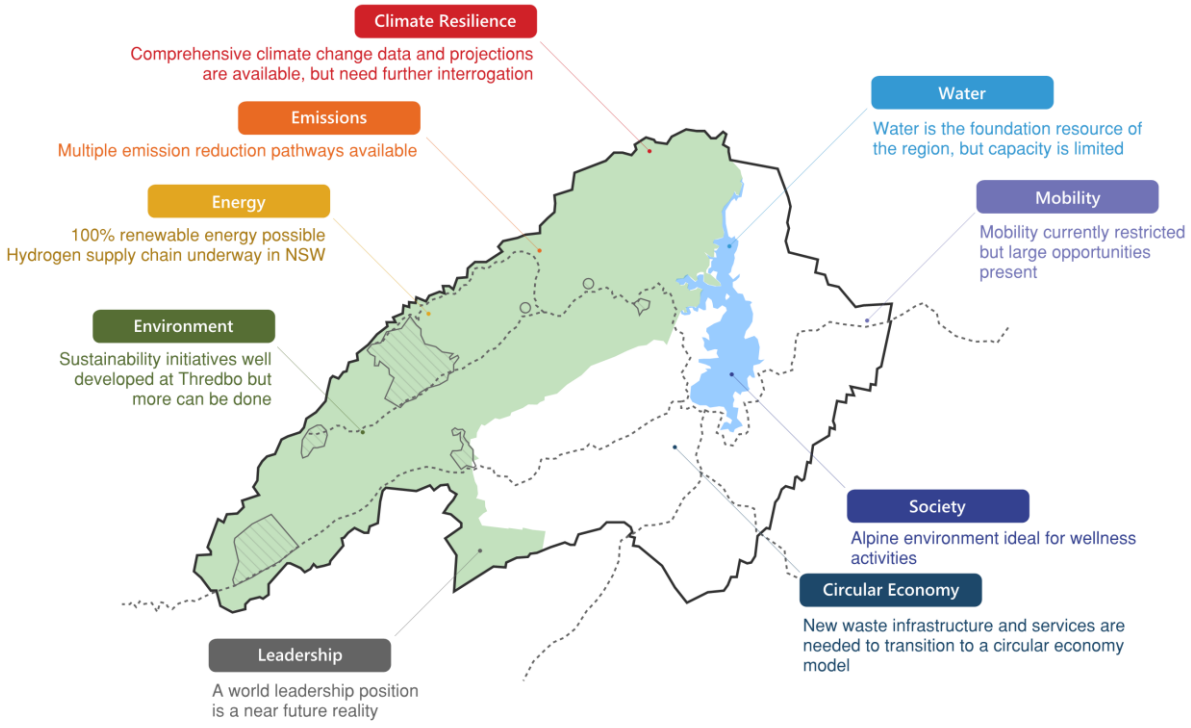


Figure 3: Snowy Mountains regional appreciation

The following provides a short overview of the context analysis and opportunities:

- Climate change is well understood with projections, data and resources available to ensure the Snowy Mountains SAP can plan for a changing climate, however these need detailed interrogation to plan for a resilient future.
- There are significant opportunities to transition to low and zero emission energy and transport options while improving resilience and supporting development growth.
- Existing renewable energy in the region generates more energy than the Snowy Mountains SAP's current demand, however supply to the region is not guaranteed. There are opportunities to secure a zero-emissions electricity supply via a combination of new renewable energy installations and a Power Purchase Agreement (PPA) with Snowy Hydro.
- The natural environment is a resource which must be respected.
- There are health and wellbeing opportunities with the alpine region, sports and adventure tourism facilitating a wide range of active lifestyles and wellness activities.
- Existing sustainability initiatives at Kosciuszko National Park (KNP) provide a foundation for region wide approaches.
- Water is abundant, but its use is prioritised elsewhere.
- Transport is the highest source of GHG emissions and capacity is a constraint, but there are opportunities to improve this.

1.6 Snowy Mountains SAP vision

The Snowy Mountains SAP vision and aspirations are very well defined and provide an inspiring basis for the ESD technical study. The ESD and wellness objectives of the vision include:

- the Snowy Mountains will be a national leader in environmental resilience and sustainability;
- with investment in renewable energies, green infrastructure, and carbon sequestration;
- aspirations for a carbon negative future;
- opportunities to connect with nature; and
- a continued protection of the vulnerable alpine environment of Kosciuszko National Park.

In each of the ESD themes, there is a section exploring how the ESD vision is aligned with the key aspects of the Snowy Mountains SAP vision.

1.7 Ecologically Sustainable Development (ESD)

Embedding ESD principles into the Structure Plan will ensure that the Snowy Mountains SAP is economically, environmentally and socially sustainable. This report has reviewed existing systems both within and outside the Snowy Mountains SAP boundary and identified trends that will provide an opportunity or present a risk to the Snowy Mountains SAP within the key themes, while also considering sustainability frameworks.

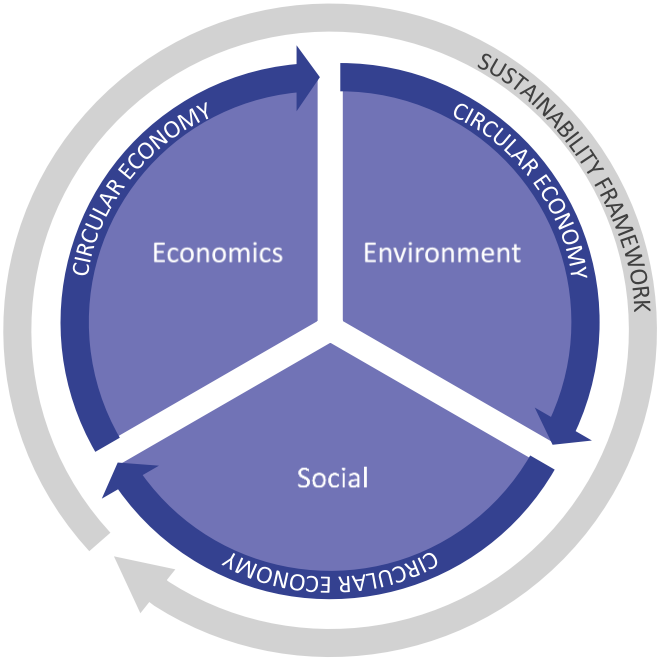


Figure 4: ESD Principles

1.8 ESD themes

As part of the development of the Parkes and Wagga Wagga SAP Master Plans, ESD themes were developed based on the local context and priorities for the SAPs which are outlined below (refer Table 1). Each SAP is unique and therefore it is inherent that the themes are relevant to each area and its specific needs. For example, the Wagga Wagga SAP included a 'digital infrastructure' theme due to the limited existing capacity in the SAP and the identification of ESD initiatives that were heavily reliant on digital systems. The table below shows the ESD themes for the Parkes and Wagga Wagga SAP's for comparison.

Table 1: ESD Theme Comparison

Parkes SAP	Wagga Wagga SAP	
Climate Resilience	Climate Change	ESD Framework
Emissions	Emissions	
Energy	Energy	
Water	Water	
Resource Optimisation	Resource Optimisation & Circular Economy	
Green Infrastructure	Green Infrastructure	
Mobility	Transport	
Assurance	Digital Infrastructure	

An analysis of the Snowy Mountains SAP context and ESD priorities has been undertaken and the following topics proposed. Due to the unique context of the Snowy Mountains SAP, with the focus on tourism and the natural environment, some of the ESD themes that were used on the previous SAPs have been adapted, and others, such as Digital Infrastructure, are no considered to be critical. This does not imply that digital infrastructure is not important, only that it is a lower priority for the project from an ESD perspective.

Theme	Relevance
Climate Resilience	Climate resilience is critical to ensure that the community understands and can respond to a changing climate.
Emissions	The Snowy Mountains SAP vision is to be carbon negative, offsetting more emissions than are produced in the region.
Energy	Delivery of secure, affordable, low carbon energy to support a carbon negative region.
Environment	The natural alpine environment needs to be conserved and enhanced for all to enjoy.
Society	Prioritise health, wellbeing and liveability for the benefit of the local community and to attract new tourism.
Mobility	Active and sustainable transport can create a new transport model to and from the region.
Circular Economy	Embedding a circular economy approach to maximise resource efficiencies and reduce waste generation.
Water	Green infrastructure is developed to support the natural water cycle.
Leadership	Demonstrate leadership in sustainable development with an internationally recognised sustainability framework.

1.9 Snowy Mountains SAP growth

The Snowy Mountains SAP planning team have been considering scenarios for growth in consultation with Regional NSW, RGDC and DPIE. The latest advice from CIE considers a Snowy Mountains SAP growth scenario which almost doubles the resident and visitor populations by 2060. It is vital that this growth is managed in a sustainable manner: to reduce emissions and work towards a climate positive and carbon negative future, whilst allowing for growth to occur. This is particularly important for carbon emissions, which could also be projected to double during this growth period with no interventions.

The ESD strategies discussed in this report are considered in this context, planning for sustainable and managed growth whilst reducing emissions through key moves and strategic infrastructure projects.

The impact of the various growth opportunities can be tested in the Snowy Mountains SAP emissions calculator (refer Section 4.4) throughout the Structure Plan development.

1.10 ESD context analysis

To inform the development of this report, a context analysis and desktop review of key documentation has been undertaken to identify areas related to ESD under the key themes.

A Strengths, Weaknesses, Opportunities and Constraints (SWOC) analysis has been collated for each topic to inform the ESD strategy and identify levers for embedding ESD into the region. The SWOC analysis has been used to identify ESD initiatives that can respond to opportunities or constraints in the region.

A summary of the context analysis has been incorporated into each of the sections of this report. Refer to Appendix A for the full Context Analysis.

1.11 Technical context analysis reports

A review of the Context Analysis Reports prepared by the Snowy Mountains SAP technical consultants has been undertaken and has informed the development of this report. Where relevant, specific sections of the Context Analysis Reports have been incorporated and referenced to remove duplication.

1.12 Case studies

A review of relevant national and international case studies has been undertaken, focussing on reference projects where ESD was a key project driver.

The following case study projects were reviewed:

- Perisher (Australia)
- Hotham (Australia)
- The Remarkables (New Zealand)
- Banff (Canada)
- Whistler (Canada)
- Zermatt (Switzerland)

Insights from these case studies can inform what may be achievable for the Snowy Mountains SAP. The case studies highlight multiple actions which could be investigated for implementation within the Snowy Mountains SAP including:

- Best practice resource use, waste avoidance and management
- A systematic approach to capture and utilise recycled water
- Self-sufficient for energy and water
- Well-designed centres connected for increased active and public transport
- Environmental care programs
- Environmental sustainability messaging, engagement and education
- Measurement, monitoring and reporting

A summary of the case study information is included in Appendix B.

1.13 Consultation and stakeholder Liaison

The following direct consultation has been undertaken as part of the development of this report:

Table 2: Consultation summary

Stakeholder	Summary
Snowy Mountains SAP team	Participation in strategic framework workshops and other briefings/workshops

Stakeholder	Summary
Snowy Monaro Regional Council	At workshops and on specific waste management initiatives.
DPIE	Liaison, workshops, EbD sessions, and project communications.
Regional NSW	Liaison, workshops, EbD sessions, and project communications.
RGDC	Liaison, workshops, EbD sessions, and project communications.
DPIE Sustainability Advantage	The Sustainability Advantage team has been contacted to investigate opportunities within the region.
Bioregional Australia	Bioregional Australia has been contacted to investigate applying the One Plant Living Standard to the Snowy Mountains SAP.
International WELL Building Institute (IWBI)	IWBI have been consulted with to determine the potential for the WELL Community Standard to be applied to parts of the Snowy Mountains SAP.
Green Building Council of Australia (GBCA)	The GBCA has been contacted to investigate the Green Star Communities tool and potential for the Future Focus tool to be applied at a precinct level.
EarthCheck	EarthCheck have been contacted to investigate the tool and potential for EarthCheck to be applied at a precinct level.
Sustainable Snowies	Representatives from NSW National Parks & Wildlife Service have been consulted with to gain information on the Sustainable Snowies initiative.
Perisher (Vail Resorts)	Discuss existing sustainability initiatives, contribution to carbon neutral precincts and deploying the EMS.
Thredbo	Discuss existing sustainability initiatives, contribution to carbon neutral precincts and deploying the EMS.
Ski-rider Resort	Discuss existing sustainability initiatives, contribution to carbon neutral precincts and deploying the EMS.
NSW Department of Education and Communities	Carbon neutral schools and future of education.
Kosciuszko National Park	Facilitated the carrying capacity workshop, including deployment of the EMS, carrying capacity model, how to integrate KNP EMS.
Transport for NSW	Sustainable transport options and transition to public mass transport
NSW DPIE Environment, Energy and Science	Climate change projection analysis.

2 Policies, strategies and plans

2.1 Introduction

A review of key international, national, state, regional and location specific policies, strategies and plans has been undertaken to ensure the Snowy Mountains SAP is aligned with local and broader priorities. These documents have been referenced where directly relevant but are not detailed to avoid repeating information which is readily accessible existing studies and plans. A high-level summary of key documents that relate to ESD has been provided below.

The review has been undertaken in line with the NSW Planning Line of Sight process (refer Figure 5).

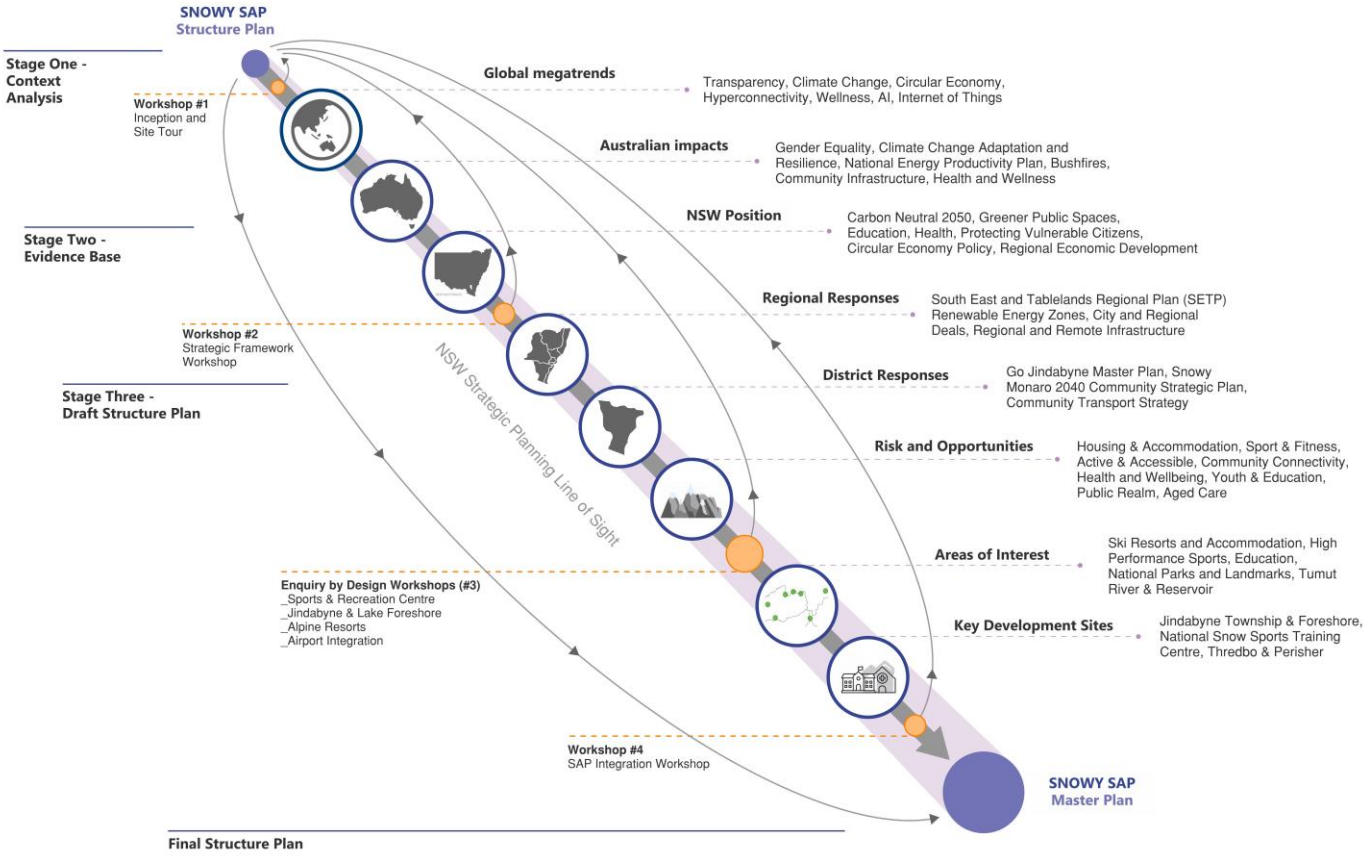


Figure 5: NSW Planning Line of Sight Alignment

2.2 International

Concerns over climate change impact are increasingly on the agenda for governments and organisations. The Intergovernmental Panel on Climate Change (IPCC) has stated that by 2030 global emissions must be down by at least 45% from 2010 levels to keep global temperature from rising by no more than 1.5°C. This is relevant to the region as the Australian Government has committed to emission reductions as part of the Paris Agreement signed in 2016).

The UN Sustainable Development Goals also provide priorities which should be integrated into strategies, plans and targets that aim to improve sustainability in the region. The UN Sustainable Developments Goals have been referenced in each topic where applicable and topics relevant to this plan have been outlined in Table 2. In addition, the UN World Tourism Organisation (WTO) has aligned and integrated the UN Sustainable Development Goals into their resources and programs (refer Figure 6) which is directly applicable to the Snowy Mountains SAP.

Figure 6: UN WTO Sustainable Development Goals Alignment

The below table outlines the UN Sustainable Development Goals and provides a summary of the relevance of each goal to the Snowy Mountains SAP, key disciplines that should be considering the SDGs and any supporting disciplines that can assist the achievement of the goal (refer Table 3).

Table 3: UN Sustainable Goals Alignment

Goal	Snowy Mountains SAP Alignment	Lead Discipline	Supporting Discipline/s
1 NO POVERTY	The Snowy Mountains SAP considers low socio-economic conditions in the region and aims to reduce poverty.	Economics	Social
2 ZERO HUNGER	The Snowy Mountains SAP considers low socio-economic conditions in the region and aims to reduce poverty.	Economics	Social
3 GOOD HEALTH AND WELL-BEING	The Snowy Mountains SAP maximises the health and wellbeing of the community and visitors.	Social	ESD
4 QUALITY EDUCATION	The Snowy Mountains SAP supports education and skills development.	Social	Planning

Goal	Snowy Mountains SAP Alignment	Lead Discipline	Supporting Discipline/s
	The Snowy Mountains SAP provides opportunities for a diverse workforce including gender equality.	Social	Tourism
	The Snowy Mountains SAP improves water quality and availability.	Environment	ESD
	The Snowy Mountains SAP provides renewable and affordable energy for all.	ESD	Infrastructure/ Energy
	The premise of the Snowy Mountains SAP program is economic growth for the region.	Economics	Social
	The Snowy Mountains SAP team must consider mega-trends and future innovations suitable for integration.	All	All
	The Snowy Mountains SAP considers low socio-economic conditions in the region and aims to reduce poverty.	Social	Economics
	The Snowy Mountains SAP will demonstrate leadership in ESD through an internationally recognised certification.	ESD	All
	The Snowy Mountains SAP will improve waste management in the wider region and all development will be in accordance with ESD principles.	ESD	All
	The Snowy Mountains SAP must develop climate resilient infrastructure and buildings.	ESD	All
	The Snowy Mountains SAP must allow development whilst also preserving natural resources.	Environment	All
	The Snowy Mountains SAP must allow development whilst also preserving natural resources.	Environment	All
	The Snowy Mountains SAP team will consider social and community needs.	Social	Planning
	The Snowy Mountains SAP team actively seeks partnerships and collaborations to enable wholesale change.	All	All

2.3 National

At a national level there are a range of strategies and plans which directly relate to the region and can be used as a high level ESD framework. At the highest-level, Australia's COP21 Paris agreement commitments include a target to reduce emissions by 26-28% on 2005 levels by 2030. Additional strategies and plans that will need to be aligned with include the National Climate Resilience and Adaptation Strategy, National Energy Productivity Plan 2015–2030 and National Waste Policy and Action Plan.

2.4 State

In line with international and national priorities, the NSW Government have implemented strategies and plans to reduce environmental impacts including the NSW Climate Change Policy Framework, Net Zero Plan Stage 1: 2020-2030, NSW Local Land Services: Future Climate Impacts and the NSW EPA Circular Economy Policy Statement: Too Good to Waste.

2.5 Local

The Snowy Mountains region has been the subject of extensive environmental studies and community consultation, which has been utilised to inform the baseline analysis and identify high priorities for the Snowy Mountains SAP. In particular, the following key plans and studies have been integrated:

- Enabling Adaptation in the South East 2017
- Australian snowpack in the NARCliM ensemble: evaluation, bias correction and future projections 2017
- Impact of Climate Change on Australia's alpine areas 2008
- Integrated Regional Vulnerability Assessment: South East NSW Pilot Study 2012
- State Environment Planning Policy (Kosciuszko National Park-Alpine Resorts) 2007
- Southeast and Tablelands Regional Plan 2017
- Snowy Mountains SAP Regional Context Analysis 2019
- Snowy Mountains SAP Strategic Design Report and P50 estimate 2020
- Snowy Mountains SAP Strategic Infrastructure Assessment 2020
- Snowy Mountains SAP Tourism in Jindabyne/ Kosciuszko National Park Report 2020
- Future Transport Strategy 2018
- Snowy Monaro Local Strategic Planning Statement 2020
- Snowy Monaro Destination Management Plan 2019
- Snowy Monaro Regional Economic Development Strategy 2018-2022
- Kosciuszko National Park Plan of Management 2006
- Australian Alps National Parks Cooperative Management Strategic Plan 2019-2022
- Jindabyne Growth Structure Plan 2011
- Jindabyne open Space and Recreational Land use Strategy 2007
- Draft Go Jindabyne masterplan
- Go Jindabyne Technical Reports including demographic projections, economic development and tourism, environment and heritage, housing and demographics, mobility and connectivity, social infrastructure and utilities and services.

A complete list of all resources consulted in the research for this report is included in the Context Analysis in Appendix A.

3 Climate resilience

3.1 Introduction

The Snowy Mountains SAP vision includes a specific aim to become a carbon negative, climate positive precinct which is directly reliant on understanding the climate and potential impacts of climate change. To ensure that the project plans for a changing climate and incorporates adaptation and resilience measures, this section outlines the known climate change impacts for the region and potential opportunities to mitigate or take advantage of these changes to create a climate positive outcome.

3.2 Context analysis

The Snowy Mountains SAP is located within the South East and Tablelands region (refer Figure 7).

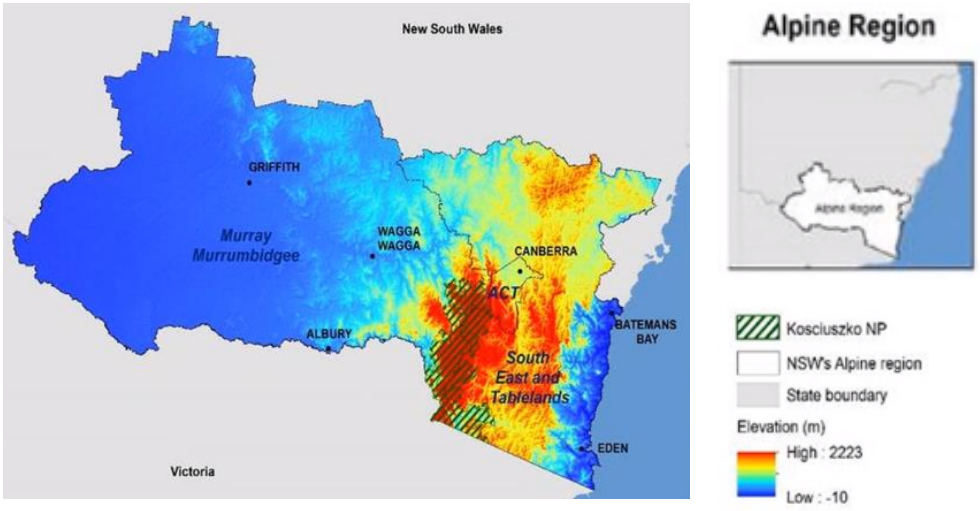


Figure 7: NSW Alpine Region

There are a number of climate change risks and impacts already identified as part of the AdaptNSW Climate Change Snapshot (refer Figure 8) and Enabling Adaptation in the South East (EASE) reports.

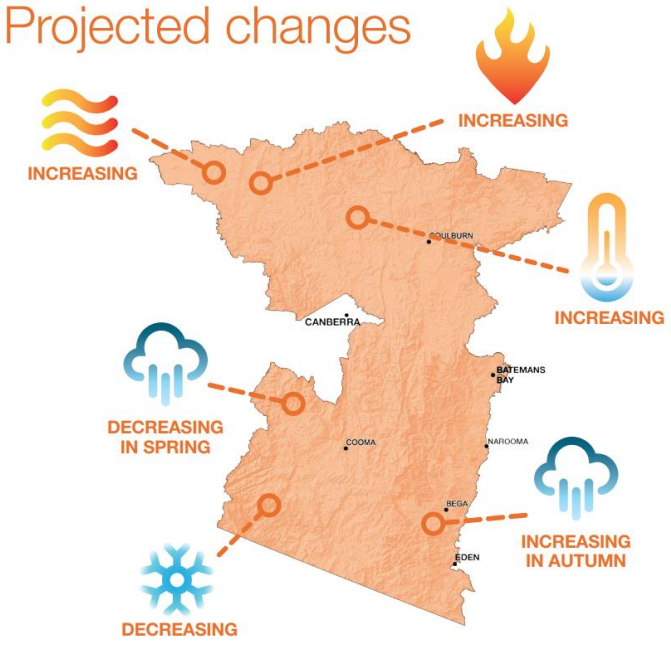


Figure 8: AdaptNSW Climate Change Snapshot report

These snapshot reports have identified the following climate change impacts (refer Figure 9).

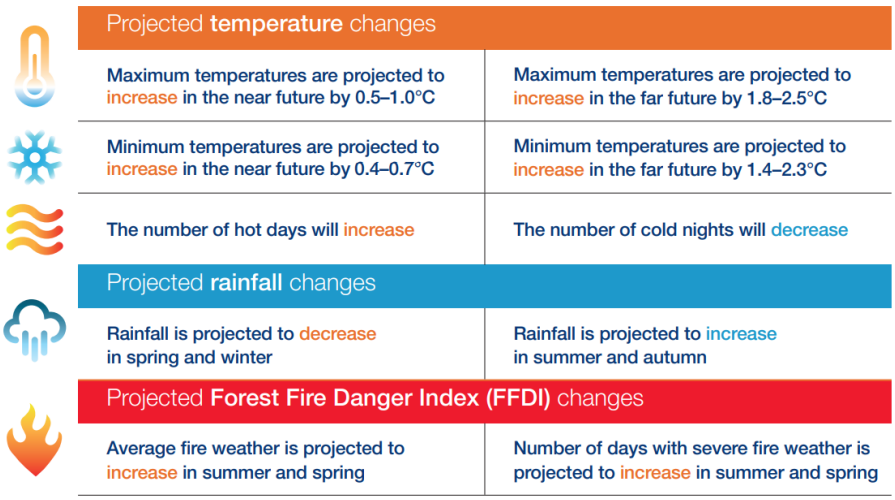


Figure 9: AdaptNSW Climate Change Projections

These projections are based on the NSW and ACT Regional Climate Modelling (NARCliM) Project and have continued to be developed and improved by the DPIE Environment, Energy and Science team. It should be noted that the NARCliM project also covers Victoria, South Australia and parts of Queensland, and a new portal is in development to incorporate the latest projections. This will facilitate a consistent approach to climate projections which can be used across multiple alpine regions in Australia.

As a result of these projections, there are a number of climate change impacts which are expected to be directly relevant to the Snowy Mountains SAP including:

- Increased temperatures, particularly during winter, and reduced snowfall is almost certain with impacts on the number of weeks available for snow activities. Detailed analysis of snow cover, depth and snow making conditions has been undertaken.
- Runoff and stream flows are likely to decrease in spring and winter which may impact hydro power generation capacity during periods of drought.
- A wide range of impacts on alpine ecosystems are likely as temperatures increase and snow fall decreases.
- Bushfire risk may increase in areas that were previously in alpine areas.
- Reduced water availability for both the Snowy Mountains SAP and downstream agricultural areas.

The NARCliM projections have been referenced and used in the Climate Change Impacts analysis.

3.2.1 Representative Concentration Pathways (RCPs)

There are a number of carbon emission scenarios which are used by the Intergovernmental Panel on Climate Change (Representative Concentration Pathways or RCPs – Refer Figure 10) and the NARCliM. The Climate Change in Australia (CCIA) Technical Report has used the same RCPs for consistency. However, NARCliM projections have used a high emissions pathway for all models and the CCIA data allows for a comparison of different pathways.

The following pathways have been used for comparison while assessing the Snowy Mountains SAP climate change impacts using the CCIA projections (refer Figure 10):

- **RCP4.5**: An intermediate pathway with CO_2 concentrations slightly above those of RCP6.0 until after mid-century, but emissions peak earlier (around 2040), and the CO_2 concentration reaches 540 ppm by 2100.

- **RCP8.5**: a future with little curbing of emissions, with a CO_2 concentration continuing to rapidly rise, reaching 940 ppm by 2100.

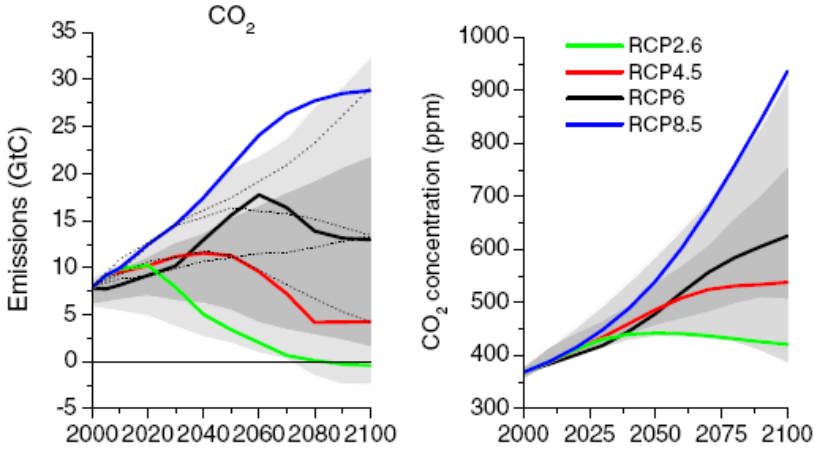


Figure 10: Representative Concentration Pathways

3.2.2 Climate Change in Australia

The CCIA Technical Report and associated cluster reports have also been referenced to provide additional information and reinforce the above NARCliM projections. In particular, the CCIA projections extend out to 2090, which can be useful when considering major infrastructure projects and the long-term nature of the Snowy Mountains SAP master plan. The NSW Government projections have been used in preference as they are some minor differences based on the modelling used in the projections.

The Snowy Mountains SAP is captured in the Murray Basin CCIA Cluster Report (refer Figure 11) however is on the border of the Southern Slopes Cluster, which also covers the south east region of Victoria and Tasmania. The Southern Slopes Cluster Report has also been reviewed for completeness as this cluster has similar mainland alpine areas which are susceptible to climate change.

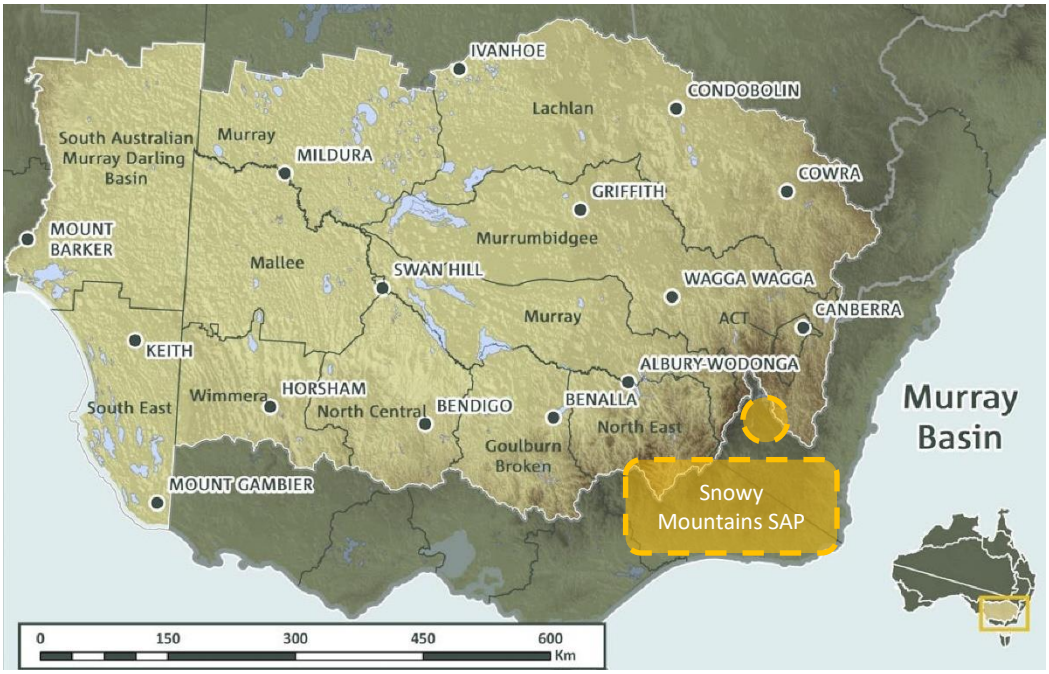


Figure 11: Murray Basin Cluster

The following section outlines the projected impacts captured in the CCIA Technical Report and cluster reports, with location specific projections based on Cooma (the closest weather station in the CCIA calculators).

3.3 Climate change impacts

The following climate change impacts have been identified from the review of projections:

Temperature

The following projections have been identified from the NARCliM data the NSW alpine regions:

Pathway	Near Future (2020 to 2039)	Far Future (2060 to 2079)
Temperature Increase	0.75 to 1.0 °C	1.1 to 2.0 °C

These increases are similar to the CCIA projections which have shown as increase of 0.8-1.0 °C from 1910 to 2013 and there is very high confidence that temperatures will continue to increase with the following projected compared to the 1981 to 2010 timeframe:

Pathway	2030	2090
RCP4.5	0.4 to 1.1 °C	1.1 to 2.0 °C
RCP8.5	0.4 to 1.1 °C	2.5 to 4.0 °C

However, the CCIA projections have shown a larger increase in temperatures in the high emissions scenario through to 2090. The NARCliM projections are currently being updated with a longer timeframe which will also include a number of improvements which may address these discrepancies.

Maximum Temperature Thresholds

The NARCliM projections have identified a continual increase in temperatures for the region which will have a direct impact on the Snowy Mountains SAP, snow conditions, snow making conditions and for the design of buildings and infrastructure.

The following has been identified for CCIA maximum temperature thresholds with days above 35 expected to increase significantly by 2070.

Days above temperature thresholds							
Temperature Threshold	Historical (1981-2010)	RCP4.5	Increase / Decrease	% Increase	RCP8.5	Increase / Decrease	% Increase
2030							
>35	1.3	2.7	1.4	108%	2.4	1.1	85%
>40	0	0	-	-	0	-	-
2070							
>35	1.3	4.6	3.3	252%	9.6	8.3	641%
>40	0	0	-	-	0	-	-

Minimum Temperature Thresholds

The NARCliM projections have identified the following for minimum temperatures for days below -2 °C which are the preferred conditions for snow making (refer Figure 12):

- Approximately 10-day reduction in nights below -2°C in the near future (2020-2039). This is expected to have an immediate impact on snow making for the resorts and is already being experienced.
- Approximately 40-day reduction in nights below -2°C in the far future (2060-2079). This is expected to have a longer-term impact however is a significant constraint on snow activities in the region.

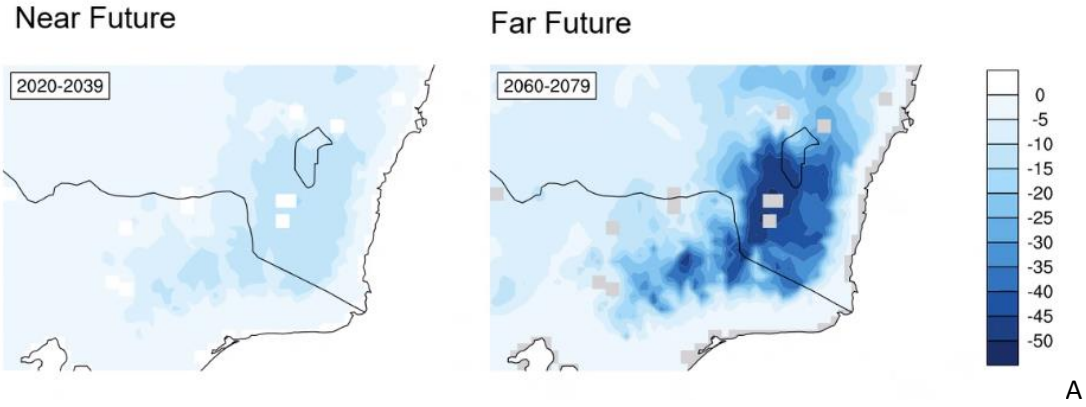


Figure 12: Days below -2 Degrees

The following has been identified for CCIA minimum temperature thresholds with days below zero analysed as this is likely to impact both snow conditions and artificial snow making.

Days below zero							
Temperature Threshold	Historical (1981-2010)	RCP4.5	Increase / Decrease	% Increase	RCP8.5	Increase / Decrease	% Increase
2030							
<0	90	71	20	22%	68	22	24%
2070							
<0	90	53	38	252%	36	55	61%

Rainfall (Precipitation)

Natural climate variability has been identified as the main driver in precipitation levels, however projections have shown some decreases in the winter, with potential increases in summer. Climate change has been projected to decrease precipitation by approximately 10% across the Snowy Mountains SAP region. This will need to be considered as part of optimising the use of water, with greater consideration for winter water consumption, and increased opportunities for using water in an efficient manner for options such as power generation during summer.

The NARCliM projections for the region have identified:

- Large seasonal changes which will impact the ability to plan for water availability

- Greater than 20% decrease in rainfall during spring.
- Greater than 10% increase in rainfall during summer.
- Overall, a 10% reduction in rainfall for the region.

Rainfall intensity is expected to increase as per the below, which will impact the ability for increased rainfall in summer to be harnessed. Overall, there is a projection of decreasing precipitation which will have impacts both on the Snowy Mountains SAP and for downstream uses such as agriculture.

Rainfall Intensity

Rainfall intensity has been projected to increase with large changes in season variability. It should be noted that the region is also impacted by east coast low pressure systems which can result in increased rainfall intensity. This further increases the impact of rainfall variability expected for the region, which will create challenges when designing infrastructure. This also has the potential to impact hydro power stations within and outside the Snowy Mountains SAP and water uses downstream e.g. agriculture.

Rainfall intensity will also have a significant impact on waterway flooding which has been captured in detailed as part of the WSP Engineering – Flooding Context Analysis.

Snow

Snow fall is projected to decrease across all Australian alpine areas, in particular at lower elevations. This is highly relevant for the Snowy Mountains SAP and has been identified as a key risk for the region, with the AdaptNSW reports identify a transition from traditional snow tourism as a priority.

Projections of large increases in the maximum temperature, with the greatest increase in winter, will greatly affect the peak snow season. With the Alpine zone projected to become drier due to reduced rainfall in spring, projections show decreased snow cover, depth and snow season futures. Natural snow season decreases of up to 96% by 2050 have been projected, with a peak snow depth reducing from 2 metres to less than half a metre and snow season length decreases by 15-110 days. As outlined in the minimum temperature section above, there is a significant reduction in days reaching minimum temperatures below 0°C which will have a direct impact on snow conditions and snow making.

Artificial snowmaking is a popular method to extend the snow season and provide good quality snow. Changes in temperature and humidity affect the number of viable days for artificial snowmaking which requires wet bulb temperatures of below -2 degrees Celsius. Wet bulb temperature is the lowest temperature that can be reached by the evaporation of water only and incorporates the relative humidity which determines snowmaking ability. Dry bulb temperature, precipitation, natural snowfall the proportion of precipitation falling as snow, as well as wind speed and direction, also impact snow-making operations.

Snowy Hydro operate a Cloud Seeding Program to increase precipitation by an average of 14%.

Studies predict that a more than 20% reduction in snowmaking conditions can be expected between 2020-2039 (relative to 1990-2009) and this reduction escalates, with 2060-79 projected to see a decrease of over 60%.

Some snow making is possible at slightly higher temperatures in certain conditions, however additional inputs (water and energy) may be required. Snow making also requires significant infrastructure including water storage, pumps, piping, electricity, hydrants and weather stations as well as snow guns. The process of snowmaking involves the pressurised pumping of stored water into the air, often with a nucleating agent. The nucleating agent should be considered from an environmental impact perspective and although there are potentially new snow making techniques being developed for warmer temperatures, it is expected to require new agents which may have a negative downstream water quality impact. As a result, the Snowy Mountains SAP will need to carefully consider what environmental impacts increased snow making will have including energy and water use and the impact of nucleating agents.

In particular, the elevation of the resorts and ski runs (summarised below) could be used to assess snow conditions and snow making viability to target areas for investment either in continuing winter sports as a short to medium term investment and transitioning lower ski runs and resort areas to alternative activities. For example, as one of the lower village elevations (refer Table 4), an analysis of snow making around Thredbo which takes into account climate change impacts and water availability could be undertaken to identify a transition pathway over a number of timescales e.g. 10-20 years, 20-40 years and 40-60 years.

Table 4: Resort village elevations

Resort	Elevation (m)
Thredbo Village	1,365
Sponars Chalet	1,500
Perisher Valley	1,720
Charlotte Pass Chalet	1,837

As a summary, one of the key constraints identified in the projections is that in the near future, snow making conditions will decrease and in the far future, suitable snow making hours may decrease to less than 200 hours for the resorts and snow fields.

Bushfire

Harsher fire weather has been identified as a risk for the region due to both increased temperatures and greater variability in rainfall with longer periods of drought (refer Figure 13). Due to the significant amounts of vegetation within the Snowy Mountains SAP and around the resorts, careful planning will be required to ensure the Snowy Mountains SAP can drive development while taking into account the impacts of climate change on bushfires. In particular, the existing infrastructure would have been constructed to a lower bushfire protection standard and in the event of replacement or refurbishment, will require significant upgrades to meet current standards.

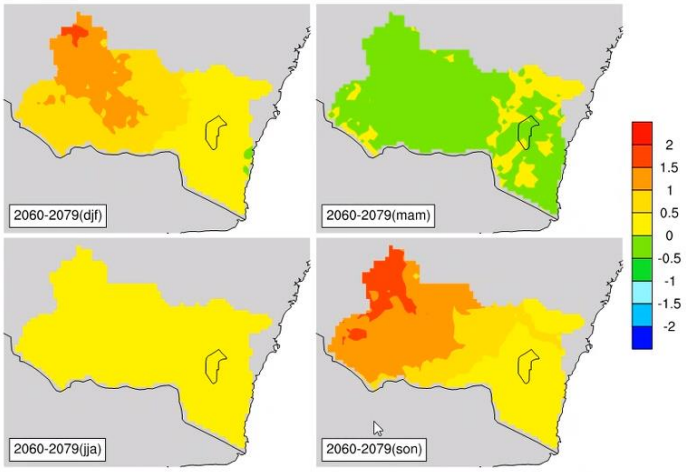


Figure 13: Intense bushfire weather

Although increased fire weather has been projected, it is in the range of a 1-2 day increase in extreme fire weather days for the Snowy Mountains SAP region with larger impacts projected for the western areas of the region. This will need to be considered, however existing bushfire management plans and the Snowy Mountains SAP structure plan should be able to address these risks within existing risk management processes.

An additional impact of increased bushfire weather and bushfire intensity is the impact of smoke inundation. This can have a direct impact on both air quality for internal and external activities in the region, as well as impact the quality of snow which can become contaminated with ash.

Solar Radiation

Increased solar radiation has been projected for the region with a high confidence. Due to reduced rainfall and therefore cloud cover, solar radiation in winter and spring is expected to increase. Although relatively minor, this will have a flow on impact on renewable energy opportunities and also has potential of increasing the number of days with clear weather which is ideal for outdoor activities.

Soil Conditions

The CCIA projections incorporated a potential increase in evapotranspiration across all seasons by 2090, with associated decreases in rainfall reducing soil moisture.

Wind speed

Minor reductions in wind speed are possible for the region, however are not expected to have a tangible impact on the Snowy Mountains SAP.

3.4 Climate impacts and risk assessment

Based on the above climate change impacts, the following climate change risks, impacts and opportunities have been incorporated into the Structure Plan to ensure the Snowy Mountains SAP is resilient and can adapt to climate change (refer Table 5). The assessment has been undertaken in line with *AS 5334:2013 Climate Change Adaptation for Settlements and Infrastructure.*

Table 5: Climate change impacts and opportunities

Topic	Climate Change Risks		Impact	Likelihood	Consequence	Risk Rating	Risk Response
Energy		**Increased Temperature**	Increased energy demand and likelihood of network capacity being exceeded with potential brown/black-outs. Increased consumption of energy from fossil fuel-based supplies and therefore increased emissions. Urban heat island effect increased around townships.	Likely	Moderate	**M**	Improve the energy efficiency of existing and new buildings to reduce demand. Increase onsite renewable energy on buildings that operate during the day to reduce peak demand. Increase vegetation and landscaping into outdoor areas and streetscapes (mindful of bushfire risks).
		**Harsher Fire-weather**	More frequent and intense bushfires in spring and summer are likely to disrupt utility supplies.	Likely	Moderate	**M**	Increase energy storage, focussing on critical infrastructure and community services. Critical infrastructure upgrades required.

Topic	Climate Change Risks		Impact	Likelihood	Consequence	Risk Rating	Risk Response
		**Increased Rainfall Variability and Evaporation**	Reduced capacity of hydro power plants, resulting in potential reduced generation capacity in the region. Increased rainfall during summer which may increase hydro power capacity.	Moderate	Minor	**L**	Increase alternative renewable energy sources not dependent on rainfall. Plan for a potential increase in hydro generation capacity in summer.
		**Reduced snow fall in winter with increased rainfall in summer**	Reduced snow fall and potentially snow melt impacts water flows through to hydro power stations.	Moderate	Minor	**L**	The impact of climate change snow and snow melt should be considered as part of water availability assessments.
		**All of the above**	The combination of climate change risks in the region has the potential of reducing the life of energy infrastructure with additional capital required to maintain, upgrade and replace infrastructure due to increased climate change design requirements.	Likely	Major	**H**	Ensure new energy infrastructure is designed to consider climate change impacts for the region.
Renewable Energy		**Increased solar radiation**	Increased solar radiation for the region has been projected which will result in a minor increase in the productivity of solar PV systems.	N/A	N/A	N/A	Increase the uptake of solar PV systems to harness increased solar radiation.
		**Reduced snow fall**	Reduced snow fall will increase solar PV generation by reducing snow coverage during winter.	N/A	N/A	N/A	Increase the uptake of solar PV systems to harness increased solar generation capacity.
		**Minor decrease in mean wind speed**	Minor decreases in mean wind projected may be possible with a negligible impact on the Snowy Mountains SAP.	N/A	N/A	N/A	N/A
		**Increased rainfall variability, evaporation and longer periods of drought**	Reduced capacity of hydro power plants, resulting in potential reduced generation capacity in the region.	Moderate	Minor	**L**	Increase alternative renewable energy sources not dependent on rainfall.

Topic	Climate Change Risks		Impact	Likelihood	Consequence	Risk Rating	Risk Response
Mobility		**Increased temperatures with prolonged and more frequent heat waves**	Increased temperatures and prolonged heat waves can result in asphalt surfaces becoming unstable and train tracks buckling due to extreme temperatures. This may impact access to the Snowy Mountains SAP, however is unlikely to impact infrastructure in the Snowy Mountains SAP due to the local climate.	Moderate	Minor	**L**	Diversify transport modes to reduce road access constraints.
		**Harsher fire-weather**	More frequent and intense bushfires may disrupt transport routes through road closures. This may also impact access to the Snowy Mountains SAP for visitors.	Likely	Moderate	**M**	Transport systems can be designed to incorporate live traffic data to reduce impacts of road closures.
		**Increased rainfall intensity**	Road access impacted by floodwater with associated increased soil erosion.	Likely	Moderate	**H**	Ensure roads and new transport infrastructure considers waterway flooding
		**Rainfall variability with increased rainfall intensity and evaporation**	Soil expansion and erosion, resulting in cracks and damage to road surfaces causing road closures. May also impact the ability for fire crews to access regional areas and the national park due to large cracks forming.	Likely	Moderate	**M**	Road infrastructure and conditions upgraded to improve access.
		**All of the above**	The combination of climate change risks in the region has the potential of reducing the life of transport infrastructure with additional capital required to maintain, upgrade and replace infrastructure due to increased climate change design requirements.	Likely	Major	**H**	Mobility systems are diversified and designed to take into account the impacts of climate change
Circular Economy		**Increased temperatures with prolonged and more frequent heat waves**	Some studies have shown that increased temperatures and drier conditions may increase the rate of methane emissions from landfill.	Moderate	Minor	**L**	Reduce waste to landfill and increase waste separation.

Topic	Climate Change Risks		Impact	Likelihood	Consequence	Risk Rating	Risk Response
		**Harsher fire-weather**	Increased demolition and material waste from more frequent and intense bushfires. May also pose a risk to waste infrastructure including processing facilities.	Likely	Moderate	**M**	Increase construction and demolition waste processing capacity and consider disaster (e.g. bushfire) waste from the region.
		**Increased rainfall intensity**	Increased rainfall intensity may increase the likelihood of contaminated water from landfill sites entering waterways and ground water.	Likely	Moderate	**M**	Reduce waste to landfill and increase waste separation opportunities.
Water		**Increased Temperature**	Increased water demand for processes (snow making) and irrigation and likelihood of network capacity being exceeded with potential supply shortages/loss.	Likely	Moderate	**M**	Consider long term availability and plan for potential impacts on non-essential water processes e.g. where is snow making less viable, should the area transition to alternative uses to reduce water demand.
		**Harsher Fire-weather**	More frequent and intense bushfires are likely to disrupt utility supplies. In addition, ash, debris, and hazardous materials washed into waterways are likely to impact water quality in catchments and increase water treatment requirements.	Likely	Major	**H**	Ensure the SAP considers and can respond to utility supply losses e.g. alternative water supplies.
		**Longer periods of drought and increased evaporation**	Increased likelihood of the region's water supply capacity being exceeded during peak periods due to lower dam levels and drought conditions.	Likely	Moderate	**M**	Assess the long-term impact of climate change on water availability and incorporate in SAP planning.
		**Increased rainfall intensity**	Increased likelihood of flooding and stormwater management system capacity being exceeded with increased likelihood of road closures due to landslides and access restrictions. Increased volume of contaminated water from bushfire affected areas likely to impact water quality impacting both the environment and potable water supply.	Likely	Major	**H**	Design major infrastructure and buildings to consider increased stormwater management requirements. Ensure buildings not currently designed for stormwater management can accommodate rainwater systems currently restricted by snow (e.g. no gutters and downpipes).

Topic	Climate Change Risks		Impact	Likelihood	Consequence	Risk Rating	Risk Response
		**All of the above**	The combination of climate change risks in the region has the potential of reducing the life of water assets and infrastructure with additional capital required to maintain, upgrade and replace infrastructure due to increased climate change design requirements.	Likely	Major	**H**	Ensure the SAP considers the impact of climate change on the usable life of infrastructure.
Environment		**Biodiversity**	The combined impacts of climate change are likely to impact habitats and result in migration of species.	Likely	Moderate	**M**	Ensure the SAP considers migration pathways and conservation areas to assist specifies in responding to climate change. Create wildlife corridors that connect areas threatened by climate change with more resilient areas.
		**Pest species**	A changing climate could result in an increase in pest specifies being introduced or flourishing in the Snowy Mountains SAP.	Likely	Moderate	**M**	Ensure the SAP considers pest management during operation.
Society		**Harsher Fire Weather**	Increased frequency and intensity of bushfires may increase smoke inundation and impact air quality.	Moderate	Minor	**M**	Consider how the SAP can assist in mitigating the impacts of smoke inundation through improved design solutions.
		**Increased Temperature & Heat Waves**	Increased temperatures and heat waves may impact the health and wellbeing of residents and visitors however the impact is expected to be minor due to the local climate.	Moderate	Minor	**L**	Ensure community facilities incorporate respite areas and shade.

3.5 Snow conditions

Recent consultation with the Climate and Atmospheric Science team in DPIE Environment, Energy and Science has identified a detailed database of additional climate data, modelling and resources which have direct relevance to the Snowy Mountains SAP and the impact of climate change on snow conditions. This includes:

- Snow conditions including depth, coverage and retention
- Artificial snow making conditions
- Water availability and downstream impacts

It is recommended that these datasets are analysed further and a detailed plan developed which considers how the Snowy Mountains SAP and resorts can transition in an informed and staged manner. A detailed climate change adaptation plan is being developed (separately) which further expands on Table 4 Climate change risks and opportunities and incorporates the latest available data for the area.

3.6 Carrying capacity alignment

Many of the above climate change impacts and opportunities directly relate to and compliment the Carrying Capacity assessment undertaken by WSP, including:

- Water capacity and availability for the environment and downstream users.
- The ability for the environment to sequester carbon emissions.
- The impact of increased rainfall intensity on water flows.
- The impact of climate change on biodiversity and species migration, both within and outside the Snowy Mountains SAP.

3.7 Snowy Mountains SAP vision alignment

Embedding climate resilience into the Snowy Mountains SAP will align with the following Vision topics:

Our Climate Resilience theme vision is:

An adaptable community resilient to climate change

This compliments the Snowy Mountains SAP visions of 'Sustainability & Wellness' and 'Infrastructure and Connections' by ensuring that the Snowy Mountains SAP is resilient to climate change which will in turn improve health and wellbeing outcomes for the community and visitors.

3.8 Outcomes of the Structure Plan

The following key ESD opportunities are included in the Structure Plan:

- The above climate change impacts and climate resilience and adaptation opportunities are embedded into the design of infrastructure and services.
- The structure plan has identified development areas and resorts most impacted by climate change and snow reductions (e.g. those at lower altitudes), to allow development to transition these areas to alternative activities over time.
- An analysis of snow conditions, coverage, depth and snow making conditions data has been undertaken and all relevant disciplines have incorporated the impact into projections.

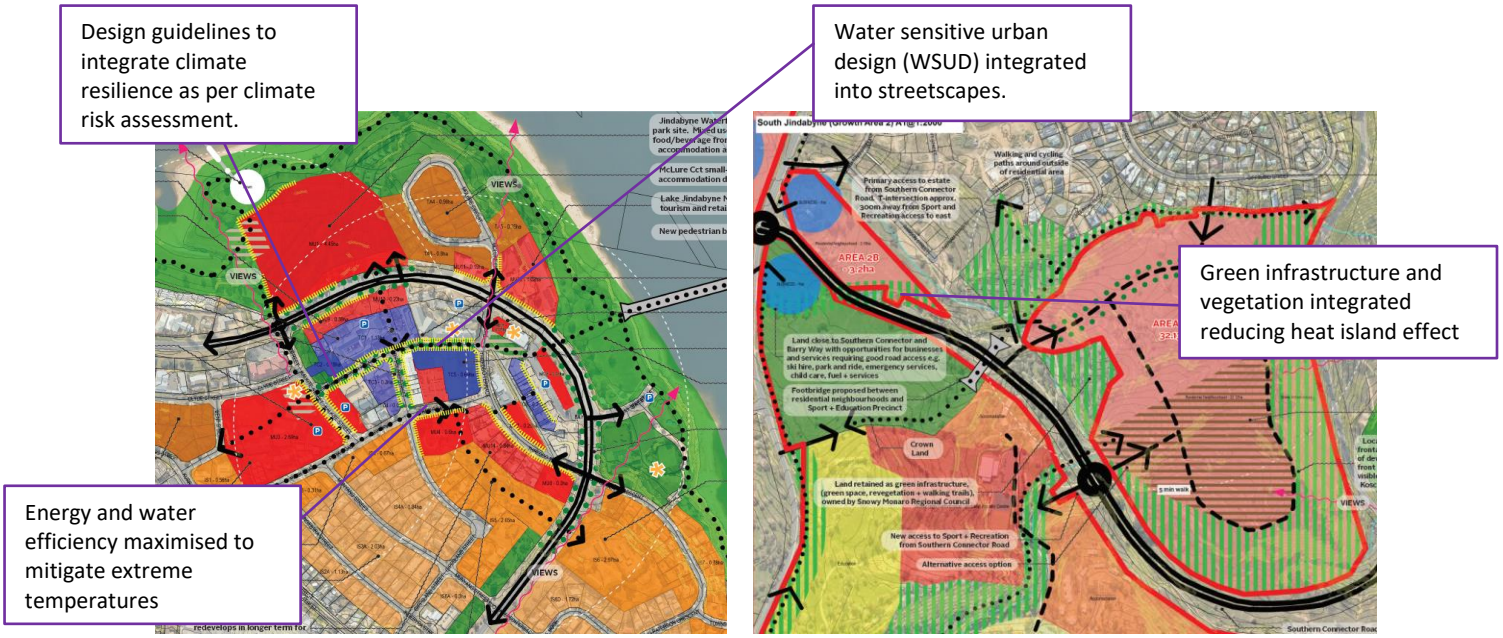


Figure 14: Climate responses in the Structure Plan

4 Emissions

4.1 Introduction

With the aim for the Snowy Mountains SAP to become a climate positive and carbon negative precinct, a greenhouse gas (GHG) boundary and emissions inventory will need to be developed and tracked in line with a recognised standard. Carbon negative infers that more emissions will be reduced or offset by the region than are emitted by its activities (also sometimes referred to as carbon positive). The Climate Active carbon neutral standard (previously the National Carbon Offset Standard – NCOS) for Precincts provides a framework for the precinct to achieve carbon neutrality, developing an emissions boundary and collating GHG emissions. Climate Active define carbon neutrality as "reducing emissions where possible and compensating for the remainder by investing in carbon offset projects to achieve zero emissions".

The following section provides a summary of emissions for the Snowy Mountains SAP, pathways to reduce emissions and opportunities to become carbon negative.

4.2 Context analysis

The NSW Government has a commitment to carbon neutrality by 2050, as outlined in the DPIE Net Zero Plan Stage 1: 2020–2030, which includes a requirement for the NSW Government to be leaders in this change. The Snowy Mountains SAP will go beyond this target to achieve a carbon negative outcome. To achieve this, the Snowy Mountains SAP's emissions will need to be decoupled from productivity and support a transition to low carbon, high performing economy. The latest State and Territory Greenhouse Gas Inventories 2017 for NSW shows an 18.2% decrease from 2005 to 2017. However, NSW contributes approximately one quarter of Australia's total GHG emissions and will be key to meeting Australia's COP21 emissions reduction target. The main contributor for NSW's emissions is stationary energy (electricity generation) due to the high percentage of electricity being generated by coal power stations. NSW's 2017 emissions are as follows (refer Figure 15):

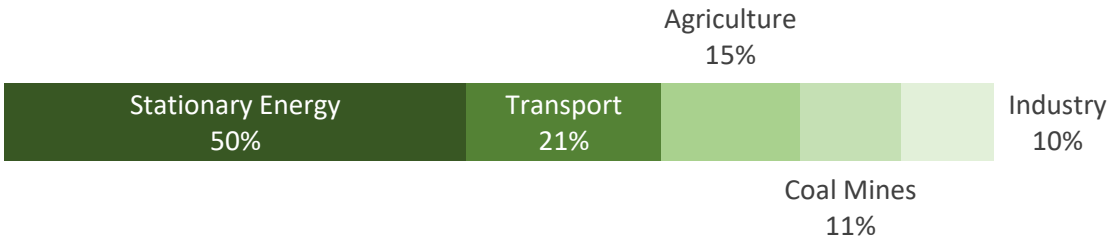


Figure 15: NSW 2017 Emissions breakdown

With over 70% of emissions associated with stationary energy and transport, which are a significant component of the Snowy Mountains SAP inventory, emission reduction measures to improve efficiencies and support the transition to low carbon transport alternatives should be a priority. Supporting existing resorts, businesses and the community to become more efficient and to reduce their emissions will require targeted and ongoing support resources.

The NSW Government has set a net-zero emissions target by 2050, with a 35% emissions reduction target by 2030, which will only be possible with energy efficiency improvements, a significant increase and integration of renewable energy into NSW's electricity supply supported by energy storage (battery storage, pumped hydro and thermal storage), alternative renewable fuels (hydrogen), the transition to low emission transport (electric vehicles and hydrogen cell vehicles), reducing waste to landfill and improving agricultural practices.

To ensure the Snowy Mountains SAP works towards net zero emissions by 2050, it is recommended the Climate Active Carbon Neutral Standard for Precincts is applied.

4.2.1 Snowy Mountains SAP emission boundary

To ensure that the Snowy Mountains SAP can achieve its aim of becoming carbon negative, an emissions boundary will need to set, emission sources and quantities will need to be collated, and opportunities to reduce emissions implemented.

The emissions boundary will need to be based on the emissions created either as a direct result or consequence of the Snowy Mountains SAP's activities. The emissions boundary can be based on both a physical boundary and/or an analysis of the where the Snowy Mountains SAP will be having a measurable impact on emissions. This may include:

- **Option 1:** A holistic physical emissions boundary set based on the final Master Plan area and all emissions generated as a result of the Snowy Mountains SAP's operations within this boundary will need to be monitored and managed (refer Figure 16).
- **Option 2:** The boundary could be based on individual sub-precincts that the Snowy Mountains SAP and associated operations and infrastructure works will impact (refer Figure 17).
- **Option 3:** The emissions boundary is set based on a more accurate boundary of the Snowy Mountains SAP's direct emissions impacts which may be different from the final Master Plan boundary. For example, agriculture is one of the main emission sources in the current study area, however the Snowy Mountains SAP may not be managing or impacting these emissions (refer Figure 18). As a result, the emissions boundary could be realigned to exclude the majority of the agricultural land and focus on areas that are being developed by the Snowy Mountains SAP.

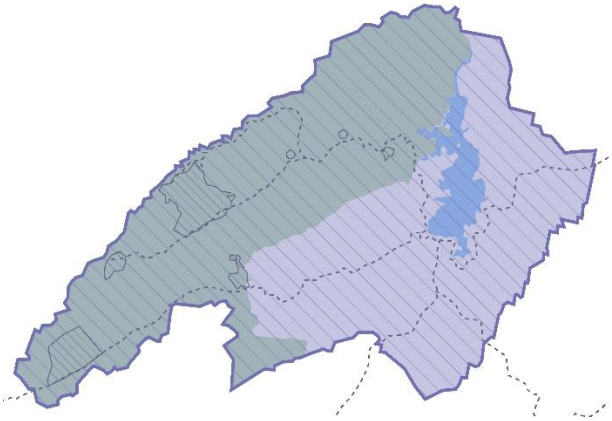


Figure 16: Emissions Boundary – Option 1

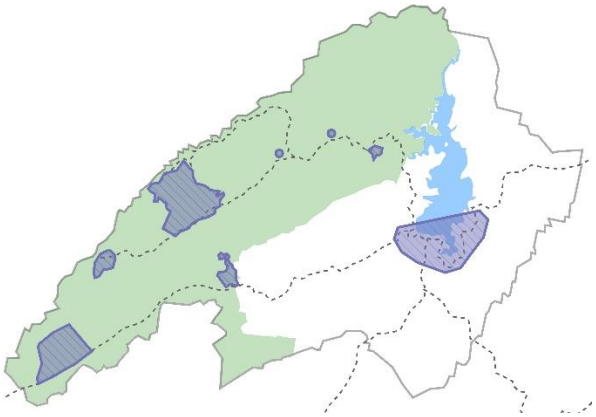


Figure 17: Emissions Boundary – Option 2

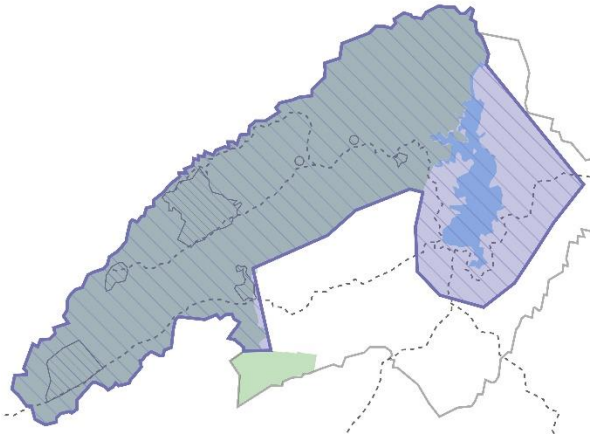


Figure 18: Emissions Boundary – Option 3

These emission boundary options have been explored during the development of the structure plan to ensure a clear boundary is set and emission sources are confirmed.

4.2.2 Emission sources

The following image provides a high-level summary of emission that will need to be captured under the Climate Active precinct standard (refer Figure 20).

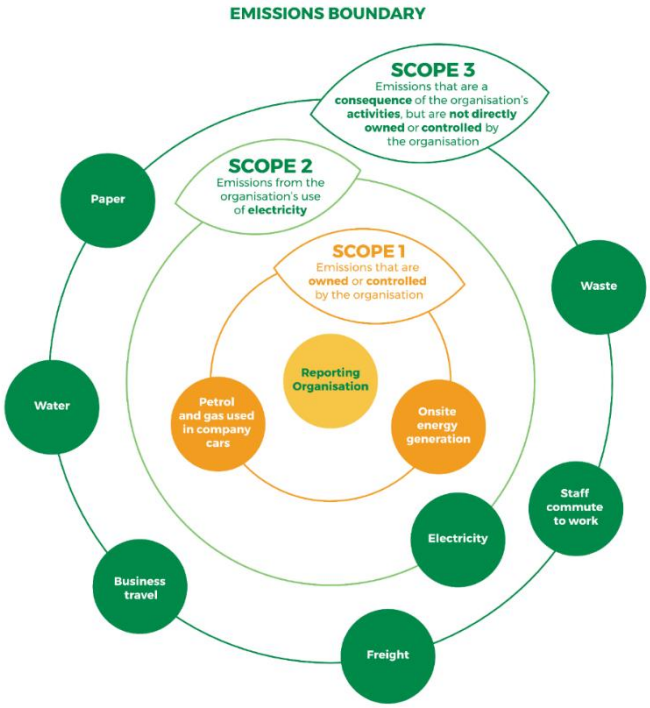


Figure 19: Emissions Boundary - Climate Active

Following the emission sources being identified, responsibility for the emissions should be determined. For example, the following potential owners should be considered:

- RGDC
- Business owners
- Council
- Residents and visitors

This is important due to the financial impact of purchasing offsets or implementing carbon sequestration projects to offset emissions which are directly associated with the precinct's operations. For example, one of the largest emission sources for the Snowy Mountains SAP will be from visitors travelling to the region which is currently reliant on fossil fuel based on transport.

The main emission sources for the Snowy Mountains SAP are expected to be associated with the following and a potential ownership or responsibility for the emissions identified (refer Table 6).

Table 6: Snowy Mountains SAP Emission Sources

Emission Source	Summary	Ownership/Responsibility
Stationary energy	Energy consumed in the Snowy Mountains SAP is generated using a mix of energy supplies including fossil fuel based and renewable energy power plants with emissions associated with fossil fuel use.	Ownership/responsibility will be the infrastructure and building owners/operators, with Council responsible for public infrastructure.
Transport	Emissions generated from the combustion of fuel to power transport. Includes energy required to power newer vehicles such as electric vehicles (EVs). Due to the Snowy Mountains SAP being a tourist destination, this includes transport emissions from people commuting to the area in the same manner that staff commute is included in an organisation's emissions.	Ownership of transport emissions are directly associated with the owner/operator of the vehicle however the emissions are increased due to the SAP. Emissions could be transferred to visitors as part of parking or resort passes (fee for emissions associated with driving to the Snowy Mountains SAP).

Emission Source	Summary	Ownership/Responsibility
Waste to landfill	Emissions generated from landfill waste and associated waste vehicle emissions. For example, recycled materials and organic waste will have a lower emissions factor due to the use of waste trucks.	Ownership/responsibility for kerbside collection will be the local council who could recover costs as part of rates. Responsibility for emissions reduction measures to be shared between RGDC, the local council and the resort operators
Refrigerants	Emissions associated with the use of refrigerants for air-conditioning systems e.g. building air-conditioning and transport refrigeration within the Snowy Mountains SAP.	Refrigerant emissions will need to be captured within the Snowy Mountains SAP with responsibility being the asset owners.
Water consumption	Emissions associated with the supply of water including water treatment and pumping.	Ownership/responsibility will be shared with RGDC, the local council and the asset owners all playing a role in reducing emissions.
Procurement	Emissions associated with the procurement of office materials (e.g. paper) and furniture.	Ownership/responsibility will be shared with RGDC, the local council and the resort operators all playing a role in reducing emissions.

The following outlines the emissions boundary and expected emission sources for the Snowy Mountains SAP (refer Figure 20).

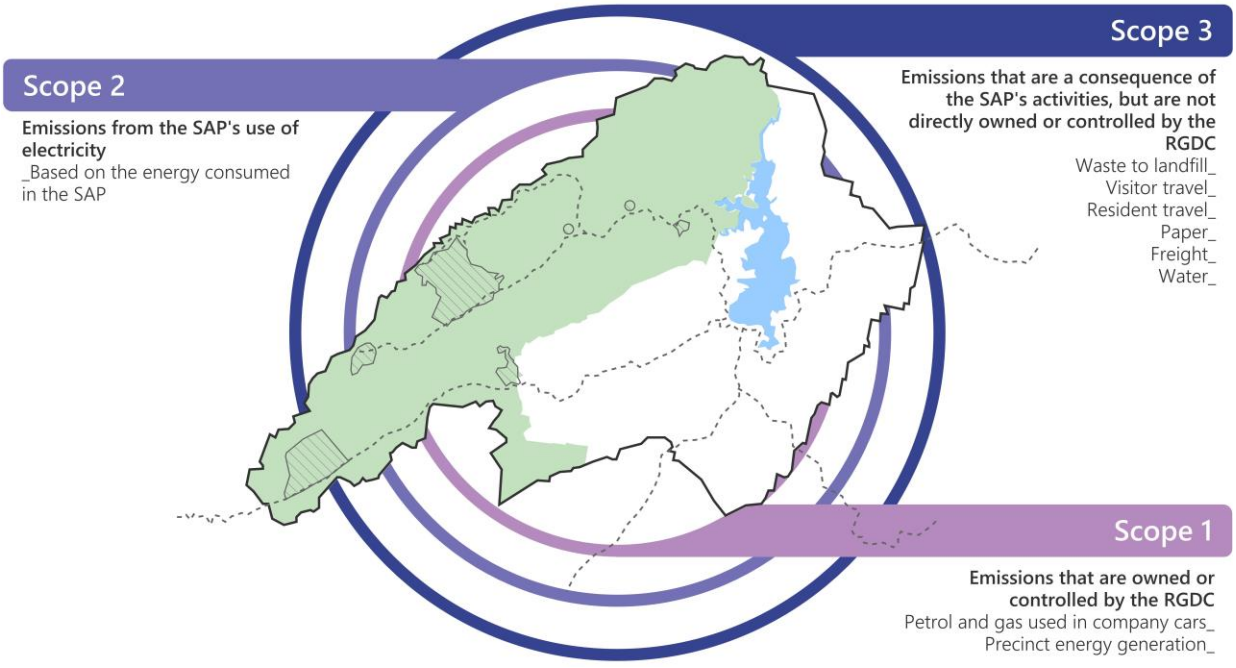
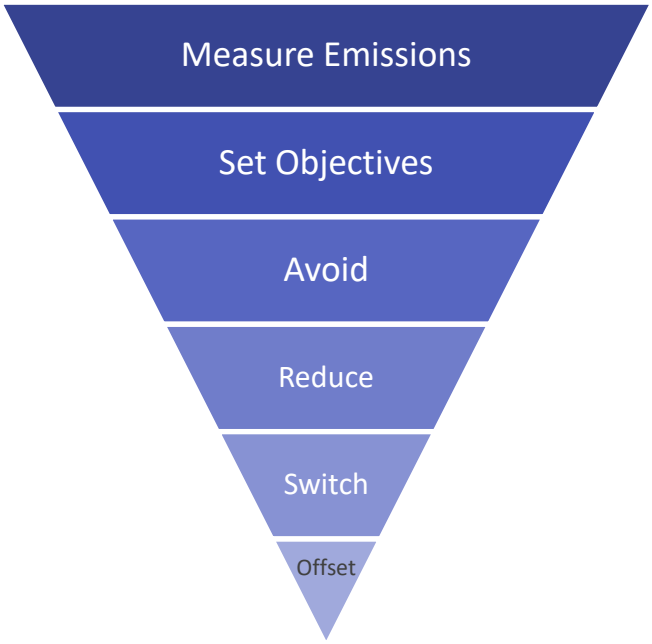


Figure 20: Snowy Mountains SAP Emissions Boundary

It is recommended a governance structure is implemented to ensure emissions can be accurately tracked and ownership allocated.

Following the emissions boundary and sources being confirmed, the below diagram (refer Figure 21) shows the pathway to reducing carbon emissions with the aim of achieving net zero 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 or carbon sequestration for any remaining emissions.

Figure 21: Emissions Reduction Pathway

4.2.3 Snowy Mountains SAP emissions

The Snowy Monaro Regional Council has developed an emissions inventory which has identified that the region's community emissions totalled 741,800 tonnes of CO_2-e in 2018/19 (refer Figure 22). Although approximately 50% of the Snowy Monaro region's emissions are associated with agricultural processes, they are largely located outside of the study area and agricultural emissions are expected to be lower for the Snowy Mountains SAP.

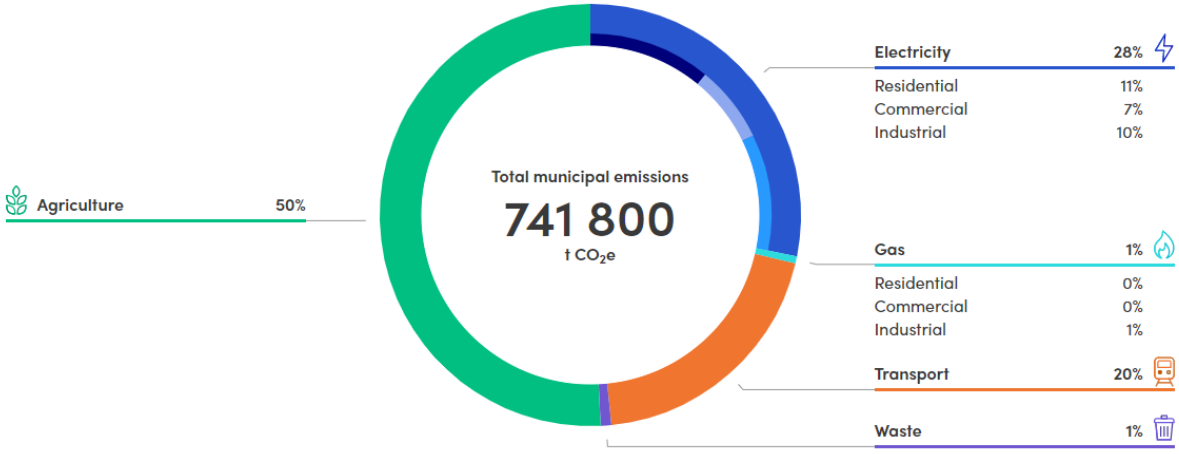


Figure 22: Snowy Monaro Regional Council Community Emissions

An analysis of the top five emissions sources based on the Snowy Monaro Regional Council's community emissions snapshot has been undertaken with the below identified for the Snowy Mountains SAP (refer Figure 23):

Figure 23: Estimated Snowy Mountains SAP Emissions by Top Categories

The above emissions estimates have been based on the following assumptions and emission factors (refer Table 7). A detailed emissions calculator is being developed which will provide a more accurate emissions estimate including changes over time as emission reduction measures are implemented by the Snowy Mountains SAP.

Table 7: Emissions Assumptions

Emissions Source		Assumptions
Stationary Energy		Annual consumption from the Renewable Energy Context Analysis of 78.9 GWh of annual consumption, converted to kWh. Combined emissions factor per kWh (Scope 2 & 3) of 0.90 for NSW – National Greenhouse Accounts Factors August 2019.
Transport	**Residents**	Resident transport emissions are based on a per capita allocation of the community emissions inventory, applied to the population of the Snowy Mountains SAP.
	Visitors	Annual visits to the Snowy Mountains with 85% driving by private vehicles and the remaining by coach/bus. Average travel distance from the main visitor region sources. Average car emissions factor of 200g CO2-e per km.
Waste		Waste data captured in the Renewable Energy Context Analysis has been collated including resident resort and landfill waste. National Greenhouse Accounts Factors August 2019 – Where specific data is available emission factors by waste type have been used. Where data is not available, a combined emissions factor has been used based on total tonnes of waste.
Agriculture		A comparison of agricultural land between the Snowy Monaro LGA and the Snowy Mountains SAP has been undertaken and a factor applied to the council's community emissions inventory.
Water		Water emissions are based on a per capita allocation of the community emissions inventory, applied to the population of the Snowy Mountains SAP.

4.2.4 Carrying capacity alignment

The Carrying Capacity Framework Development by WSP identified a number of emissions related KPI's including air quality and CO_2 emissions, energy conservation and waste management, which all have direct impacts on the Snowy Mountains SAP's emissions. This also aligns with the Leadership section (refer Section 11) which identifies tools and systems that will enable the Snowy Mountains SAP to become carbon negative. Carbon offsets can be integrated within the carrying capacity framework to assist with offsetting emissions.

4.2.5 Carbon offsets and sequestration

Following the Snowy Mountains SAP's emissions boundary being set, an emissions inventory being developed, and reduction opportunities being identified and implemented, there will always be carbon emissions remaining which will need to be offset by the purchase of offset credits or through carbon sequestration.

The cost of offset credit purchase is variable and market dependent. This means that the price fluctuates on a daily basis depending upon the availability of the standard of offset required, the market demand at the time the purchase needs to be made, and the quantity of offsets required to be purchased. As demand increases and availability decreases, the price increases. The price also decreases as the quantity required increases. Essentially, basic supply and demand principles apply.

The current market price range for accredited Grade A carbon offset units that support Australian projects ranges from $14/tonne to $34/tonne. The Australian Government Treasury Report on Carbon Pricing advises that the current carbon offset range for Australia is a core price of $20/tonne, and a high price of $62/tonne. The Treasury modelling undertaken indicates that as the demand for carbon offset units increases over time, availability will decrease, and the price will therefore increase accordingly. The following is a graph of carbon price projections which have been updated to reflect current prices compared to the original Treasury projections (refer Figure 24).

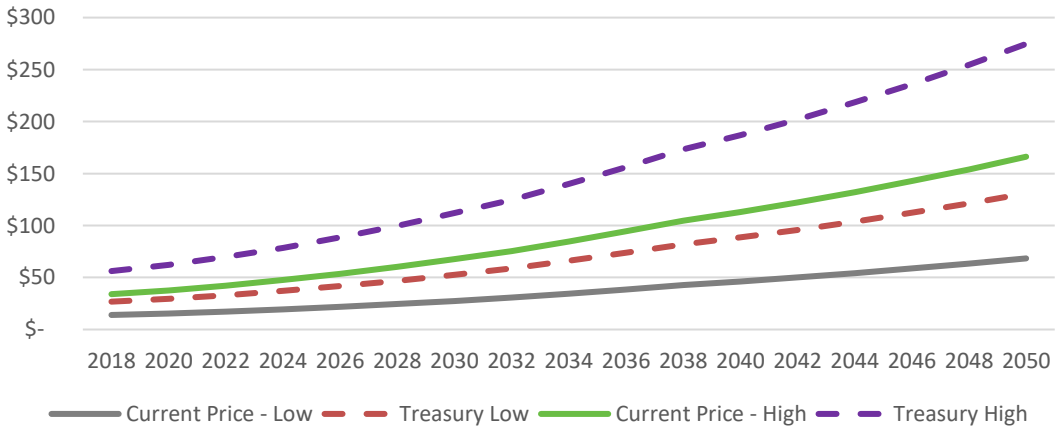


Figure 24: Carbon offset price projections

Carbon sequestration is the capture of carbon dioxide from the air and storing it in plants, soils and oceans. Sequestration occurs naturally, but additional sequestration can also occur through human actions on the land, such as revegetation or changing farming practices to increase carbon in soil. The long-term storage of carbon creates carbon sinks. Carbon sinks are an important component of reducing our overall greenhouse gas emissions.

The NSW Governments Biodiversity Offsetting scheme provides a framework for offsetting biodiversity loss due to development in the Snowy Mountains SAP, however additional offsetting and carbon sequestration will be required to reduce the Snowy Mountains SAPs emissions. It should be noted that this is not a recognised form of carbon sequestration for certification.

4.2.6 Embodied emissions

Although not captured under the Climate Active Precinct standard, embodied emissions of buildings and infrastructure constructed within the masterplan should also be considered to ensure the Snowy Mountains SAP is considering the largest emission impacts. This is important if we are to consider the Snowy Mountains SAP ESD vision of “touch the ground lightly”.

A number of major infrastructure investments in the Snowy Mountains SAP are expected to be made which will include significant embodied emissions from materials such as concrete, steel and bitumen. It is recommended that any infrastructure works include requirements for lower embodied emission materials to be specified in preference to virgin materials. Further to the embodied energy of the materials used to construct the infrastructure, the impact on vegetation and biodiversity, with associated offsetting, should be considered.

Building materials can be considered with the embodied carbon hierarchy of typical construction materials illustrated below (refer Figure 25).

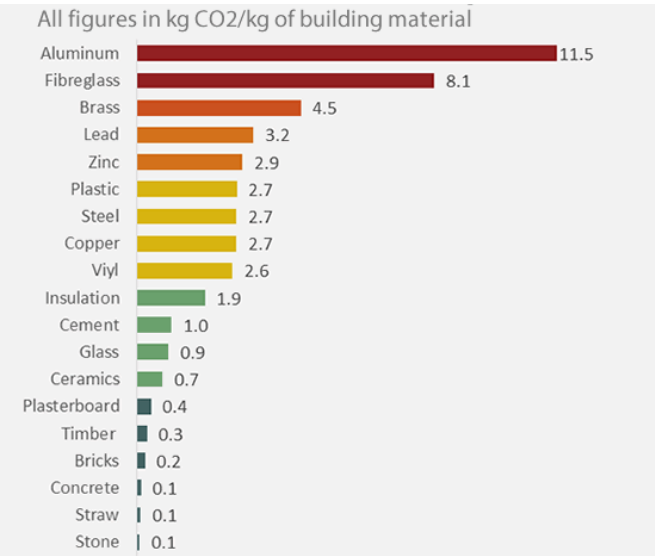


Figure 25: Embodied carbon of building materials - *Inventory of Carbon & Energy (ICE) Database*

New buildings should also consider the embodied energy of the structural framing and slabs for both building framing and substructures (refer Figure 26) with the aim of reducing embodied emissions.

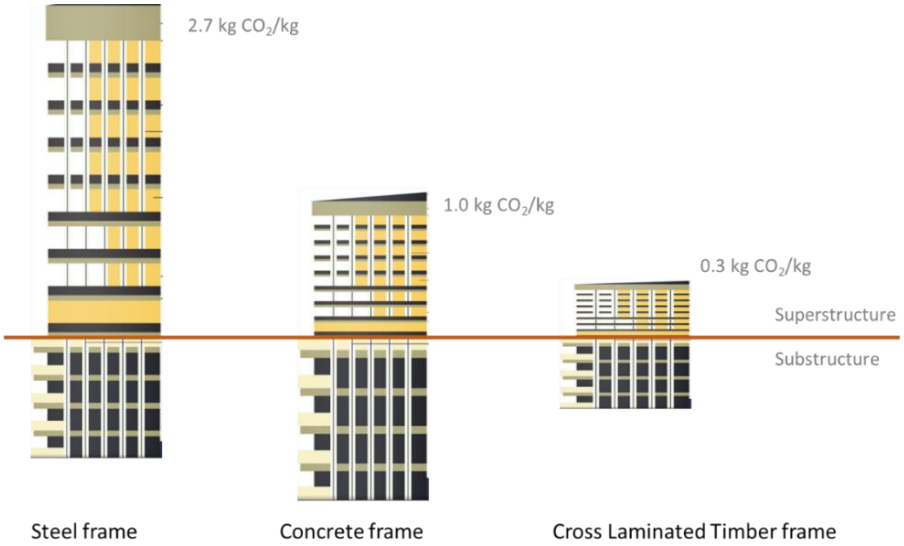


Figure 26: Inventory of Carbon & Energy (ICE) Database

Building materials and opportunities to reduce environmental impacts are outlined further in Section 8.

4.3 Opportunities

There are several opportunities to reduce emissions within the Snowy Mountains SAP which are outlined below.

4.3.1 Stationary energy

Approximately 20% of energy generated in NSW is from renewable energy supplies (wind, solar, hydro), however the majority is sourced from coal, followed by gas powered power stations. The NSW Electricity Strategy, emissions reduction targets, Renewable Energy Zones (REZs) and Snowy 2.0 are expected to increase renewable energy in NSW significantly. This will assist in reducing stationary energy emissions which will be a direct benefit to the Snowy Mountains SAP. However, this transition will take time and it is recommended that this is taken into account when developing a timeframe for becoming carbon negative and that renewable energy and energy efficiency is maximised in the Snowy Mountains SAP to reduce energy emissions as per Sections 5. It should be noted that the latest published emissions data for NSW is from 2017 and renewable energy would have increased in 2018 and 2018 as large-scale renewable energy projects were completed and with the uptake of rooftop solar PV.

The WSP energy team have explored several renewable energy opportunities for the Snowy Mountains SAP including roof-top, ground mounted and floating solar PV systems. Based on discussions and meetings with the renewable energy team, the scale of these systems is in the range of 5-10MW with a 10MW system capable of generating approximately 15GWh. When compared to the Snowy Mountains SAP's estimated energy demand of 78.9GWh, this equates to approximately 20% of the energy demand.

It is recommended that renewable energy is maximised in the Snowy Mountains SAP to reduce emissions and work towards emission targets. Renewable energy opportunities are captured in Section 5.3.3.

4.3.2 Transport

Transport emission are affected by a range of factors including fuel and vehicle type (petrol, diesel, hybrid electric, electric vehicles and hydrogen vehicles), fuel and vehicle efficiency standards (e.g. Euro 5/6) and the age of the vehicles. On average, for medium to large vehicles which would likely be used to travel to the Snowy Mountains, emissions are approximately 200g CO_2-e per kilometre travelled (refer to Table 7 for a summary of emissions by vehicle type for new vehicles). This is based on the manufacturer's laboratory testing data. Table 7 lists emission per vehicle type, with colour indicating higher emissions (transitioning to red as higher emitters).

Table 8: Average Vehicle Emissions by Vehicle Segment

Vehicle Type - Reporting Format	Petrol CO2 Emissions (g/km)	Diesel CO2 Emissions (g/km)
Small Car	139	122
Small SUV	164	130
Medium Car & SUV	172	142
Large Car & SUV	244	193
Utility	247	207
Small Van	158	126
Large Van	278	203

Based on 200g per km, a standard trip from Sydney to Jindabyne (approximately 920km return) would equate to 184kg CO_2-e per vehicle that travels to the region. The following table outlines average transport emissions based on various transport types and destinations (refer Table 9).

Table 9: Transport emissions comparison

Vehicle type	**Average emissions** (g CO2-e / km)	**Location**	**Travel Distance (Return)**	**Total Emissions Per Person / Vehicle** (kg CO2-e)
Diesel Car	200	Sydney to Jindabyne	920	184
Petrol Car	250	Sydney to Jindabyne	920	230
Electric vehicle (NSW grid charge)	110	Sydney to Jindabyne	920	101
Electric vehicle (100% renewable powered)	0	Sydney to Jindabyne	920	0
Hydrogen cell vehicle (100% green hydrogen)	0	Sydney to Jindabyne	920	0
Diesel train (theoretical)	90	Sydney to Jindabyne	920	83
Hydrogen train (theoretical – 100% green hydrogen)	0	Sydney to Jindabyne	920	0
Commercial Jet Plane	170	Sydney to Canberra	480	82
Hydrogen Plane (100% Green hydrogen)	0	Sydney to Canberra	480	0

It should also be noted that real world testing of vehicle emissions by the Australian Automotive Association demonstrated that actual emissions vary significantly (refer Figure 27) and as a result, passenger vehicle emissions are expected to be higher. This also has an impact on air quality with diesel vehicles in particular exceeding NOx levels significantly which in turn does not align with Snowy Mountains SAP's "touch the ground lightly" aim.

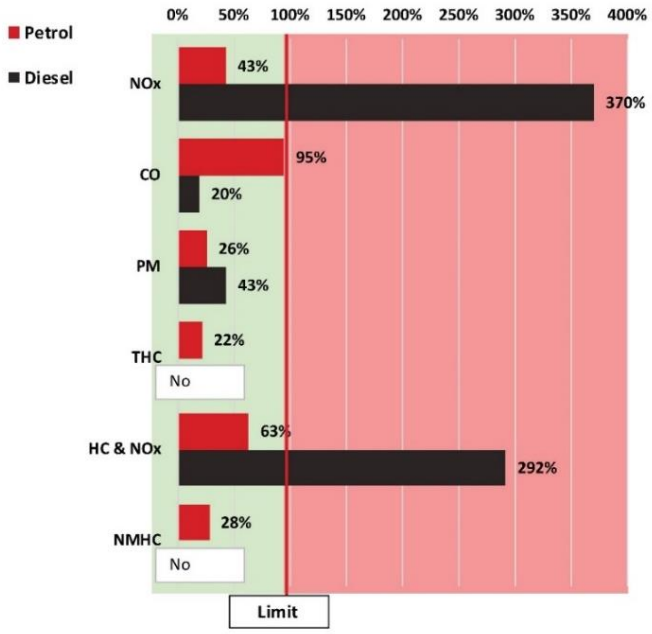


Figure 27: Real World Emissions vs. Laboratory Limits

By comparison, the emissions generated by an electric vehicle (EV), charged using electricity from the NSW grid, would be approximately half that of a petrol or diesel equivalent (100-120g CO2-e per km travelled). In locations where renewable energy penetration is higher such as South Australia, the emissions reduction would be even greater with the emissions reducing to approximately 70g CO_2-e.

With over 960,000 visitors per year and >85% travelling by private vehicle, current emissions generated by visitors travelling to the region equates to approximately 78,000 tCO_2-e per year. This is a significant emissions source which will need to be considered in the Snowy Mountains SAP's aim of becoming carbon negative.

To assist in reducing travel emissions to the region, it is recommended that low and zero emission transport options are supported including:

- Electric vehicles (EVs) with charging infrastructure provided.
- Hydrogen cell vehicles including trains, planes, trucks, buses and cars.
- Increased public transport options.
- Active and sustainable transport such as walking and cycling and assisted options such as e-bikes.

These topics are explored further in Section 7 Mobility.

It should be noted that although the emissions associated with the travelling to the region are captured within the Climate Active Precinct Standard, the cost associated with carbon offsets could be transferred to the visitor. For example, the carbon offset cost could be added to parking fees with the money used to create a Snowy Mountains SAP emissions reduction fund which is used to implement the above zero emission support measures and development carbon offset programs within the Snowy Mountains SAP.

Based on the emissions associated with private vehicle travel to the region, carbon offset prices would range between $1.2M to $2M per annum. However, if this were applied to each visitor that drives to the Snowy Mountains SAP, the cost would be approximately $3-5 per visitor which could be absorbed into car park fees. It is recommended carbon offsets are considered as part of visitor passes or car parking fees which will provide an immediate budget to implement emission reduction programs in the Snowy Mountains SAP. EVs charged from 100% renewable energy should be exempt from the offset charge.

4.3.3 Waste to landfill

Landfill waste and the generation of greenhouse gas emissions (e.g. methane and NOx) will need to be taken into consideration for the resident community, businesses and resorts within the Snowy Mountains SAP. With the projected increase in population and planned activities, there is a risk that the Snowy Mountains SAP will result in increased waste generation and associated emissions. In addition, the Jindabyne landfill site is projected to reach capacity within the next 3 years and therefore reducing waste to landfill should be a priority from both an operational and emissions perspective.

There are a number of opportunities to offset the potential waste generation increases including:

- Implementing waste education programs to reduce waste generation, increase waste separation and reduce waste to landfill.
- Create circular economy synergies between businesses and industry in the Snowy Mountains SAP to maximise resource efficiencies.
- Implementing procurement policies and procedures to increase the procurement of local materials and transition to options with less packaging and compostable packaging.
- Waste infrastructure and processing centres are provided to support the Snowy Mountains SAP and facilitate increased waste diversion and recycling rates. This should be investigated as a high priority to reduce waste to landfill and minimise the size of and landfill expansions required.

These options are explored further in Section 9.

4.3.4 Refrigerants

Refrigerants will be used within the Snowy Mountains SAP for air-conditioning systems in buildings and as part of refrigerated transport. Refrigerants are gradually being phased over to lower Global Warming Potential options in line with the Australian Government's hydrofluorocarbon (HFC) phase-down program under the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989.*

However, refrigerants will continue to contribute to the Snowy Mountains SAP's emissions and will need to be considered as part of the carbon boundary and inventory. There are opportunities to support the transition to lower GWP refrigerants for buildings and transport however this would be a specific project more suited to the proposed precinct Environmental Management System (EMS).

4.3.5 Water and wastewater

Emissions associated with water treatment and pumping will need to be considered, particularly in the context of potential increases development and in snow making requirements due to climate change. As a result, water consumption will need to be effectively tracked and water efficiency improvements implemented to reduce emissions.

Local capture and reuse of water will reduce water related emissions. Similarly, localised treatment of wastewater to be suitable for reuse will lower wastewater emissions.

Further detail on water and wastewater opportunities which will in turn reduce emissions are outlined in the Circular Economy section of this report.

4.3.6 Procurement

The procurement of goods and services as part of the Snowy Mountains SAP's operations will need to be considered including furniture used in fit outs (e.g. the school) and the procurements of goods such as paper. It is recommended procurement guidelines are developed to preference carbon neutral and low environmental impact options to reduce emissions associated with procurement.

4.4 Roadmap to Carbon Negative

In line with the aspiration for the Snowy Mountains SAP to be a climate positive, carbon negative region, a carbon negative roadmap has been developed using the emissions calculator outlined in Section 13. The emissions calculator incorporates initiatives that have been included in the Snowy Mountains SAP Structure Plan and referenced technical reports, and will allow new initiatives to be added as additional projects/initiatives are identified. Additional opportunities to reduce emissions has also been incorporated to demonstrate the impact of transitioning to implementing emission reduction initiatives.

A baseline carbon emissions projection has been developed which takes into account the expected uptake of renewable energy and transition to low and zero emission technologies over time. The baseline projections include:

- Renewable energy projections for NSW which take into account the NSW Government's Electricity Strategy and Renewable Energy Zones and are the main driver for emissions reduction over time.
- Energy consumption reduces by 1% per annum as older building stock is replaced by newer, more efficient buildings, and as a result of energy efficiency improvements.
- Electric vehicle (EV) uptake projections for Australia.
- Landfill waste diversion reducing marginally from 2020-2030. Additional landfill reductions may also be possible following the implementation of improve waste management infrastructure and services.
- Vehicle efficiency (internal combustion engine vehicles) have been projected to increase marginally prior to being replaced by hybrid vehicles and EVs.
- Water emissions are projected to remain constant.

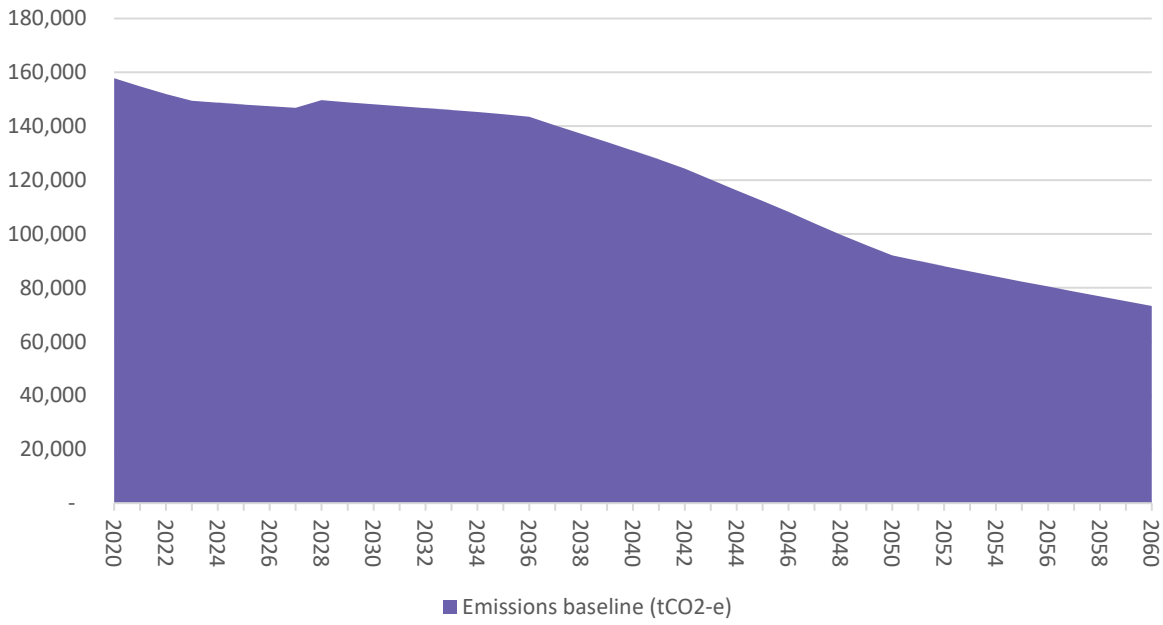


Figure 28: Baseline emissions projection

In the above graph there is a steady reduction in emissions over the next 40 years which is largely due to the increasing share of renewable energy in the NSW grid. The emissions reduction is offset in the first 10 years due to increasing visitor numbers with increases in energy, water, waste and transport emissions.

4.4.1 Emissions reduction roadmap

An initial emissions reduction roadmap has been developed in line with the emissions opportunities that can be implemented to reduce emissions as far as practicable as part of the Snowy Mountains SAP. The roadmap includes the following initiatives which demonstrate that there are significantly opportunities reduce emissions in the Snowy Mountains SAP including:

- **Energy:**
    - **Energy efficiency improvements:** Implementing energy efficiency initiatives that reduce existing consumption by 1% per annum.
    - **100% renewable energy PPA with Snowy Hydro** with a 50% utilisation assuming that not all residents and businesses will choose to participate.
- **Transport:** The following initiatives have been incorporated:
    - **Zero emission buses/coaches:** Transitioning buses and coaches to zero emission options (electric/hydrogen) from 2025.
    - **Zero emission pedestrian / cycling / MaaS:** Transitioning from private vehicles to walking, cycling and MaaS from 2021.
    - **Zero emission flights:** Transitioning to hydrogen flights from 2030.
- **Water:** Transitioning to alternative water supplies such as rainwater harvesting and recycled water supplies.
- **Waste:** Increasing waste separation rates to reduce waste to landfill.

Based on the above initiatives, the below emissions projection (refer Figure 29) has been developed to demonstrate that implementing emission reduction measures has the potential to reduce emissions by over 50% (or approximately 40,000 tCO2-e) by 2060.

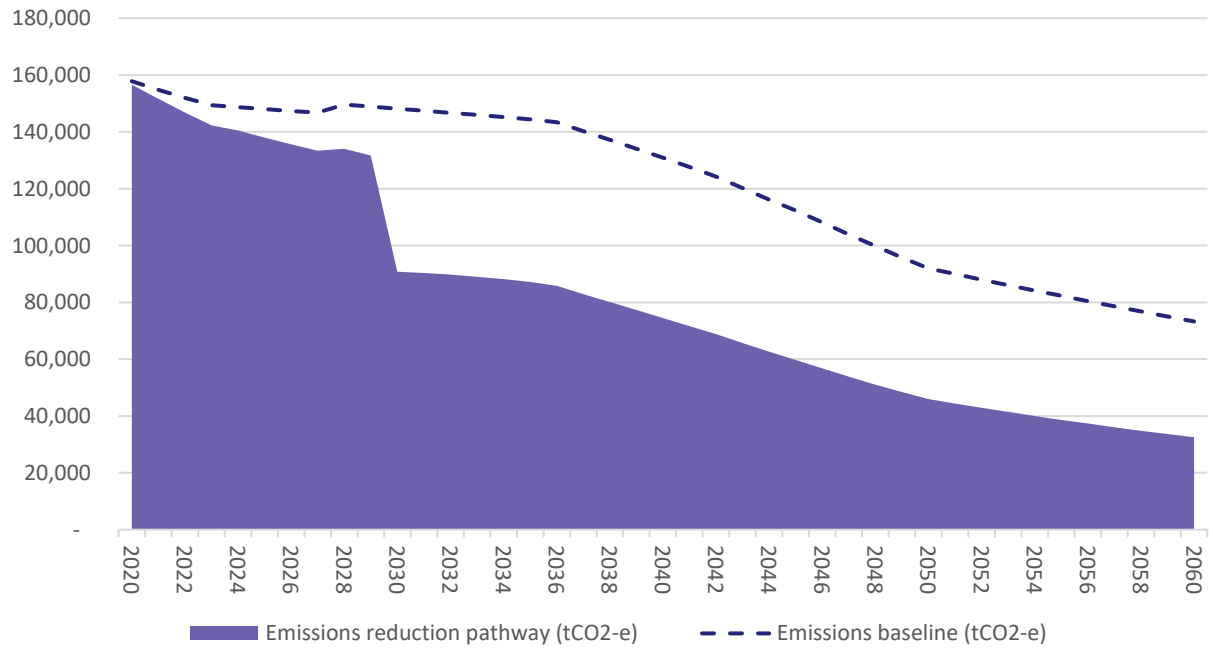


Figure 29: Emissions reduction pathway

This is a large reduction in emissions and demonstrates that by embedding emission reduction measures into the Snowy Mountains SAP Structure Plan, Delivery Plan and Precinct Design Guidelines, the project

can make a significant contribution to reducing emissions for the region, NSW and Australia in line with national and International commitments.

However, the remaining emissions will still need to be reduced and offset in line with Section 4 of this report to achieve the Snowy Mountains SAP's aim of being a climate positive, carbon negative precinct. This includes investigating additional emission reduction initiatives, increasing the targets set for various emission reduction initiatives already identified, and implementing carbon offsetting and sequestration projects to reduce the remaining emissions to zero.

4.4.2 Carbon negative roadmap

To achieve a carbon negative outcome the Snowy Mountains SAP will need to implement additional emission reduction measures over time and as new technologies are introduced. However, there will always be emissions which cannot be reduced to zero and therefore carbon sequestration and offsets will need to be considered as per Section 4.2.5.

To provide a high-level insight for carbon sequestration, in the event the Snowy Mountains SAP were to implement carbon sequestration programs for 2% of the emissions per annum, the project would need to plant the equivalent of approximately 100,000 trees per annum. The land required for this number of trees is not expected to be viable and in addition, the trees would take approximately 10 years to sequester the carbon emissions incorporated into the calculations.

As a result, to achieve the goal of becoming a carbon negative precinct, the Snowy Mountains SAP will need to implement a carbon offset program for the remaining emissions. This will need to consider the emissions ownership (visitors, council, RGDC, resorts, businesses, etc.) as per Section 4.2.2 as the emission will be too large for a single organisation to take responsibility for.

The below projections (refer Figure 30) include the carbon sequestration and offsets required to reduce the Snowy Mountains SAPs emissions to zero based on the carbon offset price projections outlined in Section 4.2.5.

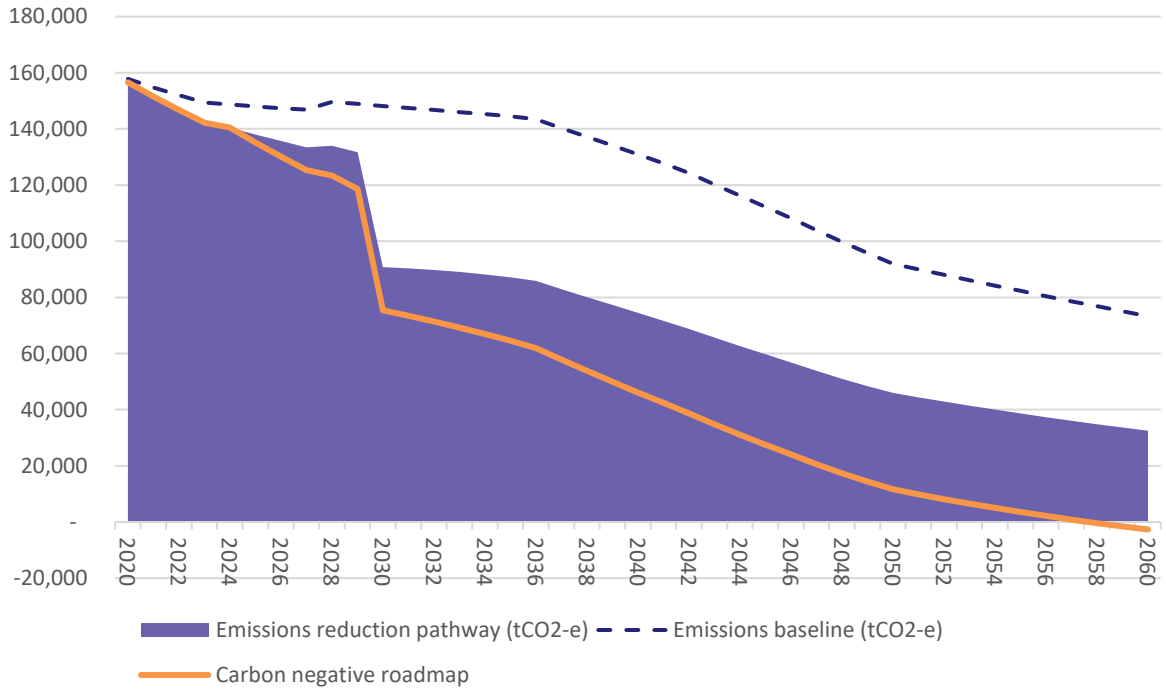


Figure 30: Carbon negative roadmap

It is recommended that the following initiatives are incorporated into the Snowy Mountains SAP Master plan, Delivery plan and management and operational processes:

- Emissions reduction initiatives are incorporated to reduce the Snowy Mountains SAP's emissions are far as practicable to reduce emissions prior to carbon sequestration and offset programs.
- A strategy and timeframe for achieving carbon neutrality is developed which captures ongoing monitoring requirements, emission reduction initiatives, roles and responsibilities and operating budgets.
- Monitoring and improvement programs are incorporated into the Snowy Mountains SAP's ISO 14001 Environmental Management System (EMS).

Final carbon negative roadmap

Following all of the above being planned for and incorporated, the below is an example carbon negative roadmap for the Snowy Mountains SAP with an emissions reduction pathway and carbon negative pathway outlined (refer Figure 31 and 32).

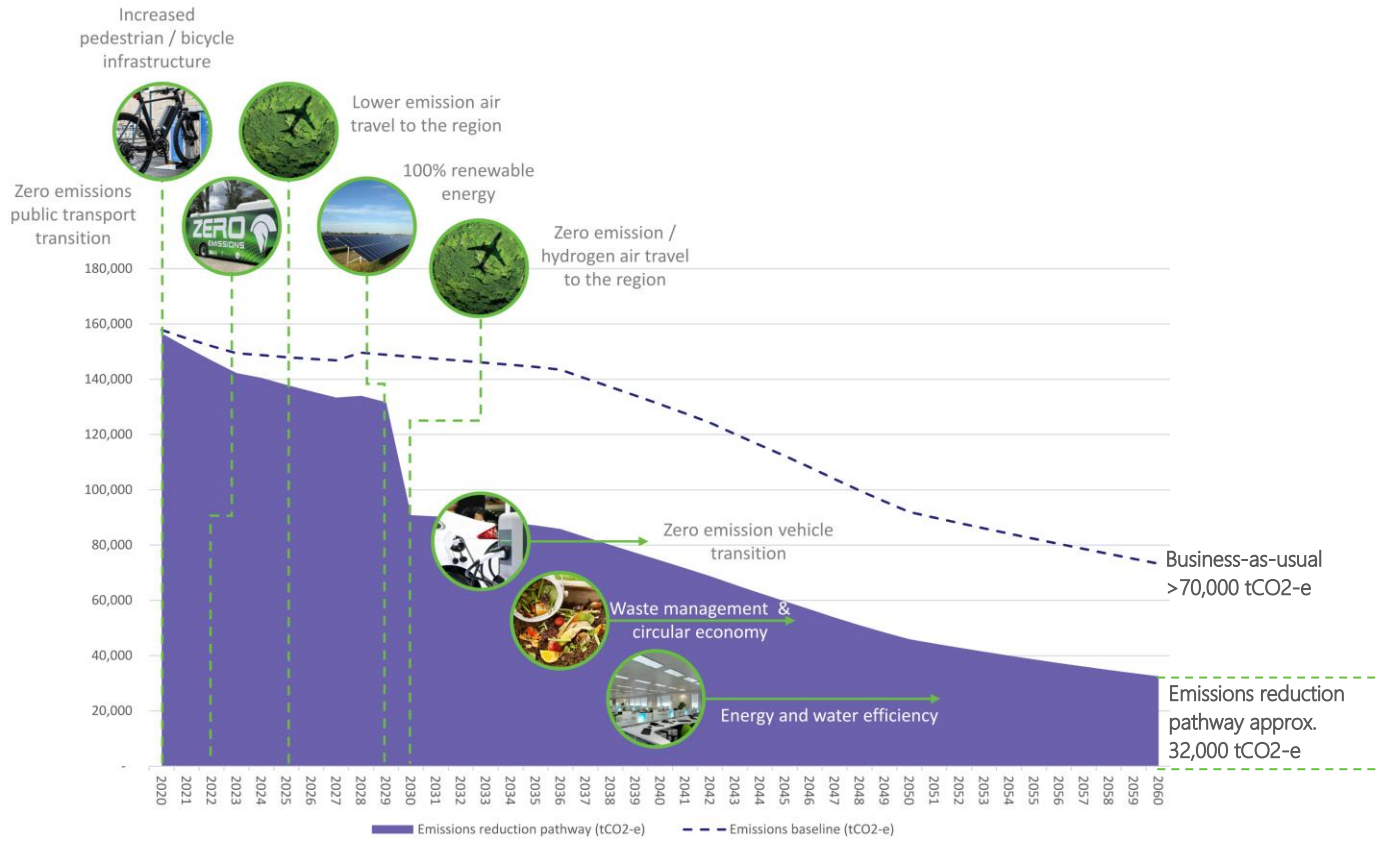


Figure 31: Carbon negative roadmap – No offsets/sequestration

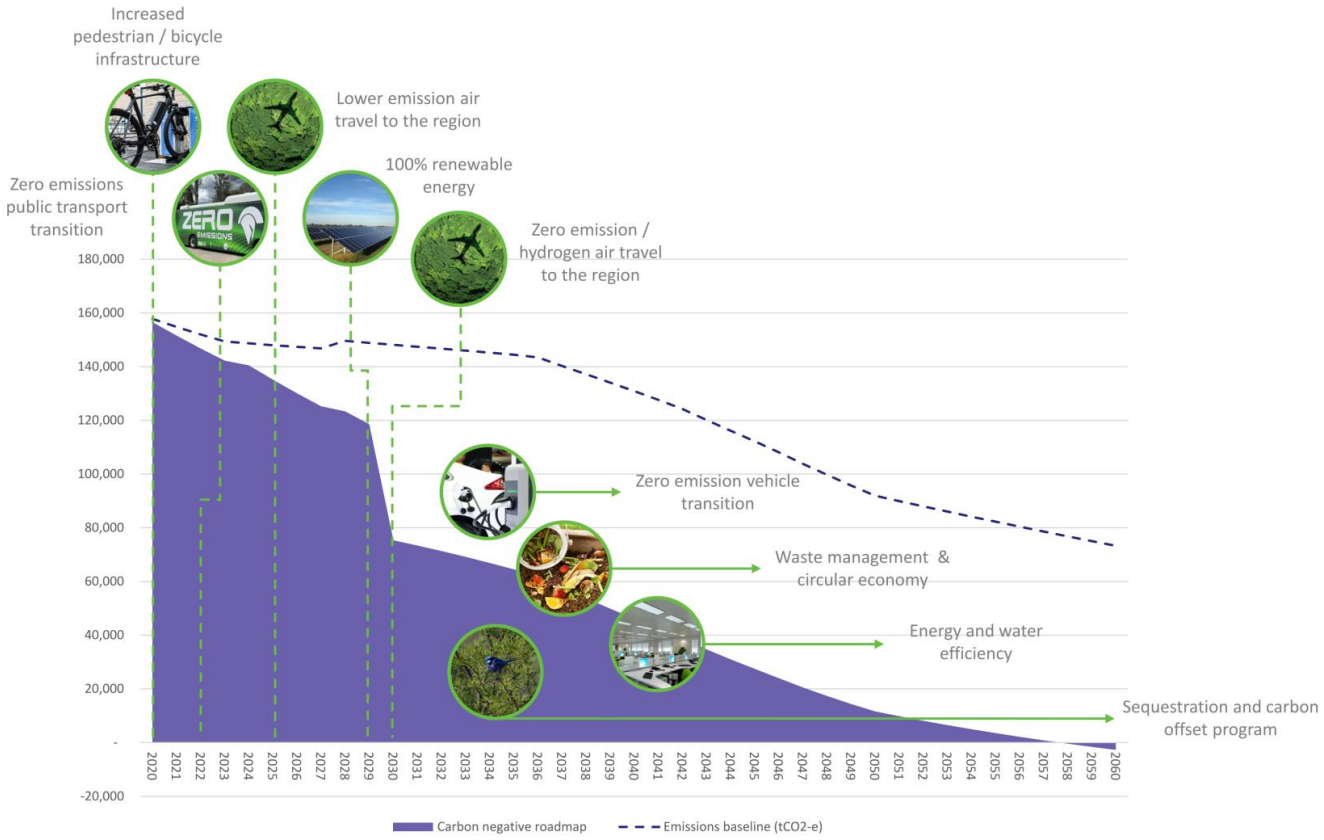


Figure 32: Carbon negative roadmap - Carbon sequestration/offset program

4.5 Snowy Mountains SAP vision alignment

Emissions reduction initiatives are aligned with the following Snowy Mountains SAP Vision topics:

Our proposed Emissions theme vision is:

Reducing emissions beyond zero

This compliments the Snowy Mountains SAP visions of 'Sustainability & Wellness' and 'Infrastructure and Connections' by reducing emissions while facilitating improved sustainable transport systems.

4.6 Outcomes of the Structure Plan

To ensure that carbon emissions are accurately measured, avoided where possible and reduced over time, the following ESD opportunities have been incorporated into the Structure Plan:

- An emissions boundary is incorporated into the Structure Plan to accurately account for the Snowy Mountains SAP's emissions.
- A framework for reducing emissions is developed with options for energy efficiency, renewable energy and circular economy opportunities incorporated.
- A carbon negative target and timeframe is confirmed to ensure the Snowy Mountains SAP can become carbon negative in a viable manner.
- Opportunities to reduce emissions Delivery Plan and Precinct Design Guidelines with reducing emissions are explored.

5 Energy

5.1 Introduction

Increased tourism, development and the planned growth of the region will result in increased energy consumption, demand, emissions and costs. In line with the NSW Electricity Strategy, National Energy Productivity Plan and emission reduction targets at both a state and federal level, the Snowy Mountains SAP will need to ensure that energy is effectively managed, renewable energy maximised and reliability secured. In particular, the Snowy Mountains SAP will need to align with the Net Zero Plan Stage 1: 2020-2030 which aims to reduce emissions by 35% by 2030 of which energy will be a key component.

The following section provides a summary of energy assets in the Snowy Mountains SAP and opportunities to improve energy management while ensuring renewable energy is maximised.

5.2 Context analysis

The Snowy Mountains SAP is connected to the National Electricity Market (NEM) with significant generation assets, electrical infrastructure and renewable energy opportunities located within, in close proximity and in adjacent regions to the Snowy Mountains SAP. This includes assets within the Snowy Mountains SAP (refer Figure 33) and the following:

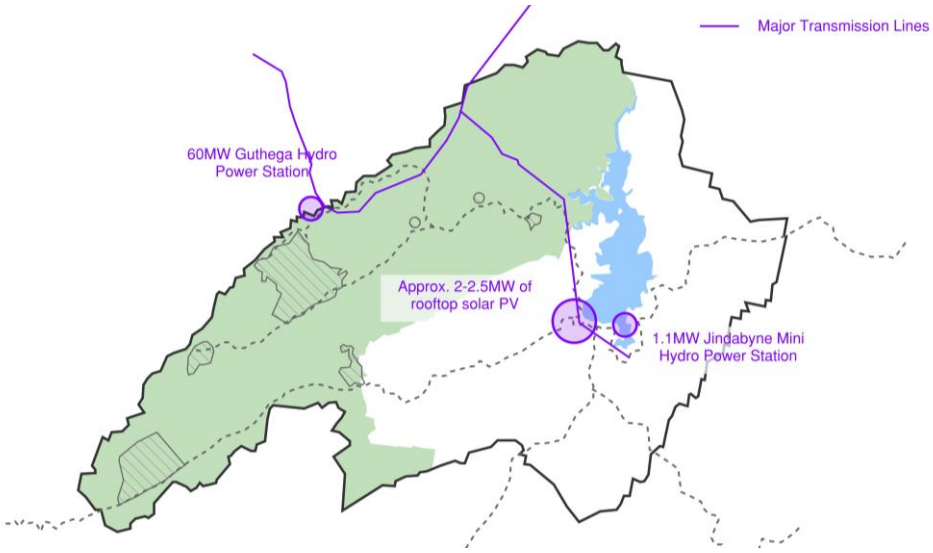


Figure 33: Energy Assets

- Hydro generation in the Snowy Mountains SAP (60MW Guthega Power Station on the boundary and 1.1MW Jindabyne Mini Hydro Power Station)
- Proposed South-West Renewable Energy Zone (refer Figure 34) to the west of the Snowy Mountains SAP
- Snowy 2.0 and SnowyLink projects
- Improved interconnectivity to Victoria and South Australia
- Planned and potential renewable energy projects in and around the Snowy Mountains SAP.

In line with the NSW Electricity Strategy, Renewable Energy Zones (REZs) have been proposed with the Central West and New England REZs committed to and the South West REZ under investigation. Although the REZs are not in close proximity to the Snowy Mountains SAP, they will benefit the area by increasing the share of renewables in the NSW electricity grid. The planned network upgrades to increase connectivity and accommodate the increased capacity of Snowy 2.0 will also assist.

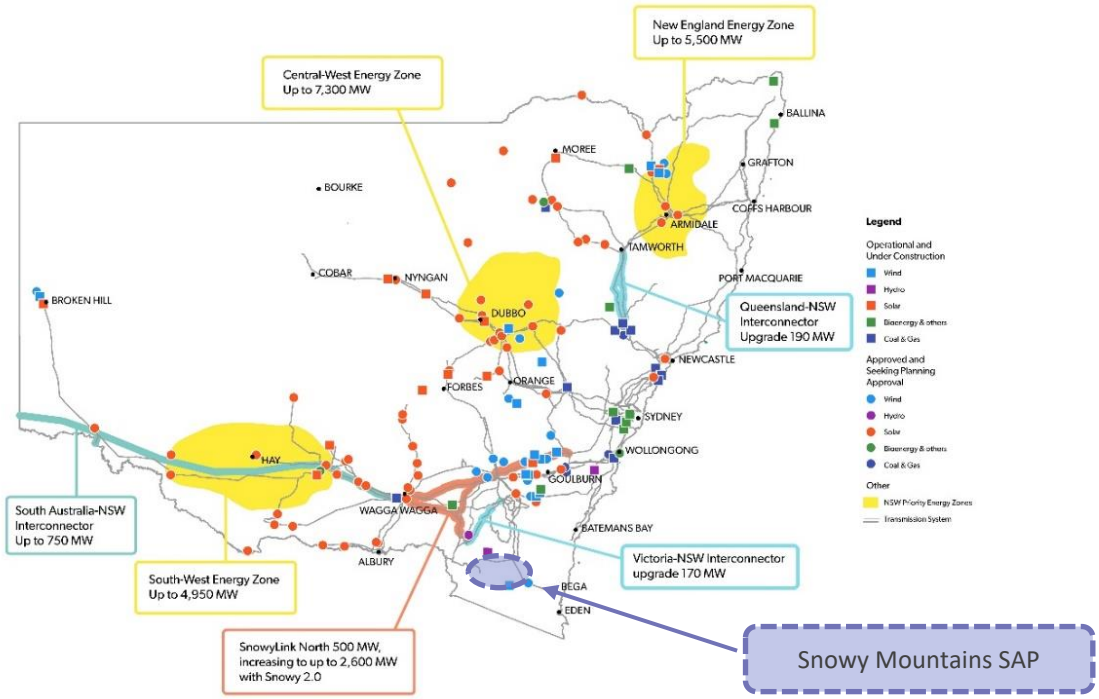


Figure 34: Renewable Energy Zones (REZs)

In addition to major generational assets in the region, rooftop solar PV systems have been installed on 18.1% of residences in the Snowy Monaro region which is expected to be similar for residences in the Snowy Mountains SAP. This is slightly lower than the state average of 20.4% and there are no systems greater than 100kW in the region. The estimated capacity of these systems is approximately 9.2MW which would generate approximately 13.8GWh per annum. Based on the number of dwellings in the Snowy Mountains SAP, it is expected that approximately 2-2.5MW of the rooftop solar PV systems are located in the Snowy Mountains SAP generating 3-3.5GWh per annum.

The renewable energy assets in the Snowy Mountains SAP are as follows (refer Table 10).

Table 10: Renewable energy assets

Generation Asset	Size (MW)	Annual Generation (GWh)
Guthega Power Station	60	>125
Jindabyne Mini Hydro Power Station*	1.1	Data not available publicly
Rooftop Solar PV	2-2.5	>3
Total	**63.1**	**>128**
Snowy Mountains SAP Annual Electricity Consumption		**88.7**
% Renewable Energy		**>150%**

*Mini hydro not originally in the Snowy Hydro scheme and smaller in capacity

Combined, these assets generate more energy than the Snowy Mountains SAP consumes. However, due to the Snowy Mountains SAP being connected to the NEM which is a combination of renewable and fossil fuel-based energy, the flow and peak of energy may result in non-renewable forms of energy being imported into the grid when demand is high, when hydro power is reduced due to market fluctuations and during planned maintenance and shutdown periods.

For example, based on generational data from AEMO during July 2020, the 60MW Guthega Power Station was operating at approximately 50% capacity (30MW) for the majority of the month with only 2 days where generation increased to full capacity and was not operating at all times (refer Figure 35). This is likely due to demand in the NEM, in response to NEM wholesale prices and to take advantage of alternative revenue streams such as Frequency Control Ancillary Services (FCAS). As a result, when the Guthega power station is not generating, energy is being imported from the rest of NSW which is heavily reliant on coal power and therefore the Snowy Mountains SAP is not powered by renewables at all times.

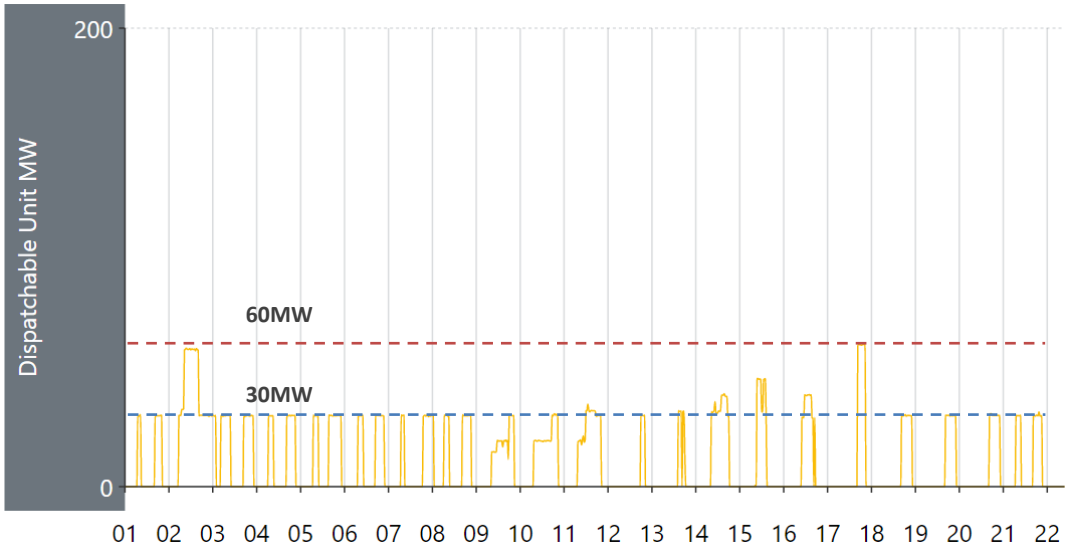


Figure 35: Guthega Generation Data - July 2020

Furthermore, the renewable energy is being traded on the NEM and although the actual electrons may be consumed within the Snowy Mountains SAP, electricity and carbon accounting methods result in this energy not being attributed to the Snowy Mountains SAP but sold to other customers in the NEM.

An example of this is the 120MW Bomen Solar Farm in the Wagga Wagga SAP where the solar is connected to one of the main sub-stations in the SAP, and therefore would be directly supplying the SAP with renewable energy. However, the renewable energy had already been contracted as part of a Power Purchase Agreement (PPA) with Westpac securing 45% of the energy generated over the next 10 years.

It is therefore important that the project supports additional renewable energy systems to ensure that the Snowy Mountains SAP is powered by renewables at all times. This could be achieved by PPA's or innovative structures where the RGDC become an energy retailer if private investment is not immediately viable. Any renewable energy systems proposed for the Snowy Mountains SAP will need to consider the environmental impact and touch the ground lightly.

To ensure the Snowy Mountains SAP takes advantage of the renewable energy opportunities and to improve energy security and reliability, planning will be required to ensure the Snowy Mountains SAP can:

- access these resources both as part of physical infrastructure upgrades and by implementing innovative solutions to connect virtually;
- improve energy efficiency and peak demand management;
- increase monitoring and control capacity;
- support a transition from fossil fuels to renewable energy supplies; and
- improve energy security and reliability.

Refer to Appendix A for the SWOC analysis undertaken for Energy in the Snowy Mountains SAP.

5.2.1 Energy demand

There are a number of factors associated with the development of the Snowy Mountains SAP and transitioning to alternative systems that will alter the energy demand including:

Table 11: Energy Demand Analysis

Increased energy consumption and demand due to	Reduced non-renewable energy consumption and demand due to
New buildings and infrastructure	More efficient buildings and infrastructure replacing older assets
Electric Vehicle (EV) charging infrastructure	Increased temperatures due to climate change reducing heating requirements for buildings during winter
Increased snow making due to climate change	Increased uptake of renewable energy
Increased temperature and prolonged heat waves due to climate change resulting in increased energy consumption for building cooling.	Potentially reduced snow making in certain regions when no longer viable due to climate change

5.2.2 Transport energy demand

One of the largest increases in energy demand is expected to be associated with the provision and use of EV charging infrastructure to support a transition to EV's. The below provides an example of the increase in energy consumption based on the projected cumulative uptake of EVs by AEMO for NSW (refer Section 7.3.6), the number of vehicles driving to the Snowy Mountains SAP, increased visitation in a medium growth scenario and based on a 70% charge of an average sized EV battery (refer Figure 36). This assumes that EV owners will charge once at the Snowy Mountains SAP following a longer drive to the region.

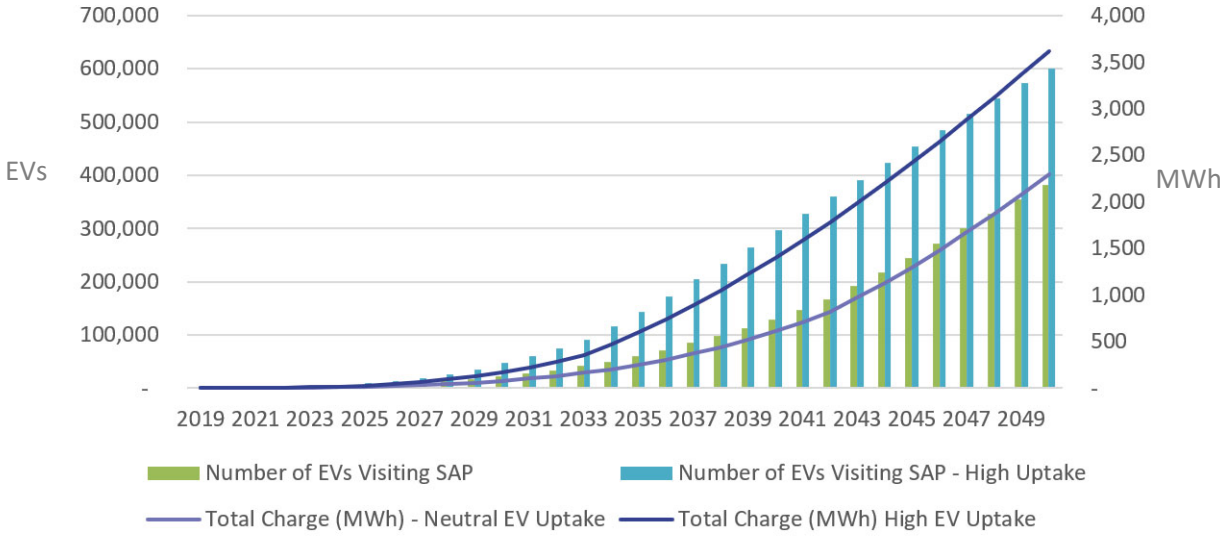


Figure 36: EV Uptake and Energy Consumption in the Snowy Mountains SAP

5.2.3 Hydrogen

In line with Australia's National Hydrogen Strategy, hydrogen production, utilisation and export has been identified as a high priority to maximise Australia's energy resources and transition to a low carbon economy. In addition, the NSW Government has set a target to blend up to 10% hydrogen into the existing natural gas network by 2030.

The National Hydrogen Strategy has identified the following hydrogen opportunities for Australia (refer Figure 37).

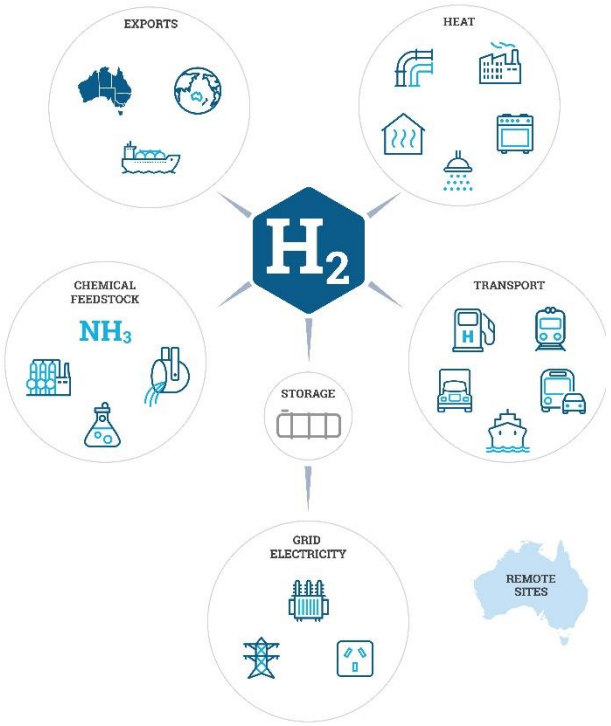


Figure 37: Hydrogen Opportunities - National Hydrogen Strategy

Hydrogen is a fuel that has zero carbon emissions when consumed, and if created using renewable energy can be a zero-emission energy resource i.e. "green" hydrogen. There are multiple definitions of hydrogen production as follows:

- **Green Hydrogen:** Produced from 100% renewable energy using electrolysis with zero emissions during production and consumption.
- **Blue Hydrogen:** Produced from fossil fuel energy supplies (e.g. coal and gas) coupled with carbon capture and storage (CCS) to reduce emissions. It be noted that CCS technologies are still in early stages of commercial deployment and typically require government policy and subsidies to be viable. A recent report by the International Energy Agency (IEA – June 2020) has stated that CCS deployment is not on track to achieve the required carbon emission reductions typically identified in emission reduction pathways. As a result, care should be taken when increasing energy demand from fossil fuels to power hydrogen plants due to the current status of CCS technologies.
- **Grey Hydrogen:** Typically produced from natural gas using a steam methane reforming process.
- **Brown Hydrogen:** Typically produced from the gasification of coal.

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. In addition, hydrogen electrolyser demonstration plants are being implemented across the country with projects underway as per the below (refer to Table 12).

It should be noted that the demonstration plants are typically coupled with a renewable energy source to generate "green" hydrogen and ammonia. Where a fossil fuel energy source is used, they are heavily reliant on carbon capture and storage (CCS) technologies to reduce emissions and generate "blue" hydrogen. In these cases, they are unable to be marketed as a zero-emissions fuel supply unless additional renewable energy agreements are entered into which should be considered for both domestic and international markets.

Table 12: Australian Hydrogen Projects

Location	Organisation	Size	Output	Power Source	Grant Funding
Western Sydney NSW	Jemena	0.5MW	Hydrogen	Solar and Wind	ARENA
Tonsley SA	Australia Gas Networks	1.25MW	Hydrogen	Solar	SA Government
Port Lincoln SA	The Hydrogen Utility	30MW	Hydrogen + Ammonia	Solar and Wind	SA Government
Crystal Brook SA	Neoen	50 MW	Hydrogen	Solar, Wind, Battery Storage	SA Government
Latrobe Valley VIC	Hydrogen Energy Supply Chain	Unknown – Pilot project	Hydrogen	Brown Coal with carbon capture and storage/utilisation	Victorian Government
Perth WA	Hazer Group Limited		Hydrogen and Graphite	Biogas from wastewater	ARENA

An alternative to physically connecting to renewable power is to enter into a renewable energy supply agreement such as a power purchase agreement (PPA) as outlined in section 5.3.3 below.

NSW has been key to developing the National Hydrogen Strategy and the NSW Chief Scientist and relevant NSW Government departments have been developing hydrogen hubs to support the strategy and maximise hydrogen opportunities. Port Kembla and Newcastle have been identified in the National Hydrogen Strategy as potential hydrogen hubs and were selected based on a Hydrogen Hubs Study commissioned by the Council of Australian Governments (COAG) Energy Council.

The following hydrogen opportunities are currently being investigated in NSW:

- Hydrogen production at Port Kembla and Newcastle.
- Feasibility studies into replacing fossil fuel supplies with hydrogen in steelworks (e.g. University of Wollongong and BlueScope Steel in Wollongong).
- Supplying renewable hydrogen to power plants with 10-15% blends possible.
- Supplying hydrogen to heavy transport including hydrogen powered trains and buses.
- Supplying hydrogen to new housing developments.
- Export of green hydrogen to international markets.

5.3 Opportunities

The following opportunities have been identified and included in the Structure Plan.

5.3.1 Energy efficiency

Although there is a relatively small amount of major industrial and commercial properties in the Snowy Mountains SAP, the high energy demand of alpine resorts and projected impacts of climate change, along with the planned growth as a result of the Snowy Mountains SAP, is expected to increase energy demand and therefore emissions and costs. As a result, energy efficiency and productivity provide significant opportunities to both reduce emissions and costs while supporting national and state strategies and priorities. This includes the National Energy Productivity Plan to improve energy productivity by 40% between 2015 and 2030, and the NSW Electricity Strategy Energy Security Safeguard energy efficiency scheme which aims to reduce consumption of gas and electricity from the wholesale market.

The 2019 update to the National Construction Code (NCC) included an update to Section J Energy Efficiency which is expected to increase the energy efficiency of new buildings and major refurbishments. Based on an analysis by the Australian Building Codes Board (ABCB), the improvement is expected to be in the range of 35% compared to the 2016 version of the NCC.

Improving energy efficiency provides a wide range of benefits including reducing consumption and costs for users, electricity network demand (improving grid stability) and emissions associated with stationary energy generation with the following opportunities identified.

Residential

Both existing and new residential developments in the Snowy Mountains SAP are expected to have significant opportunities for energy efficiency improvements which will reduce consumption, emissions and household electricity costs. With over 20% of Australia's electricity consumption being associated with the residential sector, improving the energy efficiency of new developments and upgrading existing housing stock should be a priority.

Existing programs such as the NSW Energy Savings Scheme (ESS) and the National Construction Code (NCC) Section J requirements are already targeting energy efficiency and have been achieving energy efficiency improvements. In addition, the COAG Energy Council's Trajectory for Low Energy Buildings has identified that the energy efficiency requirements in the NCC should be increased from 2022 which are expected to continue to improve the efficiency for new residential developments.

However, the Australian Sustainable Built Environment Council (ASBEC) has identified that on average, existing dwellings in Australia have a NatHERS equivalent rating of 1.7, compared to 6.1 for new homes. This identifies that existing older dwellings in the region would be comparatively inefficient and that energy efficiency upgrades may be a large opportunity for the region. This would be particularly relevant for older resorts and chalets which would have been constructed to less stringent building code requirements with lower energy efficiency outcomes.

In addition, the CSIRO Australian Housing Data portal, which tracks NatHERS energy ratings across Australia, has identified that on average NSW homes are achieving a slightly below average NatHERS rating with 6 Stars versus the national average of 6.2. Although minor, 6 Stars is the minimum NCC compliance requirement which indicates new residential housing in NSW has room for improvement.

The CSIRO and ASBEC have also undertaken studies of both existing and new housing and identified that air tightness performance (air permeability or infiltration) in households can significantly exceed assumptions in NatHERS modelling and as a result, the 6 Star rating may not be accurate. On average, households that have appropriate building sealing and are well constructed should achieve a rate of 10 air changes per hour (ACH) at 50 Pascals, however households in Sydney achieve an average 18.3 ACH @ 50 Pascals which indicates energy performance would be reduced.

Build quality and sealing should be considered as part of new housing developments and resort upgrades and is particularly relevant for alpine and sub-alpine regions where building performance is a higher priority.

The following residential energy efficiency opportunities are present:

- Incorporating improved passive design and energy efficiency requirements in planning rules and building approvals above NCC and BASIX requirements for residential developments.
- Developing a sustainability grant scheme to support energy efficiency upgrades of existing residential buildings. This could target older buildings where average performance is lower.
- Identifying residential growth areas in Snowy Mountains SAP that could be classified as a sustainable housing hub or demonstration development, targeting a minimum 7 Stars NatHERS rating. This will also align with the 2022 uptake of the NCC which is exploring an increase in the minimum NatHERS rating to 7 Stars.

Commercial

For new commercial developments, it is recommended that minimum passive design and energy efficiency requirements are incorporated into the Delivery Plan with opportunities to incorporate carbon neutral buildings as a preferred solution, and low carbon options as an alternative solution.

Existing resorts and facilities in the region would also benefit from following the Hotel Energy Solutions Key Energy Efficiency Solutions for hotels to identify energy efficiency improvements.

Building Upgrade Finance (BUF) programs may also provide an opportunity for existing building owners to implement energy efficiency upgrades which is a benefit both to the owner through improved assets and marketability (e.g. the ability to market an energy efficiency building and support a NABERS office rating) and to the tenant who typically pays for utilities. It is recommended that the Snowy Monaro Regional Council investigates BUF eligibility and a targeted program developed to provide information on BUF to commercial organisations in the region.

Improving energy efficiency and productivity will also facilitate the installation of renewable energy systems which will be designed to match efficient operations instead of installing larger systems to cover inefficient systems. This can reduce the size of the renewable energy systems and capital required and can also form part of the BUF program.

Industrial

Although there are relatively small amounts of industrial developments in the area, incorporating mandatory energy efficiency and building performance requirements will ensure that as the Snowy Mountains SAP grows, new developments work towards the Snowy Mountains SAP's aims of being carbon negative. The Precinct Design Guidelines for the Parks and Wagga Wagga SAPs are expected to provide a strong framework for improving the efficiency of new industrial developments considering the strong industrial focus of the previous SAPs.

5.3.2 Demand management

In addition to energy efficiency and productivity, peak demand management is a key opportunity to reduce both operating costs for organisations and assist in improving network stability and reliability. Peak demand tariffs (kVA) are often a significant component of commercial and industrial electricity bills and implementing demand management technologies or scheduling plant and equipment outside of peak demand periods can reduce electricity costs significantly. In addition, reducing peak demand can decrease reliance on fossil fuel powered gas plants (peaking plants) which typically increase generation or come online during peak demand periods.

Peak demand management opportunities include:

- Upgrading older plant and equipment at larger commercial sites and the resorts with more efficient systems that have a lower peak electricity demand.
- Scheduling a staggered start-up for energy intensive equipment to flatten peak demand. This may incorporate energy intensive equipment such as snow making which is expected to increase due to climate change impacts.
- Shifting operations with a high peak demand to off-peak periods when tariffs are lower e.g. scheduling energy intensive equipment outside of peak periods.
- Energy storage systems (e.g. battery or thermal storage) are charged during off-peak periods and discharged during peak periods when tariffs are higher.

The recent AEMC wholesale demand response rule change presents a significant opportunity for industrial and commercial businesses to implement demand management systems that will enable them to participate in demand response markets. This could be a combined energy efficiency and demand response upgrade that will reduce operating costs and emissions and open up new revenue streams.

Energy efficiency improvements as outlined in Section 5.3.1 will also reduce peak demand and should be considered in this context.

5.3.3 Renewable energy

As identified in the Context Analysis (refer Section 5.2), there is already significant amounts of renewable energy in the Snowy Mountains SAP to support the existing consumption. However, due to the Snowy Mountains SAP being connected to the NEM and the way carbon accounting standards are based on state-based emission factors, the renewable energy is not recognised under carbon accounting standards.

The Renewable Energy Technical Analysis by WSP has identified a number of renewable energy opportunities in the Snowy Mountains SAP and surrounding regions including:

- Rooftop solar photovoltaic (PV) systems on existing residential areas and resorts.
- Ground mounted solar PV systems over car parks.

It is recommended increased solar PV systems are supported through the Structure Plan as an opportunity to increase renewable energy generation within the Snowy Mountains SAP which will in turn support:

- An increase share of renewable energy in the Snowy Mountains SAP to offset periods when hydro power stations are not operating.
- A transition to all-electric buildings which will take advantage of renewable energy supplies compared to gas.
- A transition to electric vehicles (EVs) including private vehicles driving to area and shuttle buses and buses to and around the Snowy Mountains SAP. This includes co-locating EV charging infrastructure adjacent renewable energy systems to reduce transport emissions.
- Increased snow making to offset climate change impacts.

In addition to increasing physical renewable energy assets in the Snowy Mountains SAP, it is also recommended that renewable energy contracts are investigated to secure a 100% renewable energy supply for the Snowy Mountains SAP. This can take advantage of the existing Snowy Hydro scheme, Snowy 2.0 and large-scale solar PV and wind farms in development in adjacent regions.

There are a number of potential renewable energy procurement options available including:

- **Power Purchase Agreements (PPA):** A PPA is a direct agreement with an energy generator such as Snowy Hydro, wind farms and solar farms where a discounted rate can be secured by committing to purchasing a set volume of energy per annum. For example, Westpac entered into a PPA with Spark Infrastructure to source 45% of its electricity from the Bomen Solar Farm in Wagga Wagga which was recently completed. There are a number of PPA structures which will need to be considered and it is recommended a procurement specialist is engaged if pursued.
- **100% Renewables Expression of Interest:** An alternative to pursuing a PPA is to open an Expression of Interest (EOI) with the aim of procuring 100% renewables which allows the market to respond with innovative options. This could be expanded to include additional options such as energy efficiency improvements (Energy Performance Contracts – EPCs), demand controls and response, Virtual Power Plants (VPPs) and new forms of energy generation that could locate in the region if a contract is secured.
- **Green Power:** A more traditional approach is to enter into standard electricity contracts with an electricity retailer with 100% Green Power included. Green Power can be an added cost to standard electricity rates however recent commercial contracts have demonstrated that it is possible to secure Green Power without a significant cost impact. For example, recently negotiated electricity contracts have a reducing electricity rate over the next 3 years and although Green Power resulted in a higher price per kWh in the first year, by the second year the rate had reduced below current electricity prices. As a result, the total cost of electricity does not increase over the life of the contract.
- **Capital Funding:** Due to the relatively small scale of industry and development in the Snowy Mountains SAP, a final option is to install a solar PV farm with sufficient energy to supply the Snowy Mountains SAP's energy requirements and reduce electricity emissions to zero. Although this option requires a large capital investment, a joint solar PV farm between the NSW Government, the resorts and Snowy Monaro Regional Council may provide an economically viable solution which does not require a long-term agreement with a private operator. In addition, the solar farm could be oversized with the aim of providing renewable energy to private organisations in the Snowy Mountains SAP as a strategy to reduce emissions in a coordinated way. In this case the Regional Growth NSW Development Corporation (RGDC) would need to become an authorised electricity retailer to sell excess electricity to organisations.

Another opportunity to be investigated further is treating the Snowy Mountains SAP as a separate zone in the NEM that does not use the standardised emissions factor for NSW which is based on a higher penetration of coal power stations. Using NEM generation data, the Snowy Mountains SAP could lobby for a policy change in the National Greenhouse Account Factors where smaller regions are created which take into account the real-world generation data and apply emission factors that represent the actual share of renewable energy generation. This would both support maximising the use of existing renewable energy assets and accurately represent renewable energy in the Snowy Mountains SAP. This will need to be explored further as it will have flow on effects on emissions accounting in a range of markets.

5.3.4 Energy storage

As a simple definition, energy storage is the capture of energy generated at one point in time for use at a later time. The energy can be generated from both renewable and non-renewable sources and can be used to:

- support increased renewable energy integration by smoothing the intermittent nature of renewables (e.g. voltage and frequency control);
- reduce operating costs by storing energy during off-peak periods and discharging during peak periods;
- manage peak demand at a customer and network level;

- access alternative energy markets such as Frequency Control Ancillary Services (FCAS); and
- provide back-up power provisions while reducing emissions compared to using a fossil fuel supply such as diesel.

In particular, energy storage provides an opportunity to improve resilience and provide back-up power to the townships and resorts in the Snowy Mountains SAP which are more vulnerable to power losses due to transmission and distribution infrastructure (poles and wires) disruptions. There may be an opportunity to take advantage of the Australian Government Regional and Remote Communities Reliability Fund Microgrids which is being run over 5 years through to 2023/24.

There are a range of energy storage opportunities available to the Snowy Mountains SAP which will provide solutions for increasing renewable energy integration and improving grid stability and resilience. This includes pumped hydro already in development, battery storage, thermal storage, hydrogen gas and biogenic gas. Energy storage options are explored further in the WSP Renewable Energy Technical Analysis.

In particular, due to the existing renewable energy assets within the area implementing energy storage within the area will ensure that energy generated is stored and used within the Snowy Mountains SAP instead of exporting to adjacent regions. This will assist in capturing hydro energy when the plants are in operation and utilising the energy during shutdown periods.

It is recommended energy storage opportunities are supported in the Snowy Mountains SAP to facilitate increased renewable energy generation and provide additional services (e.g. Frequency Control Ancillary Services - FCAS) and revenue streams. This includes the integration of EVs with vehicle to grid (V2G) capabilities (refer to Section 7.3.6 for further information).

5.3.5 Hydrogen storage

The Renewable Energy Context Analysis has identified that hydrogen production for the Snowy Mountains SAP is not viable however hydrogen storage for the transport sector may be an opportunity to support hydrogen vehicles (refer to Section 7 Mobility for further information).

It is recommended that the Snowy Mountains SAP investigates the full hydrogen supply chain cycle and focus on downstream opportunities not associated with hydrogen production with opportunities present to showcase hydrogen-based transport, create a hydrogen supply hub and reduce emissions.

This could include creating a hydrogen-based Mobility-as-a-Service network which could use the Snowy SUV set to be manufactured in Port Kembla (refer Section 7.3.6).

5.4 Snowy Mountains SAP vision alignment

Energy initiatives are aligned with the following Snowy Mountains SAP Vision topics:

Our Energy theme vision is:

Powered by renewables

This compliments the Snowy Mountains SAP visions of 'Sustainability & Wellness' and 'Infrastructure and Connections' by improving energy efficiency and maximising renewable energy systems, which in turn supports low emission transport options such as electric vehicles.

5.5 Outcomes of the Structure Plan

The following key ESD opportunities are included in the Structure Plan:

- A renewable Power Purchase Agreement (PPA) is negotiated with Snowy Hydro to supply 100% renewable energy to the Snowy Mountains SAP.
- The integration of solar PV and battery storage systems on a smaller scale to support individual developments where viable.
- Integrate energy efficiency and productivity into development design guidelines, with both embodied energy and lifecycle emissions considered.

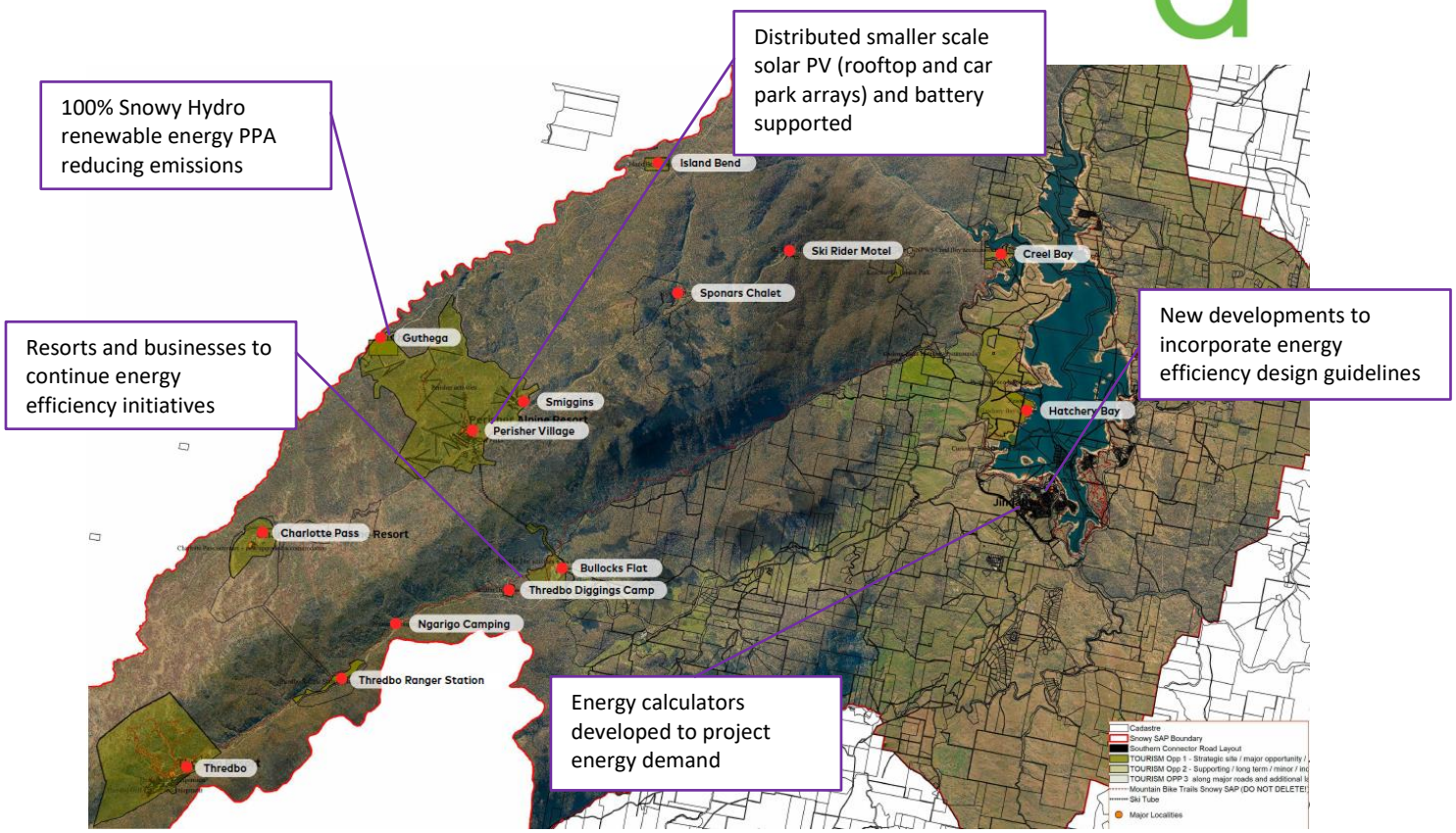


Figure 38: Energy initiatives in the Structure Plan

6 Society

6.1 Introduction

Sustainable communities include resilient and healthy societies. The ESD theme of 'Society' includes community health and wellbeing, social connections, heritage and culture, and connection to place.

According to a McKinsey report of 2012, 'wellness' is the next trillion-dollar industry. The Global Wellness Institute (GWI) define 'wellness' as the pursuit of activities, choices, and lifestyles that lead to an improved state of health and wellbeing.

The global trend in wellness is growing rapidly, with people much more aware of their own general health, wellbeing and fitness. This is evidenced in the rapid rise of technologies to support wellbeing, such as personal activity trackers, membership of gyms and other fitness centres, increased interest in nutrition and healthy eating, and spending on personal care. According to the GWI *Global Wellness Economy Monitor* (released in October 2018, with data for 2017), the global wellness economy is estimated at US$4.5 trillion (refer Figure 39).

Figure 39: Wellness Market. Global Wellness Institute

The recent Covid-19 pandemic has also heightened the awareness of the general public of issues such as hygiene, access to healthcare, and air quality management.

The International WELL Building Institute (WELL) determines that our health is determined by four key factors: our physical/social environment, our lifestyle/health behaviours, our quality of medical care, and genetics (refer Figure 40).

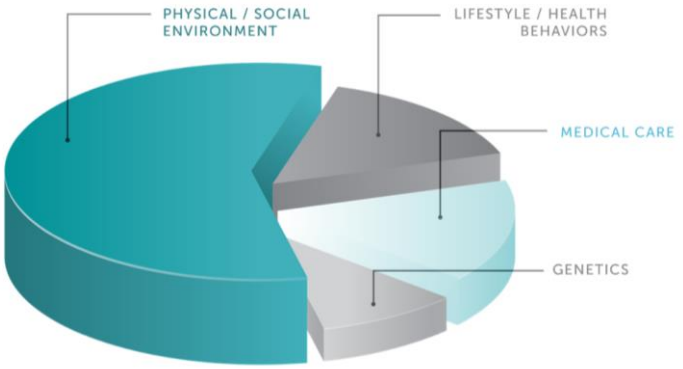


Figure 40: Factors affecting Wellbeing. IWBI

Almost 60% of our health is determined by our physical and social environment, which is largely dictated by buildings and our physical environment. A further 20% is determined by our lifestyle and health behaviours, which can be influenced by the provision of healthy choices in our communities.

It therefore follows that if we design infrastructure and buildings which create healthy environments for communities, and facilitate the use of the assets in a healthy way with education and support for the people who use it, the result will be significantly healthier people.

The tourism industry has also seen the effect of the increase in interest and spending in wellbeing and combines two growing industries – the tourist and wellness industries to provide 'wellness tourism'. The Lonely Planet estimates a 10% annual rise in wellness tourism, with Intrepid Travel recently launching a new travel tour wellness category, focussing on three key categories of mindfulness, movement, and nourishment.

This section summarises the opportunities for Society to be delivered by the Snowy Mountains SAP.

6.2 Context analysis

The Alpine environment of the Snowy Mountains naturally draws people to a lifestyle based on connection to the outdoors. There already exists a diversity of recreational activities in the region, with a strong focus on nature-based activities supporting health and wellbeing outcomes. These include winter snow sports, walking, hiking, fishing, mountain biking, as well as other outdoor pursuits.

The region contains Kosciusko National Park, the largest National Park in Australia, and the first to achieve a certified *Ecotourism Destination Certification*. Ecotourism Australia define ecotourism as "ecologically sustainable tourism with a primary focus on experiencing natural areas that fosters environmental and cultural understanding, appreciation and conservation." However, a search of ecotourism opportunities in the area only results in one business 'EcoCrackenback' providing ecotourism accommodation in the area, which indicates that this certification is currently underutilised.

The community of Jindabyne has great access to the open space areas around the lake, water-based activities on the lake, and access to the mountains. In consultation for the draft Go Jindabyne masterplan, the local community noted that major drawcards for living in the area was the relaxed pace of life, healthy and balanced lifestyle, friendly and inclusive atmosphere, and connections to nature. All of this contributes to the sense of community and place. However, it was also noted that opportunities for connection and integration of these assets are underutilised.

Overall, the region does seem to have many opportunities for health and wellbeing, however, does not necessarily promote this as one of the key reasons to visit the region.

6.3 Opportunities

The following section highlights opportunities for sustainable development of the Snowy region as they relate to society.

6.3.1 Wellness tourism

The natural and physical assets of the Snowy region make it well placed to take advantage of wellness tourism. This has been popular in mountain regions in other countries for many years, with many towns and resorts in the European Alps promoting the health benefits of fresh air and exercise, often combined with healthy food choices and unique or luxury accommodation.

Snowy is knows for active, outdoor mountain and alpine experiences in Australia. The benefits between outdoor education, health, wellbeing and sustainability are recognised as a key driver for the growth of the region as part of the Snowy Mountains SAP vision. A key opportunity is to develop wellness tourism and eco-tourism together.

Due to the Covid-19 pandemic, overseas travel is expected to greatly reduce in the coming years, initially due to lockdowns and travel bans, but also in the medium to long term it is anticipated that Australian's will look to travel domestically due to ongoing concerns related to ongoing quarantines and infection.

This does present an opportunity for local travel, which is based on natural experiences, with discovery, rest and relaxation they key focus, rather than ticking off bucket list items on an international itinerary. According to the GWI, the next wave in travel 'should be wellness-enhancing by inspiring wonder, awe, and connection'.

The promotion of Snowy as a healthy region to visit to experience healthy activities, wellness tourism and connection to land can take advantage of this change in travel mindset.

6.3.2 Sports and fitness

Closely tied to wellness tourism is the ability to experience outdoor sports and recreation. The need for improved sports and recreation facilities is well documented in the Snowy Mountains SAP vision, DHW Sports Infrastructure Study and previous studies.

To promote wellness, the Snowy Mountains SAP should offer opportunities that promote movement, physical activity and active living, and discourages sedentary behaviour. This can be through all aspects of visiting the region, including active transport opportunities, active recreation, and sports.

There are opportunities to promote sports and recreation activities that have a low environmental footprint, and therefore have a positive influence on the region's carrying capacity, for example:

- Hiking
- Fishing
- Walking
- Trail biking
- Horse riding
- Rafting, kayaking, and rowing

The ski resorts have already noted their impact on the environment, and need to protect the delicate and unique alpine environments that they operate in. Vail, who own and operate Perisher, have an 'Epic Promise' which is a goal to achieving a zero net operating footprint by 2030.

The carbon footprint of participating in sports and recreation includes many aspects, including:

- Transport emissions of getting to the sporting area

- Resources consumed in taking part, such as energy, water, materials, and generation of waste
- Impact of the sport on the environment, such as emissions, and damage to natural environment.

There does not appear to be much available research into the carbon impact of various sporting activities. However, encouraging lower impact activities to support wellbeing could be a key initiative for the Snowy Mountains SAP, to balance some of the existing higher impact activities, such as skiing.

These sport and recreation activities which are lower environmental impact also contribute well to the health and wellbeing aim. These include:

- Passive sporting opportunities, such as walking, hiking, fishing, kayaking, and camping.
- Active sporting opportunities, which may be able to reduce physical footprint through taking advantage of skiing or other existing infrastructure, such as mountain biking, triathlon and running events.

The sports infrastructure strategy for the Snowy Mountains SAP has been developed to take account of the climate risks and carbon impact of sporting infrastructure.

6.3.3 Heritage and Connection

First nations engagement can offer strong community connection, economic and social resilience, whilst also providing diverse education. Local indigenous knowledge of the natural environment and artefacts may be shared by locals through eco-tourism but also through planning and development, informing sustainable development and encouraging environmental stewardship; part of the Snowy Mountains SAP's reputation.

The diverse western and Asian multicultural background and history of the region can also be celebrated through education and skill sharing opportunities, which provide long-lasting and immersive experiences. This may be via a dedicated heritage centre, the preservation of heritage buildings and/or events and structured educational activities.

Opportunities to celebrate heritage have been explored in the tourism offerings, including aboriginal cultural experiences, heritage tours of the old Jindabyne township, and information centres that celebrate the renewable energy heritage of the region.

6.3.4 Community wellbeing

To flourish as a community, its residents must be connected and engaged in meaningful ways, be resilient to the impacts of a transient tourist population and foster social engagement.

The recent bushfires in the areas and impacts of the Covid-19 pandemic have shown the importance of community connections in times of uncertainty.

The draft Go Jindabyne Masterplan showed the majority of the community principles that were developed as a result of consultation were related to a better-connected town, with high quality open spaces, accessible to all, and a vibrant town centre, to enable connection, collaboration and sharing.

The International WELL Building Institute (IWBI) has developed the WELL Community rating tool to address these needs at a precinct scale. The tool aims to improve people's health and wellbeing through the public spaces where they spend their days, and the social infrastructure available to them. The key features of the tool include:

- Equitable access to clean air, water and light
- Public facilities and spaces that support fitness, hydration and good nutrition
- Public spaces that prioritise natural, durable and sustainable materials
- Climate change adaptation and community resilience

- Community wellbeing, connectivity, and access to physical and mental health resources to support a healthy community

This aligns with the NSW Government's Priority on Greener Public spaces, which aims to increase quality public space to support health and wellbeing, environmental resilience, and create prosperous local economies.

The Green Star Communities rating tool also prioritises community health and wellbeing. These rating tools are explored further in the Leadership section of this report.

6.3.5 Social Infrastructure

A review of the existing social infrastructure within the region has been undertaken by Liesl Codrington as part of the Snowy Mountains SAP planning team, and is covered in the Social Infrastructure Study report.

In general, it is concluded that the social infrastructure needs of the community are well serviced, however more of these services will be required to meet the Snowy Mountains SAP visions. This includes the needs of residents, seasonal workers, and visitors. This provides an opportunity to provide high quality, sustainable community infrastructure that supports the health, wellbeing and resilience of the community and provides connection to people and place.

6.3.6 Building design

How buildings are designed can have a significant impact on the health and wellbeing of occupants. Almost 40% of our health is determined by our physical and social environment, which is largely dictated by buildings and our physical environment. A further 20% is determined by our lifestyle and health behaviours, which can be influenced and help by the provision of education and health programmes in our communities.

It therefore follows that if we design buildings which create healthy environments for the occupants, and facilitate the use of the building in a healthy way with education and support for the people who use it, the result will be significantly healthier people.

There is a significant global research resource available which quantifies the benefits to people of working in a healthier environment and quantifying the benefits both in terms of health and financial return on a health initiative investment.

The International WELL Building Institute (IWBI) have developed the WELL building tool in specific response to this research and need for healthy buildings.

The WELL tool comprises ten key concepts (refer Figure 41):

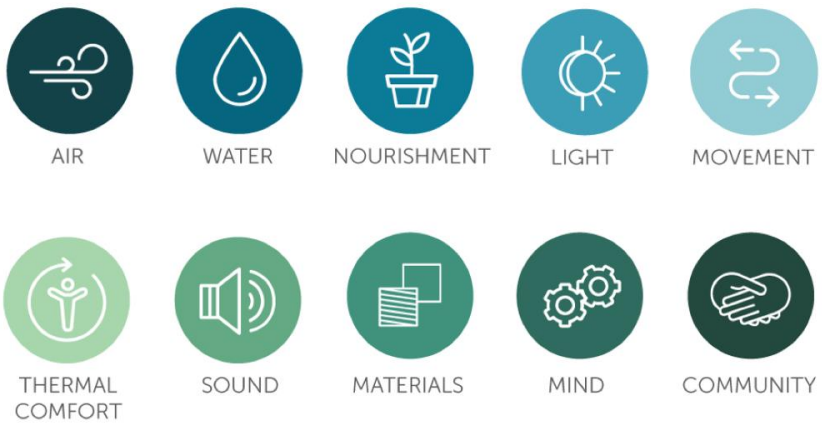


Figure 41: WELL building rating. IWBI

The WELL rating is determined by benchmarking the operational achievements of the building. Therefore, it provides a third-party verification that the buildings are designed and operated to achieve health and wellbeing outcomes.

It is recommended that all new buildings are designed for wellness, with consideration given to key buildings achieving a WELL rating. Key buildings could include the new school or sports centre which are ideally positioned to promote and educate the visitors and occupants on wellness in buildings.

6.3.7 Biophilic design

Biophilic design is simply described as the connection of buildings to nature. The following principles, derived from *The Practice of Biophilic Design* represent fundamental conditions for successful practice of biophilic design:

- Should establish repeated and sustained engagement with nature.
- Focus on human adaptations to the natural world that over evolutionary time have advanced people's health, fitness and wellbeing.
- Encourages an emotional attachment to particular settings and places.
- Promote positive interactions between people and nature that encourage an expanded sense of relationship and responsibility for human and natural communities.
- Biophilic design encourages mutual reinforcing, interconnected and integrated architectural solutions.

Designing with biophilia in mind also has other ESD impacts, as these spaces tend to be low energy, filled with light, and fresh air (refer Figure 42). The following biophilic design solutions should be explored for all buildings within the Snowy Mountains SAP:

- Maximise daylight access and views to outside.
- Use of natural materials to being texture and nature into buildings. In particular the use of timber has many health benefits within building interiors.
- Use of colour and art within interior spaces.
- Internal planting, linking to external landscaped design.
- Provide 100% fresh air to spaces, through openable facades or increase fresh air through air conditioning systems.

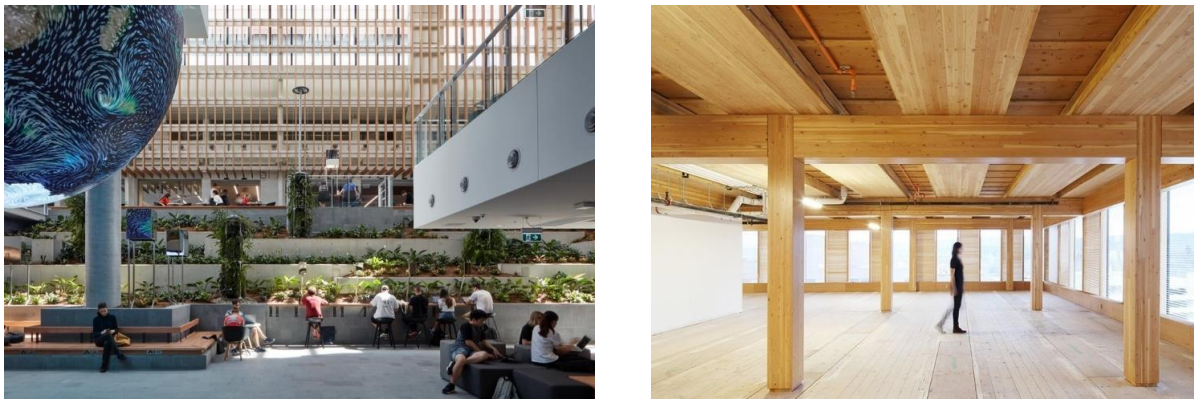


Figure 42: Examples of biophilic design

6.3.8 Food and nourishment

Poor nutrition is linked to a multitude of chronic diseases, not least the growing risk of obesity in Australia. Trends towards calorie dense and nutrient poor food sources is also leading to malnutrition, particularly in children.

Eating patterns are influenced by a mix of factors, including the local food environment, which is the type of food on offer and how it is sold. Where the food offering is predominantly healthy, and there is information on health and nutrition, this leads to better nutritional outcomes for communities. Our choices are also influenced by the local supply chains, which in turn impacts the greenhouse gas emissions transporting food to the region.

The following nutrition opportunities can be integrated into the Structure Plan:

- Consider the local food sources available within the region and prioritise these to limit the amount of 'food miles', which is the distance food travels from producer to consumer.
- Promote healthy eating and local food, providing security and benefit to local agriculture and manufacturers.
- Ensure all new food retail areas offer fresh fruit and vegetables. Limit sugar content in packaged food offerings.
- Consider an 'urban farm' where the local community is involved and engaged in the development of local food. This can include community gardens, orchards and edible landscaping.
- Address issues of food affordability. Eating out and take away can be expensive, so ensure there are opportunities for people to prepare their own fresh and healthy foods, such as public BBQ's.
- Develop a local market focused on fresh food and local produce.

6.3.9 Sustainable events

Events and festivals present an opportunity to showcase and promote the sustainability of the region. Events have both drawing and holding power, attracting new visitors, creating a branding opportunity, and retaining visitors who stay on to live and work in the region.

Social connections are one of the pillars of wellness. A growing number of festivals feature opportunities for social and spiritual connection, and there is a need to locate these events in natural environments that are inspirational, healthy and connected. For example, Wanderlust is a growing International Festival located in mountain and lakeside areas, where attendees practice yoga, meditation and fitness, combined with music and food for a whole wellness experience (https://wanderlust.com/mission/)

With appropriate infrastructure and planning, the area could become recognised as a prominent eco and wellness tourism destination that offers engaging sustainable events, facilitating connectivity and resilience in the community and beyond. This also offers opportunities for being known for inclusivity and creativity, with appropriate design allowing diverse access, inclusion and artistic expression.

Opportunities could include:

- A dedicated multi-purpose building/venue, designed for the climate, in harmony with the natural environment, built with sustainability and wellness principles.
- Carbon neutral events. People's experience of events is one of the most overt ways to showcase sustainability credentials.
- Local bush tucker supplied and prepared by locals (ideally first nations people), that includes education and nature connectivity.
- Event information tracking: energy & water use, waste generation, economic impact, and job creation.

Benefits include:

- Area branding and environmental reputation
- Visitor draw and retention
- Local and regional economic injection
- Social cohesion, community connectivity and community solidarity/pride
- Improved wellbeing
- Environmental stewardship and education
- Diversified activity offering for the region
- Increased employment and skills base
- Increased accessibility and inclusion

Types of sustainable events can include:

- Wellness retreats with yoga, meditation, forest bathing and local cuisines, all adding to the offering.
- Multisport festivals (such as triathlon, decathlon) specific to the adventure sports of the region, such as kayaking, trail running and mountain biking.
- Re-wilding experiences, with opportunities to contribute to planting and revegetation in the region.

6.4 Snowy Mountains SAP vision alignment

Social initiatives are aligned with the following Snowy Mountains SAP Vision topics:

Our proposed Society theme vision is:

Mind, body and soul rejuvenated

This compliments the Snowy Mountains Snowy Mountains SAP visions of 'Sustainability & Wellness' and 'Adventure and Ecotourism' by facilitating a growth in wellness tourism and a focus on society.

6.5 Outcomes of the Structure Plan

The following key ESD opportunities are included in the Structure Plan:

- Community and visitor health and wellbeing are prioritised through inclusion of wellbeing principles in all development. Walkability, fitness, open space and community spaces are integrated throughout the Structure Plan. Many of the proposed new sports facilities are to be designed for shared community access.
- Creation of social infrastructure focussed on equity.
- Recognising and celebrating history and heritage, including the new Snowy Discovery Centre.
- The Structure Plan includes expansion of existing and development of new sports and tourism developments, focussing on the wellbeing of the community, visitors and tourists. Refer to the Sports reports for more information.
- Snowy Mountains SAP design guidelines are to be developed which will including requirements to design buildings and community spaces for wellness.

7 Mobility

7.1 Introduction

The Snowy Mountains SAP has a strong focus on transport systems and improving connections both within and to the area and the following section explores a number of opportunities to create a more efficient and effective transport system.

7.2 Context analysis

Current transport systems in the Snowy Mountains SAP are heavily reliant on private vehicle ownership for travel to and within the region. Based on visitor data and surveys, over 85% of the visitors to the region access it via private vehicles with an estimated 400,000 vehicles travelling to the Snowy Mountains per year. The main access to the region is via Cooma, with additional access provided via the Snowy Mountains Airport outside of Cooma.

In addition, public transport networks operate in the region but are restricted and are a constraint with the main source of mass transport provided by chartered buses during the peak ski season and the Ski Tube (refer Figure 43). A train services previously operated to the East of the Snowy Mountains SAP with a station at Cooma, however ceased operating in 1988.

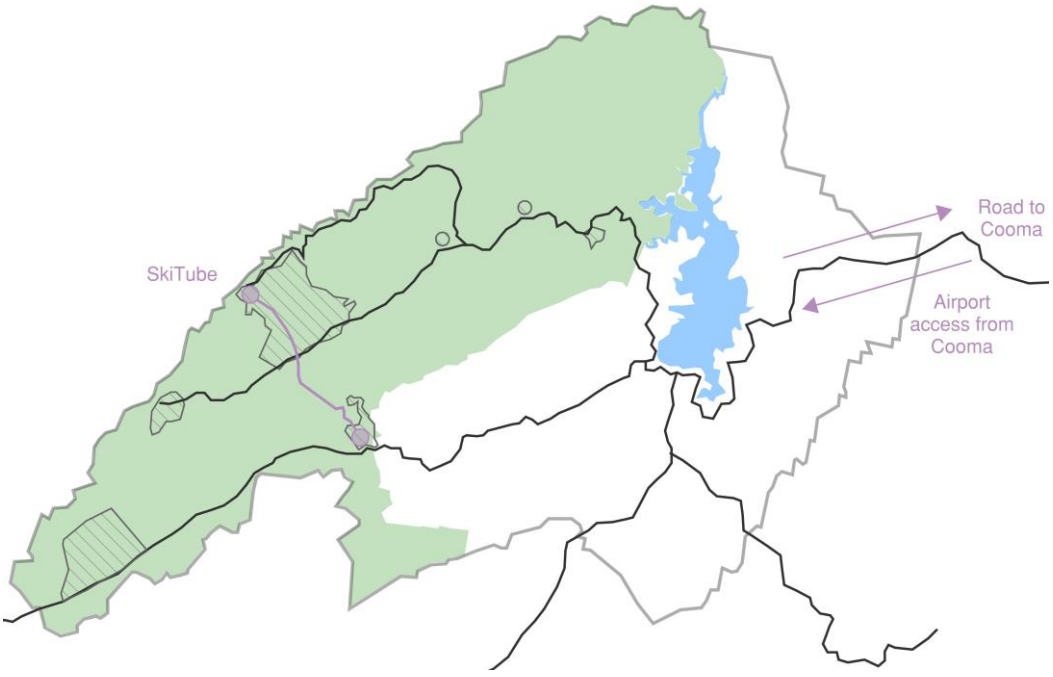


Figure 43: Snowy Mountains SAP Transport Network

As per Section 4, transport is estimated to be the main source of carbon emissions for the Snowy Mountains SAP and therefore it should be a priority to transition from fossil fuel-based transport to efficient and sustainable transport systems. It should be noted that as the share of renewable powered electric and hydrogen vehicles increases, emissions in the transport sector will decrease over time.

7.3 Opportunities

The following opportunities have been identified for integration in the Structure Plan.

7.3.1 Buses

The Transport Context Analysis has identified that the main mass transport option used to travel to and within the Snowy Mountains SAP is provided by privately operated chartered buses. Although chartered buses would be providing a lower emissions factor per passenger when compared to passenger vehicles, alternative lower emission options should be considered including:

- Electric buses
- Hydrogen cell buses
- On demand public transport options
- Smaller electric transit buses and shuttles

These options will require supporting infrastructure to be provided including EV fast charging (refer Figure 44) and hydrogen refuelling stations (refer Figure 45). It is recommended that the Snowy Mountains SAP Delivery Plan, incorporates support mechanisms to implement EV and hydrogen charging/refuelling infrastructure to transition to these options.

Figure 44: ABB Electric bus charging

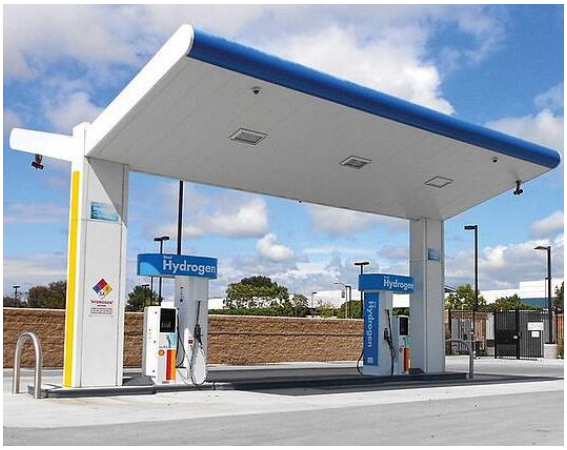


Figure 45: Hydrogen Refuelling Station

7.3.2 Conventional rail

As identified in the Transport Context Analysis there is limited public transport options to the region and the main train line from Canberra to Cooma ceased operating in 1988. Trains are an effective mass mode of transport with significantly less emissions compared to passenger vehicles. For example, an average Sport Utility Vehicle (SUV) produces approximately 200g CO2-e per km travelled, whereas a diesel train emits less than half per passenger (90-100g CO2-e). In addition, approximately 12% of visitors come from the ACT and reinstating the train network may provide an efficient transport option which could be interconnected with trains from Sydney to Canberra.

The capital cost and viability of reinstating the train line has resulted in this option not being pursued and it is not recommended the Snowy Mountains SAP pursues conventional trains to the Snowy Mountains SAP. However, in line with the WSP Transport Technical Report, light rail and metro rail options have been explored between Jindabyne and the Ski Tube which are supported as a lower emissions option which will also reduce congestion.

Hydrogen Trains

Hydrogen powered trains are increasingly being implemented internationally with Germany operating 8 trains, French state rail operator SNCF recently ordering 15 hydrogen trains for their network and trials underway in the UK and Japan. The Alstom hydrogen trains operating in Germany (refer Figure 46) have a range of approximately 1,000km from a single tank of hydrogen fuel which is similar to most diesel trains and therefore range should not be a concern. In addition to the emissions reduction possible with standard trains, trains fuelled by green hydrogen have zero emissions in operation and during the hydrogen electrolysis process. As per Section 4.2.2, transport emissions to the region are extensive and this is an opportunity to reduce emissions while improving public transport access to the Snowy Mountains SAP. It is recommended hydrogen powered options are considered for any light rail or metro rail solutions.

Figure 46: Alstom Hydrogen Train in Germany

7.3.3 Ski tube

The existing Ski Tube between Bullocks Flat and Perisher is already providing an efficient form of mass transport and is electric powered which would be benefitting from the region's renewable energy systems. However, the tunnel and rack-rail tracks were constructed in 1987 and may be providing a lower amenity solution. This option is being explored in the Transport Technical Study and it is recommended that the age, condition and suitability of the Ski Tube is investigated further.

Due to the high costs associated upgrading the ski tube, alternative options for mass transport have been proposed including bus ways and gondolas. These options provide a lower emission option that will also reduce congestion on roads and parking capacity which is already a concern. It is recommended that any upgrades to the Ski Tube or alternative transport options explore opportunities to become a tourist attraction with an alpine scenic view experience (refer Figure 47). It is recognised that this image would not apply to the existing enclosed ski tube route.

Figure 47: Scenic train experience

7.3.4 Gondolas

Gondolas have been identified as an opportunity to link Jindabyne and the mountain bike park as a tourist experience that can operate across the year and provide an alternative form of transport to passenger vehicles and public transport.

The concept of utilising a gondola as a form of mass transport meets a number of ESD themes including reducing emissions by reducing passenger vehicle use, touching the ground lightly by removing the need for new roads and car infrastructure, and will take advantage of renewable energy in the region.

Thredbo have recently replaced the existing 2-seater chairlift with an 8 person gondola, which quadruples the capacity to take people up to the top station. It is recommended the following is considered if a gondola network is pursued:

- Powering the gondola from 100% renewable energy. As an all-electric option, this could be achieved through either a renewable energy contract (refer Section 5.3.3) or by installing a solar farm in the vicinity of the Jindabyne station with sufficient capacity to supply the annual energy requirements of the gondola. This could be part of the tourist attraction, i.e. experience a 100% renewable energy powered gondola in the Snowy Mountains.
- Incorporating sufficient space for adventure and sports-based activities and associated gear and equipment (in addition to skis and snowboards). This includes safe storage of bicycles, hiking gear and camping equipment which will facilitate summer-based activities around the resorts.
- Ensuring that there are flexible, zero emission transport options to and from the gondola stations including buses and shuttles, bicycle and walking tracks, and MaaS.

7.3.5 Flights

The WSP Transport report has outlined a number of initiatives to improve access to the region including improved public transport to and from Canberra and the Snowy Mountains Airport and greater connectivity to surrounding areas. Increased flights to the region should be considered from an emissions reduction perspective and as a way to facilitate other forms of sustainable transport.

Based on a flight from Sydney to Canberra, carbon emissions per passenger is approximately 41kg CO2-e over 237km. This equates to approximately 170g CO2-e per km travelled per person (based on a commercial jet) however are expected to be higher for smaller passenger planes with lower passenger numbers. As a result, increasing air travel to region based on current technologies may shift emissions from passenger vehicle (approximately 200g CO_2-e per km) to a slightly lower emission for flights. This is important as flight travel may provide a high amenity option without increasing emission which are a major factor for the Snowy Mountains SAP.

Figure 48: ZeroAvia Renewable Hydrogen Aviation vision

In addition, it is recommended that zero emission flight technologies such as renewable hydrogen fuelled aircraft (refer Figure 48) are investigated further to maximise the potential of air travel to the Snowy Mountains SAP. This may include smaller hydrogen powered aircraft in the short term which targets a zero-carbon tourist market while longer term plans are established for commercial jet hydrogen powered flights.

It is recommended that as part of any new air transport investigations, hydrogen fuel storage is considered for both air travel to the region and for refuelling other forms of travel including passenger vehicles, trucks and buses. These transport options could then be used for zero emissions travel in the region.

In addition to flights to and from the region, low emission technologies such as electric helicopters and planes (refer Figure 49 and Figure 50) may also be an opportunity to provide zero-carbon tourist attractions such as scenic flights around the area that could be powered by renewables both with and outside the Snowy Mountains SAP. This could include scenic flights around the Snowy Mountains by helicopter and around Jindabyne Lake using electric sea planes.

Figure 49: Tier 1 Engineering Electric Helicopter

Figure 50: Harbour Air and magniX e-plane

It is recommended the Snowy Mountains SAP investigate supporting the transition to zero emission aircraft which will:

- Reduce transport emissions for the Snowy Mountains SAP.
- Align with “Touching the ground lightly” (refer Section 8) by reducing air pollution.
- Provide a drawcard for low emission tourists.
- Align with hydrogen supply chain opportunities.

7.3.6 Passenger vehicles

Passenger vehicles are the predominant form of travel in the Snowy Mountains SAP (>85%) which would be a significant source of emissions and air pollution. With increased renewable energy opportunities identified and a hydrogen supply chain in development, there are significant opportunities to facilitate a transition to sustainable transport and low to zero emission transport options for passenger vehicles.

Electric Vehicles

Electric vehicles have been commercially available in Australia since 2010 with an exponential growth occurring in vehicle registrations since 2014. The Electric Vehicle Council has recently updated their figures and have stated that over 6,700 EVs were sold in 2019 which was an increase of over 200% compared to approximately 2,200 sold in 2018. The following figure shows the growth of EV sales from 2011 to 2018 (note that this does not take into account the growth in 2019 sales).

Figure 51: Electric Vehicle Sales. Source: Electric Vehicle Council

Projections from the Australian Energy Market Operator (AEMO) are that with moderate intervention from across government, EV sales will increase from approximately 2,200 vehicles in 2018, to 70,000 by 2023 and will make up the majority of vehicle sales by 2050 (refer Figure 52). Moderate intervention includes targets being set by state governments as part of net-zero strategies, transitioning state and local government fleets to EV's and the rollout of charging infrastructure. This also assumes a relatively slow uptake of hydrogen vehicles which may have changed since the National Hydrogen Strategy was released.

The below illustrates the increased uptake of EV sales in various scenarios of Government intervention (refer Figure 52).

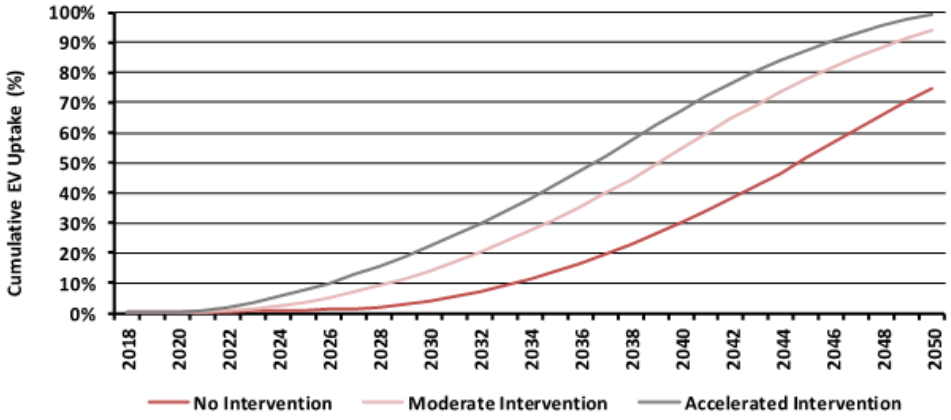


Figure 52: AEMO EV Projections

However, EV sales in NSW are comparatively low per 10,000 vehicles sold (refer Figure 53) and it is recommended that the Snowy Mountains SAP support EVs in travelling to region. The NSW Net Zero Plan has incorporated an Electric Vehicle Infrastructure and Model Availability Program to accelerate EV uptake which is an opportunity for the Snowy Mountains SAP if a coordinated approach to EVs and hydrogen cell vehicles is taken. This could be coordinated by the local council to drive the uptake of EVs.

Figure 53: EV Sales per State

The provision of public charging infrastructure by government (Federal/State/Local) is one of the top three areas that consumers believe will increase the uptake of electric vehicles, along with subsidies for EV's and installing home charging systems. As a result, it is recommended that the Snowy Mountains SAP facilitate the installation of additional charging points to both support the community and travellers from Sydney that will increasingly transition to electric vehicles. There is also an opportunity to integrate EV charging with the proposed solar PV systems across the Snowy Mountains SAP which will increase renewable powered transport systems (refer Figure 54).

Figure 54: Tesla EV Charing and Solar PV Integration

Hydrogen Vehicles

Hydrogen cell vehicles are becoming increasingly available and with the hydrogen supply chain currently in development across NSW in line with the National Hydrogen Strategy, and hydrogen vehicle production announced for the Snowy SUV in Port Kembla NSW (refer Figure 55), hydrogen vehicles may be a key transport initiative to reduce emissions for the Snowy Mountains SAP.

Figure 55: H2X Australia - Hydrogen SUV to be manufactured at Port Kembla

It is recommended that hydrogen vehicle refuelling infrastructure for passenger vehicles is investigated for the Snowy Mountains SAP to support this transition. The refuelling stations may also be aligned with other forms of hydrogen-based transport including trucks and aircraft and may provide an ideal location to provide hydrogen storage for both the aviation and road transport sectors.

It is also recommended that H2X is contacted to investigate whether the first production line versions of the Snowy SUV could be used for mobility services with the Snowy Mountains SAP.

Emissions reduction

Both EVs and hydrogen passenger vehicles have no emissions during operation which will improve air quality both within the Snowy Mountains SAP and as vehicles travel to the area. In addition, even when incorporating energy generation emissions to charge EVs, the emissions are still less than half that of petrol and diesel vehicles. With transport emissions totalling 78,000 tonnes of CO_2-e, this equates to a significant emissions reduction for the Snowy Mountains SAP which should be supported.

7.3.7 Over-snow vehicles

With a large number of over-snow vehicles being operated by the resorts including winter transport to Charlotte Pass, snow mobiles and snow grooming, there is an opportunity to create a hydrogen fuelled vehicle solution for snow vehicles. This could include a smaller scale, renewable energy powered hydrogen electrolyser which is used to refuel smaller hydrogen vehicles. This has recently been trialled at the Hinterstoder-Wurzeralm ski resort during a skiing event in February 2020 with the Fronius Solhub (refer Figure 56) which includes a 34.5kW solar PV system and a electrolyser capable of producing 52kg of hydrogen daily, coupled with BRP-Rotax hydrogen powered snow mobile (refer Figure 57).

Figure 56: Fronius Solhub Hydrogen Station

Figure 57: BRP-Rotax Hydrogen Snow Mobile

It is recommended smaller scale hydrogen electrolysers, powered by renewables, are investigated for the Snowy Mountains SAP as a tourist attraction for experiencing zero emission snow transport. This could also be scaled to transition larger snow vehicles to hydrogen as new hydrogen vehicle segments become available.

7.3.8 Heavy vehicles

An additional opportunity to extend on hydrogen passenger and over-snow vehicles is to investigate larger vehicles such as construction and demolition machinery and heavy vehicles which are likely to be used as part of infrastructure development and ongoing maintenance of the Snowy Mountains SAP. This includes opportunities such as Hyundai Construction Equipment's aim to develop mass production hydrogen construction equipment by 2023.

It is recommended that opportunities for support a transition to hydrogen heavy vehicles are considered as part of hydrogen storage and refuelling network investigations.

7.3.9 All-Terrain vehicles

With all-terrain vehicles expected to be used across the Snowy Mountains SAP and agriculture forming a relatively large percentage of the region's emissions, emission reduction measures for agriculture should also be considered. It is recommended options for transitioning all-terrain vehicles (tractors, quad bikes, dirt bikes, etc.) to lower or zero emission options (refer Figure 58 and Figure 59) will provide an environmental benefit while also improving resilience by reducing the use of imported fossil fuel supplies. These vehicles would also be applicable to other uses within the Snowy Mountains SAP including transport around the alpine areas and as part of the maintenance of snow fields.

Figure 58: Electric Quad Bike

Figure 59: H2X Hydrogen Tractor

With the implementation of increased renewables and hydrogen storage in the region options include electric farm quad bikes and hydrogen tractors which can be fuelled from local supplies instead of imported fossil fuels. For example, green hydrogen generated at Port Kembla could supply the Snowy Mountains SAP and hydrogen vehicles manufactured in NSW used to transition to zero emission vehicles.

Grants and incentives to assist organisations to transition, while providing initial demand for locally produced vehicles, may be an option to kick start low emission agricultural vehicle uptake in the region. It is also recommended information on lower emission options is celebrated in the Snowy Mountains SAP and information provided to the local community.

7.3.10 Mobility as a Service (MaaS)

Mobility as a Service (MaaS) aims to shift travel from conventional options (car ownership) to a service experience where car ownership is no longer required for daily travel needs by combining multiple transport modes into a seamless user experience. A number of MaaS options include car, bicycle, e-bike and e-scooter sharing networks and shared taxi services and when integrated with public transport networks, have the potential to reduce costs and emissions.

In particular, MaaS options powered by renewable energy, implemented around the Jindabyne township and foreshore and Lake Jindabyne, could provide an eco-tourism experience including:

- E-bike and e-scooter hire. This will also facilitate less physically able-bodied visitors who still want to experience the outdoors.
- Guided e-tours e.g. electric shuttle bus which could also be autonomous
- Autonomous vehicle tours.
- Off-road e-bikes for adventure tourists.

These opportunities should be investigated in the Snowy Mountains SAP, with a focus placed on low and zero emissions vehicles such as EVs, electric buses and shuttle bus services and facilitating active transport options such as bike and e-bike share schemes. These options should also be supported as part of an integrated model which interconnects mass transport options such as the Snowy Mountains Airport, with on demand, MaaS options to move around the Snowy Mountains SAP. Additional opportunities in the future include autonomous vehicles and helicopter air services which may assist in reducing congestion in areas with limited road access. There are also multiple companies working on autonomous drone technologies which could be used for passenger services. Although these types of services are many years away from mass commercialisation, future transport plans for the region should consider these changes as part of plans and strategies.

7.3.11 Active and sustainable transport

The Transport Context Analysis has identified a large number of initiatives including improved pedestrian, bicycle, public transport and sustainable transport opportunities that are in various stages of delivery. It is recommended that these strategies continue to be developed

It is recommended these transport options continue to be maximised with the full health and economic benefits factored in including:

- **Health benefits from walking and riding** which (typically) outweigh the increased risk of injury and death from road accidents.
- **Improved air quality** due to reduced personal vehicle use.
- **Reduced capital and operating costs** for vehicle and infrastructure maintenance.
- **Reduced emissions** associated with the transport sector.

It is recommended that the resorts, tourist services and local councils continue to promote and support the use of active and sustainable transport options including e-bikes, ride share schemes and public transport.

7.3.12 Digital and autonomous systems

In addition to physical infrastructure works (roads, rail, bike lanes, etc.), opportunities are also available to utilise digital and autonomous systems to reduce dependence on personal and business travel, while improving the efficiency of the transport system. This includes:

- **Real time data**: Supporting real time traffic and public transport data can assist in mapping and planning for congestion and support the uptake of MaaS.
- **On-demand Public Transport:** Supporting flexible public transport systems such as on-demand public transport can assist in improving public transport access and effectiveness and may be particularly relevant in the southern parts of the region where public transport is limited.
- **Ride Sharing**: Supporting ride sharing services such as Uber and OLA can reduce private car use, diversify the transport sector and reduce costs associated with purchasing and maintaining private vehicles. It should be noted that taxi services also provide some of these benefits and can have a larger presence in regional areas with potential job impacts considered.
- **Autonomous Vehicles:** Although autonomous vehicles are still a number of years away, supporting the industry through trials, providing research grants and supporting industry collaboration can place the region in a strong position to implement autonomous vehicles. Autonomous vehicles have a number of potential benefits including reduced car ownership, improved efficiency and safety and reduced congestion.

It is recommended digital and autonomous support mechanisms are investigated in the Snowy Mountains SAP including improved digital connectivity and supporting and collaborating with new industries to trial and research future transport opportunities

Comprehensive digital infrastructure services to support these systems will be required and are outlined in the Infrastructure and Transport Context Analysis reports.

7.3.13 Zero emissions transport experience

It is recommended that a fully integrated, smart travel network is implemented in the Snowy Mountains SAP which includes a zero-emission transport experience which:

- Creates a gateway experience to the Snowy Mountains SAP with mobility connections to the Snowy Mountains Airport providing a sustainable, zero emission transport experience.

- Facilitates travel to and from the Snowy Mountains SAP via a sustainable form of travel (electric vehicles and green hydrogen train/plane/vehicle) which considers the transport needs of adventure tourism and snow sports (e.g. storage of skis/snowboards).
- Provides efficient and effective public and on-demand forms of transport including EV buses, shuttle buses and autonomous vehicles;
- Integrates MaaS for shorter trips including bicycle, e-bike and ride sharing.
- Supports and promotes active and sustainable transport networks including bicycle and pedestrian pathways, e-bike hire and adventure tourist attractions.
- Provides improved digital and autonomous systems to provide real time data and support to transport networks in the Snowy Mountains SAP.
- Provides alternatives to private vehicle use and enables a car free experience.

7.4 Snowy Mountains SAP vision alignment

Mobility reduction initiatives are aligned with the following Snowy Mountains SAP Vision topics:

Our proposed Mobility theme vision is:

Experience the future of efficient mobility

This compliments the Snowy Mountains SAP visions of 'Sustainability & Wellness' and 'Infrastructure and Connections' by improving access to sustainable and efficient forms of transport while improving the health and wellbeing of residents and visitors through active transport networks.

7.5 Outcomes of the Structure Plan

The following key ESD opportunities are included in the Structure Plan:

- Walking and cycling infrastructure has been incorporated to support zero emission transport options and create a 20-minute Jindabyne. This is further supported by lower speed limits around key community areas which improves safety and promotes people getting out of their car and walking or cycling.
- Zero-emission transport options are being developed to support passenger and mass transport options around the Snowy Mountains SAP. This includes electric vehicle charging stations and zero emission shuttles services being proposed.
- Active transport and recreation options are being expanded including an adventure/mountain bike park with a gondola to support movement around the park and reduce private vehicle dependence.
- Public transport is prioritised as the preferred method of transport around the Snowy Mountains SAP area, as per the WSP Transport Technical Report. This is part of a fully integrated transport model which provides a seamless service and supports increased air travel to the region.

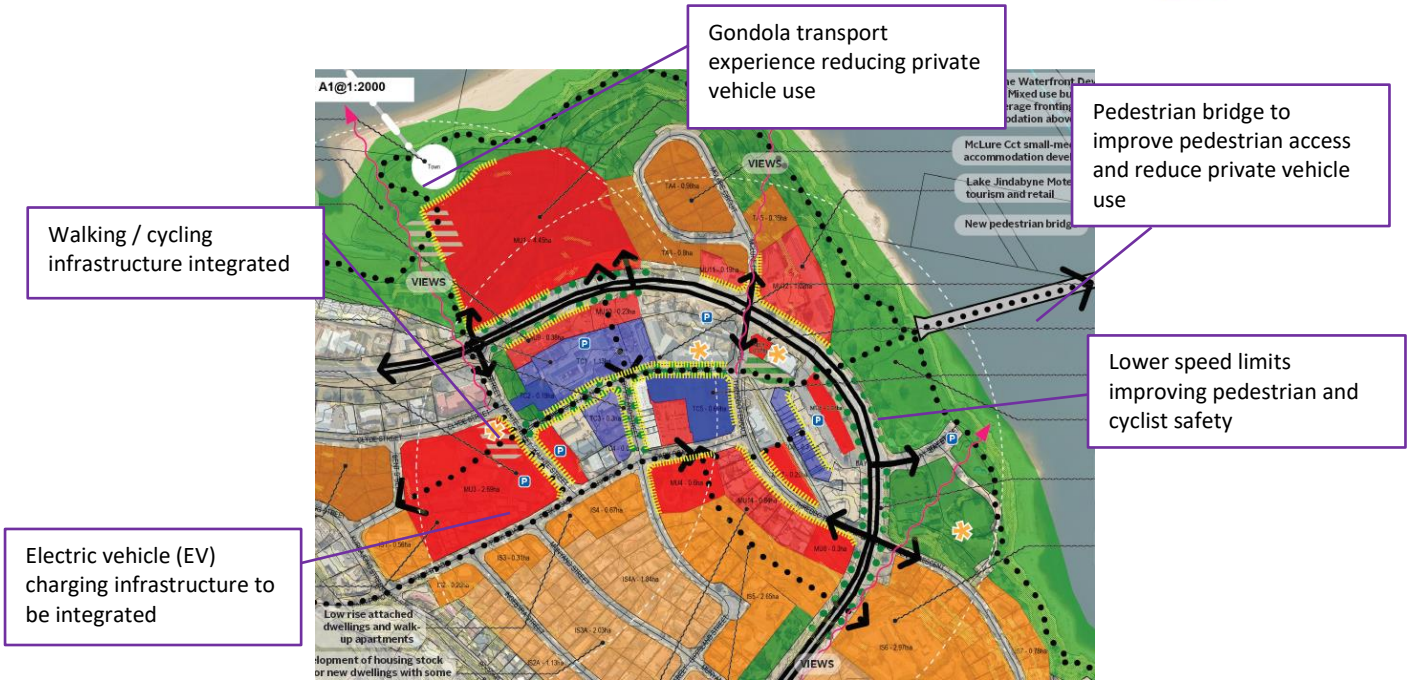


Figure 60: Mobility outcomes in the Structure Plan

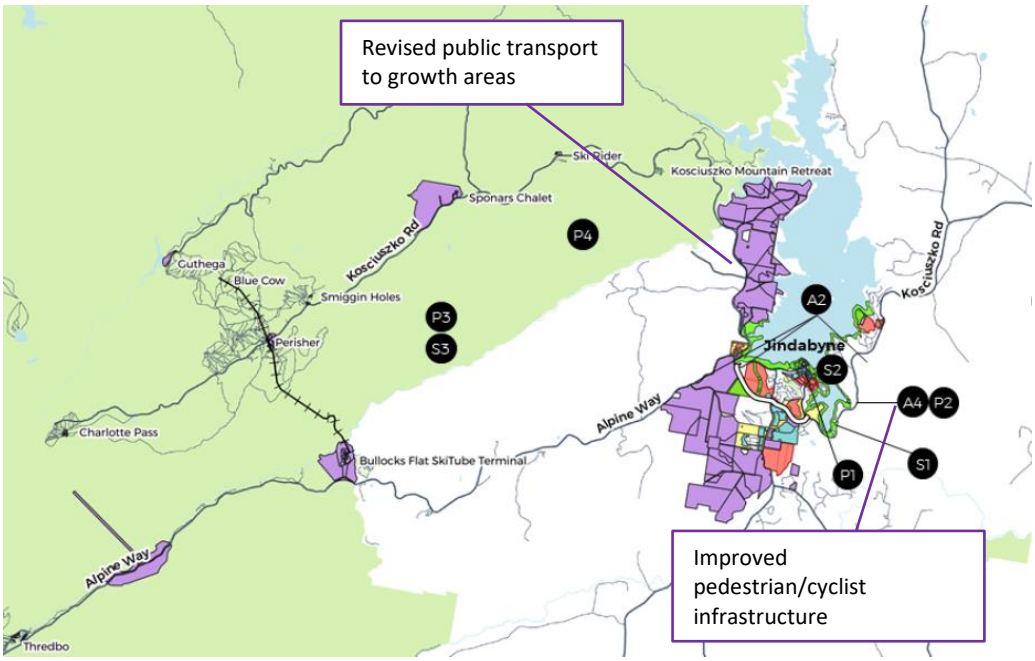


Figure 61: Mobility initiatives in the WSP Transport report

8 Environment

8.1 Introduction

Environmental conservation is a critical aspect of the overall Snowy Mountains SAP vision, where development and conservation must be aligned to allow the successful growth of the area.

This section of the report provides a summary of the environmental considerations in developing the Snowy Mountains SAP, in particular related to the vision to grow the region into 'Australia's Alpine Capital'. It is imperative that development of the region is carried out in an environmentally sustainable way, to minimise impact on this pristine natural environment.

8.2 Context analysis

The natural environment is the key attraction for the Snowy Mountains region.

Kosciuszko National Park is the largest National Park in Australia, constituting a significant part of the Australian Alps Bioregion and containing the highest mountain in Australia. In 1967 it was recognised as a UNESCO site as a 'International Biosphere Reserve', one of only two in NSW. Blue Lake and environs on the Main Range are listed as wetlands of international significance under the Ramsar Convention and the Park was listed on the Australian National Heritage List in 2008. Around 50% of the Park is declared wilderness, within nine separate areas.

Twenty-nine threatened species are known/predicted in the Snowy Mountains SAP Park area and twenty-six potential candidate threatened fauna species are identified in the tourism areas.

Significant geomorphological features are located within the Park. The waters of the Snowy, Murray, Murrumbidgee and Tumut rivers all rise in the Park, with the lakes of the Main Range being the only Australian water bodies formed by glaciers.

Given the vulnerability of the region's alpine landscape and the sensitivity of its native flora and fauna to climate change and global warming, it's important that environmental resilience is a cornerstone of future growth. WSP have prepared the Environmental Technical Reports for the Snowy Mountains SAP, including Biodiversity and Carrying Capacity.

The area is subject to earthquake risks and this should be considered in building design. The WSP Hydrology Context Report also notes that radon is emitted by the granite rocks in the region, which could expose people to radon gas, which may need to be managed during the construction of new facilities.

The natural environment already plays a huge part in the region's economy, with the Alpine area famous for winter snow sports. Other nature-based activities in the region include walking, hiking, fishing, mountain biking, and water-based sports on Lake Jindabyne.

Development in the region has at times impacted adversely on the natural environment, and there have been conflicts in the past over water quality and flows (from the Snowy Hydro development), indigenous understanding and respect, traffic and over population issues at peak tourist times. Whilst some of these issues have been and continue to be resolved, there is an opportunity for the Snowy Mountains SAP structure plan to alter the focus so that all development is designed in harmony with the surrounding landscape and existing community.

Due to previous development, there is some legacy infrastructure which may be able to be reused or repurposed to avoid disturbing new areas of wilderness. There is also some aged infrastructure which needs to be repaired or removed, including the former buildings of the old Snowy village, which have been left in place and have asbestos issues.

8.3 Context analysis - resorts

The Alpine towns of Thredbo, Crackenback, Charlottes Pass, Cabramurra, Selwyn and Perisher offer a resort experience for tourists. Whilst each resort is unique, commonalities include:

- restricted road access including active and public transport with a focus on private vehicle access
- limited parking and chain-bay availability
- limited accommodation offerings
- on-site sewage treatment plants
- some heritage buildings, mostly 2 storeys with a strong focus on character retention
- many resorts are near water courses
- some resorts only operate in the ski season
- resort locations provide good views, regardless of season

8.3.1 Thredbo Resort

Thredbo resort is the southern-most resort in the Park, surrounded by heavily vegetated steep terrain. It's a year-round resort with snow sports in winter and walking/riding/cycling trails in other seasons. It has diverse infrastructure for additional activities as well as a waste transfer station and waste water treatment facility.

It has diverse flora and fauna and has a great diversity and intensity of land uses. Buildings are located within close proximity making it a dense resort with pedestrian accessibility. Thredbo was the first Australian ski resort to have its major operations powered by renewable energy, through a contract for 100% renewable energy with Red Energy and Snowy Hydro**.** Thredbo resort lists the following environmental initiatives and activities:

- Organics recycling machine: composting food waste via a closed loop system.
- Plastic reduction plan: removing single-use plastic products.
- Rehabilitation: stabilising soil and providing habitats for native animals as part of the mountain bike trail development.
- Repurposing materials: building materials have been reused in landscaping.
- Greenfleet: since 2009, Thredbo has partnered with Greenfleet to offset resort vehicle emissions including all fuel used to run snow groomers and shuttle buses.
- Carbon offset: a voluntary forestry carbon offset program for guests, enabling them to purchase a tree for $4 when buying lift products.
- EarthCheck: Thredbo measures its environmental performance using the EarthCheck benchmark, achieving a silver certification for three consecutive years.
- Environmental week: a week dedicated to driving awareness about environmental initiatives with the broader community.
- Biodiversity Management: in partnership with the NSW National Parks and Wildlife Service, Thredbo acts to protect native flora and fauna within the resort. This includes fauna crossings and planting of native flora.
- Energy Management: Energy efficient equipment (Gondola, lifts, snow-making machines, heat pumps and lighting) and solar PV installations have reduced energy and utilised renewable energy.
- Waste Management: multiple separation and recycling initiatives are practiced for common and more challenging waste streams at the resort.

- Water Management: water use is reduced through water efficient appliances and fittings and water quality is monitored.

Policies that guide the care and protection of Thredbo's environment and heritage include:

- The Thredbo 2020 Environmental and Social Sustainability Policy
- Thredbo Environmental Sustainability Action Plan
- Annual NSW Alpine Resorts Environmental Performance Report
- Environmental Initiatives 2020

Nearby Lake Crackenback has a range of mountain bike and pump tracks with connected service roads for mountain bike access.

8.3.2 Perisher Resort

Perisher resort is the largest alpine resort complex within the Park in terms of skiable terrain and number of lifts. It has 2 ski-tube terminals and outside of ski season is an access point for hiking trails. Accommodation is provided for 3500 people and retail and hospitality facilities are available as well as a medical centre, pharmacy, post office and supermarket. A waste transfer station is nearby and a waste water treatment plant is in the valley.

The resort has implemented environmentally sustainable activities as part of the Vail Resorts network who share a commitment to net zero operating footprint. This includes:

- Improving waste diversion across all operational areas, including a focus on organics composting
- Removal of waste bins in staff areas to encourage better utilisation of centralised waste separation stations
- Replacing single-use plastic straws with compostable alternatives
- Removal of single-use plastic products like condiments and implementing reusable crockery and cutlery across various operational areas
- Increased the number of water stations to encourage BYO drink bottles and reduce single-use plastic bottles
- Incorporating habitat connectivity features in development proposals, with three new fauna crossings installed in the last 2 years
- Using innovative construction techniques to avoid or minimise disturbance to biodiversity
- Campaigning to reduce litter and holding clean-up activities

Perisher are members of the CERES Business for Innovative Climate and Energy Policy as well as RE100. The resort engages with vendors and suppliers to identify and collaborate on opportunities to reduce emissions and impacts. Information is published with progress shared in their annual report. Vail Resorts measures GHG footprint and in 2016, calculated a per skier footprint of 0.0127T CO_2 per visit.

8.3.3 Charlotte Pass Resort

Charlotte Pass resort is the highest snow resort in the Snowy Mountains SAP and during winter the resort is snowbound with access via over-snow vehicles only. There are efforts to improve access with shared car parking and group transport proposed at Sawpit Creek and/or revival of a chairlift.

The resort has a local wastewater treatment plant which discharges to Spencers Creek Bog. The 10-year master plan notes upgrades to this facility including roofing over tanks, recladding of buildings and automated programmable logic controllers. Charlotte's Pass aims to monitor stormwater and increase investment in energy saving initiatives, as well as developing waste programs to raise awareness. The area around the resort is primarily disturbed vegetation but the area supports important biodiversity. The resort is compact with buildings within close proximity allowing pedestrian access.

8.4 Opportunities

The environmental impact of new development in the region must be carefully considered to ensure that they are appropriately managed and mitigated. Opportunities to manage the environmental impact of new developments are summarised as follows.

8.4.1 Brownfield development

Where possible, development should occur within previously developed areas. This is important in the national park, but also in Jindabyne and surrounds, to preserve areas of vegetation around the town and lake and to reduce the environmental impact of new development. This is especially important due to the vision of the region to 'touch the ground lightly'.

All of the resorts are connected to infrastructure (electricity and mains water) and most have road access. As the majority of use is in winter, it is logical to use this existing infrastructure to support growth in summer activities where possible. Where new facilities are required, brownfield (previously developed sites) should be prioritised.

Sites where previous uses have been abandoned, such as the old Snowy village and disused airstrip, new uses should be identified and development prioritised here over pristine areas. In particular, it is noted that the abandoned Snowy village is adjacent to one of the region's most popular campgrounds. This area should be decontaminated (asbestos in buildings) and cleared, to be rehabilitated and restored for a new camping or tourist accommodation site.

The village of Jindabyne may be the best location for sustainable growth of the population, although well considered smaller pockets of development to activate the lakefront can also be possible if developed sustainably.

8.4.2 Biodiversity

The rich biodiversity in the region supports ecosystem services and provides important educational and attraction opportunities. The conservation and ongoing protection of this biodiversity as climate change impacts affect the region is particularly important.

Given the interest in nature-based tourism and environmental awareness, biodiversity projects can benefit from eco-tourism experiences which offer hands-on opportunities for paying tourists as well as volunteers, students and community groups. Revegetation, wildlife rehabilitation and corridor building, regenerative agriculture, carbon offset planting and field surveying activities provide important educational and practical skill development opportunities which can not only appropriately aid environmental management, but also provide health and wellbeing benefits, connectivity and foster stewardship.

The 'leave no trace' movement (low impact ecotourism) can become the norm for not only the National Park but for the entire region, branding the area as an environmentally conscious and responsible destination. This premium brand can be further supported by appropriate development and planning and by adopting permaculture principles and whole-systems thinking. This can extend and connect the Snowy Mountains SAP's environmental and sustainability focus with linkages between people and the earth, focussing on regeneration which will aid not only biodiversity, but the achievement of a climate positive and carbon negative region.

8.4.3 Carrying capacity

The development of specific alpine zone carrying capacity models which take into account environmental considerations can help to reduce environmental impact and improve ongoing sustainability. Specific regional carrying capacity models within the Snowy Mountains SAP can more appropriately reflect the unique environments and ecosystem services in the direct vicinity, which can also aid in climate change considerations for altered habitats and species migration.

Traditionally carrying capacity in Snowy has been based on bed count, i.e. the number of beds determines the number of visitors. Many other models use the limits of infrastructure to dictate the maximum capacity of a region, such as energy and water supplies, or road capacity. Tracking visitation numbers and comparing this to utility usage can further inform carrying capacity models, which in turn will assist with impact projections, a useful tool for developmental planning and carbon accounting.

To take an ESD approach to carrying capacity, it should be considered if regeneration can occur within the carrying capacity limits. Rather than set the capacity based on how many people or how much development the area can take without causing damage, allowing for regeneration ensures that the area is protected and improved over time.

In ecological terms, the carrying capacity of an ecosystem is the size of the population that can be supported indefinitely upon the available resources and services of that ecosystem. This description would indicate that a carrying capacity for the Snowy region should consider what resources are available within the region to support its needs, and to take advantage of these as a priority. Ideally, no resources would be imported into the region, although it is recognised that this is nearly impossible in reality. However, perhaps this could be balanced through a combination of sustainable development, circular economy and carbon balancing. WSP have prepared a detailed report on carrying capacity in consultation with the technical consultants, including ESD input. The following Carrying Capacity Framework is proposed:

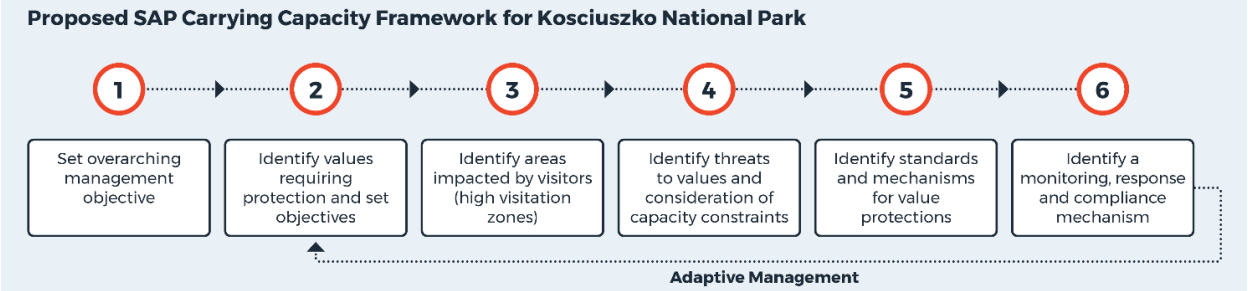


Figure 62: WSP Carrying Capacity Framework

Within the WSP report, it is proposed that an Environmental Management System is implemented to ensure that all of the sustainability and environmental values are captured in the carrying capacity framework, and that the EMS is used to create and manage KPI's for development. This aligns well with the recommendation of a Snowy EMS as per section 11 of this report. Further information on the Carrying Capacity Framework is contained within the WSP report.

8.4.4 Environmental and ecotourism education

The diversity of landscapes, elevations, natural features, flora and fauna within Kosciusko National Park and the wider Snowy Mountains SAP area offer significant opportunities for health and education. Students can learn about natural systems and environmental sciences, ecotourism, sports and recreation, nature therapy, history and culture and a multitude of other practical skills. These skills may also prove useful for emergency response and defence field training, as well as sports training.

Kosciuszko National Park and Snowy Mountains SAP branding can reflect environmental stewardship, building the reputation of the area and affecting behavioural actions of both visitors and the local community.

8.4.5 Regenerative building design

The built environment plays a substantial role with relation to impacts on and connection to the natural environment. To reflect the natural assets of the region, buildings within the Snowy Mountains SAP can utilise sustainable local natural materials, replicate natural forms and showcase sustainable design features. This ensures that they respect the character of the region, whilst offering aesthetically pleasing and practically comfortable spaces that are resource efficient and resilient to climate changes.

Encouraging all new infrastructure to take the natural environment into consideration with regard to aesthetics and climate change can ensure more sustainable buildings, with lower ongoing running costs. This offers a unique visitor experience whilst boosting local resilience.

All building design should consider modular and prefabricated design where possible to minimise the environmental impacts of construction.

8.4.6 Carbon sequestration

Within the Snowy Mountains SAP area, there are opportunities for carbon offsetting projects, mostly with vegetation-based sequestration. Sequestration is the removal of atmospheric carbon dioxide through biological processes in plants and trees. Regenerative agriculture and forestry can provide carbon offsetting activities, as well as supporting landscape restoration, food security and resilience to the impacts of climate change.

This has been further explored with WSP's biodiversity team, to establish carbon sequestration opportunities which also support the region's biodiversity and ecology alongside the biodiversity offsets required for the development.

8.4.7 Green Infrastructure

The climate of Jindabyne can be extreme, with cold winters and very hot days in summer. Working with the urban design team, green infrastructure projects are included in the Structure Plan, to reduce the heat island effect on the town and to make the community more resilient to climate change. Green infrastructure opportunities include:

- Rehabilitate landscaped areas in poor condition, such as vegetated areas along the lakefront.
- Working with the urban design team to include street planting/trees in the urban regeneration.
- Incorporating water sensitive urban design principles (WSUD) into public space design.
- Inclusion of new green spaces, such as parks, playgrounds and open spaces.
- Green infrastructure in building design, such as green walls/ roofs and internal planting.

Figure 63: Green infrastructure examples

Figure 64: Green infrastructure examples

8.5 Snowy Mountains SAP Vision Alignment

The natural environment supports all activities within the Snowy Mountains SAP and beyond, and offers unique opportunities for health, ecotourism experiences, education and connectivity. Environmental initiatives are aligned with the following Snowy Mountains SAP Vision topics:

Our proposed Environment theme vision is:

Touch the ground lightly

This compliments the Snowy Mountains SAP visions of 'Sustainability & Wellness' and 'Adventure & Ecotourism' by considering opportunities to protect and regenerate the natural environment of the region.

8.6 Outcomes of the Structure Plan

The following key ESD opportunities are included in the Structure Plan:

- Touch the ground lightly is the overarching development strategy for new buildings and infrastructure.
- Green Infrastructure to be embedded in urban design.
- Develop existing buildings and previously developed sites, including the old Snowy village and previously developed areas around Jindabyne. All of the recommended development within KNP is within existing tourism and development areas.
- Develop design guidelines for all new infrastrucutre and buildings in accordance with the sustainability framworks identified in the Leadership section of this report.
- Carrying Capacity is fully integrated with the Snowy Mountains SAP EMS with topics and Key Performance Indicators (KPI's) alinged for consistency.

9 Circular Economy

9.1 Introduction

A circular economy model redesigns current linear thinking to a closed loop or circular systems approach, which maximises resource efficiencies, reduces waste and improves natural systems. Creating a circular economy within the region can provide benefits from an environmental, economic and social perspective, with increased efficiencies providing greater return on investment for the local economy and reduced resource consumption decreasing environmental impact.

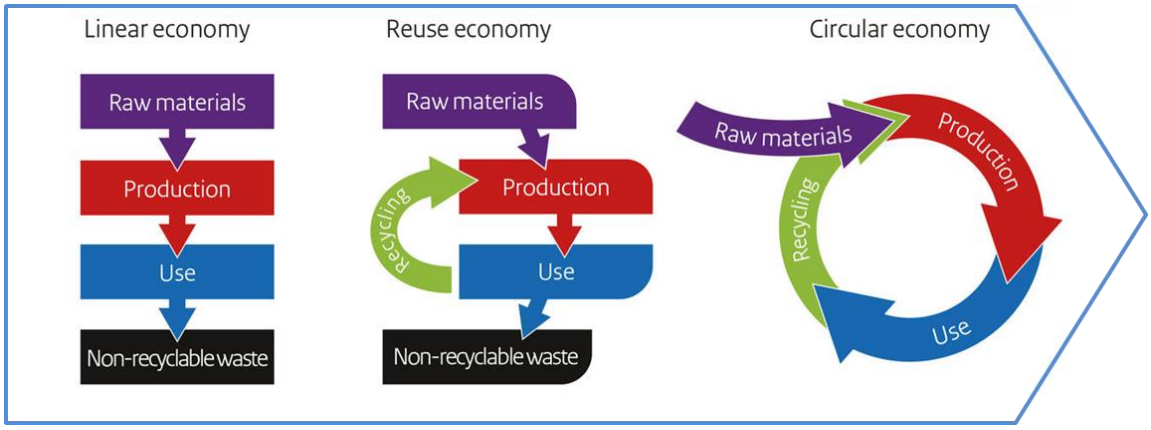


Figure 65: Transitioning from Linear to Circular Economy

This section of this report explores a circular economy approach applied to a region focussed on tourism.

9.2 Context analysis

Circular Economy

The majority of the resource use and waste management in the region appears to happen in the traditional sense, in a linear fashion where resources are brought to the area, used and disposed of. There is no major manufacturing within the Snowy Mountains SAP boundary, and the agriculture is limited and mainly exported.

From our initial research there appears to be limited circular economy approaches undertaken within the Snowy Mountains SAP boundary at present. Studies into this area by Snowy Monaro Regional Council seem to focus on waste and recycling, and this is the subject of the remainder of this context analysis.

Waste and Resources

There are three major landfills and six transfer stations operating in the area, with limited organic composting available in Cooma. Some resorts have implemented site compost and specialised materials collection initiatives; however, this is not commonplace and could be further supported. The SMRC Waste Management Strategy is currently in draft and suggests an emphasis on organics processing, with potential infrastructure upgrades in Jindabyne, and consideration of feasibility studies for local recycling of items such as glass and plastics. The final draft strategy includes expanding the Jindabyne landfill, capping the previous cell and designing and construction a new transfer facility. Other initiatives include expanding kerbside collection across the LGA, improving organics and composting facilities (with a compost facility located at Cooma), addressing illegal dumping, improving construction and demolition waste management and developing education programs. The strategy and improvement waste management services are expected to support the Snowy Mountains SAP as expanded services are offered and reduced landfill waste is created.

Waste management within the area is varied, with the Snowy Mountains Regional Council offering residential and some commercial services upon request. All recycling materials collected by Council are transferred to the Hume Materials Recovery Facility in the ACT for appropriate sorting and reprocessing. Resorts independently arrange waste management so management and disposal differing for each site and contractor.

There are three major landfills and six transfer stations operating in the area, with limited organic composting available in Cooma. Some resorts have implemented site compost and specialised materials collection initiatives; however, this is not commonplace and could be further supported. The SMRC Waste Management Strategy is currently in draft and suggests an emphasis on organics processing, with potential infrastructure in Jindabyne, and consideration of feasibility studies for local recycling of items such as glass and plastics.

Major landfills are operational in Jindabyne, Cooma and Bombala. Sawpit Creek and Thredbo landfill sites are no longer operational and Bombala landfill may be transitioned to a transfer station in the near future. There are six existing transfer stations nearby.

The total Jindabyne landfill site area is approximately 25.46ha and is licenced for disposal of total solid waste of 12,000 tonnes per annum and total special wastes of 550 tonnes per annum. 5 tonnes of hazardous waste can be stored at any one time. Approximately 14,232 tonnes of waste materials were received in 2017/18.

There is currently no Council organics collections within the Snowy Mountains SAP meaning that organic matter is sent to the Jindabyne landfill site. This site is nearing capacity, with approximately 3 years remining. An expansion proposal is currently undergoing Environmental Impact Assessment, with an additional cell of approximately 400,000m^2 planned in the old quarry. This would be appropriately lined and demonstrate best practice waste management. Given that local organics composting is a priority, methane capture from the new cell is not planned as there will be limited organic materials within landfill.

According to the Jindabyne Regional Waste Management Facility Options Assessment Report (GHD, 2019) landfill goes up with the influx of seasonal tourism, but recycling does not. This may be due to various factors including the lack of infrastructure; with only landfill bins in public spaces, the lack of appropriate tourist disposal and education, and/or additional heavy organics disposed in landfill.

A Jindabyne Regional Waste Management Facility Options Assessment Report (GHD, 2019) recommended data collection, expansion of a three-bin system, landfill and transfer station expansion and key waste stream (organics and construction & demolition) development. An expansion of the landfill into the quarry was also recommended to meet the needs of the growing community, however the council have elected to upgrade the Cooma landfill site which will support services to the Snowy Mountains SAP.

Some of the resorts currently practice waste and recycling management techniques. For example, Thredbo resort has a waste transfer station and wastewater treatment facility, including organics recycling to compost food waste via a closed loop system, environmental awareness programs, and reuse of building materials in landscaping projects.

NPWS have rolled out a program of collecting organic food waste from within Perisher Ski Resort, which is then composted at Sawpit Creek. 52-90 tonnes of food scraps were collected in each of the 2016-2019 ski seasons. Compost is utilised by NPWS in all planting programs. In addition, NPWS recently purchased a soft plastics baler at Perisher Waste Transfer Station. The soft plastic bales are taken to Plastic Forests in Albury to be made into new plastic products.

Perisher also has green waste composting, no single use plastics and programs to encourage visitors to bring their own bottles to reduce plastic and glass waste. Perisher's owner Vail Resorts have a zero-waste commitment as part of their sustainability policy.

9.3 Opportunities

Embedding circular economy into the Structure Plan may present the following opportunities.

9.3.1 Waste and resources

There are many opportunities to improve waste management processes within the Snowy Mountains SAP and to become a leader in effective waste management in public places. Some of the key opportunities include:

Organics resources

Organics material capture and reprocessing provides an opportunity for waste diversion and lowering environmental and economic impacts. A composting facility within the same boundary area as the current Jindabyne landfill could utilise biosolids and reclaimed water from the Jindabyne wastewater treatment plant. Finished compost can be utilised for local revegetation or sold to neighbouring agricultural areas as a valuable natural soil enhancer, which can improve crops and increase resilience.

All new developments should include organics collection, including residential developments.

Local recycled resources

Given that the area has high tourism activities, beverage containers constitute a large proportion of recyclable materials generated. Increased levels of recycling will reduce the landfill pressures and should be investigated prior to, or in combination with, landfill expansions. The Jindabyne Regional Waste Management Facility Options Assessment Report (GHD, 2019) suggested that increased recycling of glass plastics and organic waste, could reduce waste to landfill by 32% and should be factored into any waste facility upgrades.

Provide a centralised soft plastics baler to allow Jindabyne businesses to collect and recycle soft plastics.

Sports Gear

Design an area for reuse of snow sports gear and other sports equipment, where people can drop off old sports equipment that they have no more use for to be reused by future visitors.

Community engagement

By delivering best practice waste management and sharing the experience with the greater community, buy-in and stewardship can be fostered. Engaging educational campaigns can shift consumer behaviour and practices, whilst providing rapport building relationships between Council and the greater community and achieving desired outcomes. This strong shift can further support the branding of the Snowy Mountains SAP as a sustainable destination, hence further facilitating responsible sustainable practices.

9.3.2 Micro closed loops

All resorts in the Snowy Mountains SAP area should be required to follow the same waste management principles that are currently implemented at Thredbo and Perisher, to divert as much waste from landfill as possible. Alpine resorts should aim to be zero waste to landfill.

In addition, any new resorts or tourist accommodation should investigate opportunities to be energy neutral through energy efficient building design and renewable energy, and water neutral through capture and reuse. Resort infrastructure that is sensitive to the natural environment; designed and built sustainably to the conditions, could showcase the areas commitment to the environment and become a tourist attraction in itself, whilst supporting other values of the region.

9.3.3 Construction standards

The building design standards for the Snowy Mountains SAP should require circular economy opportunities to be investigated for new developments. This could include the procurement of recovered or recycled materials in construction.

In addition, design of new assets should give consideration to deconstruction opportunities. Buildings that can be easily disassembled into parts can be more readily reused/recycled at end of life, or in the event of disaster management (i.e. bushfires) and can also be redesigned and adapted to be more resilient to future climate risks.

9.3.4 Business partnerships

Connecting local businesses may allow further opportunities for circular economy outcomes to develop. This will be further assessed with Sustainability Advantage to better understand opportunities in the region. Examples of opportunities for business engagements from the previous Snowy Mountains SAP projects that could be successful in the Snowy Mountains SAP include:

- Develop a virtual energy network connecting major businesses within the Snowy Mountains SAP to maximise renewable energy integration, manage peak demand and minimise energy costs (see Energy section for further information on renewables for the whole precinct).
- Establish a local circular economy network to establish greater collaboration between businesses creating a greater sense of community and connectivity.

9.3.5 Education and learning

Given that tourism is a growing industry and the Alpine region offers unique experiences, training and skills development can be offered to further support the industry, raising awareness and support. This could be on sustainability, ecotourism, circular economy, etc. Training may be in the form of a dedicated institution or via embedded topics in existing education.

By encouraging partnerships with local businesses, students can then seek employment opportunities within the area to grow their skills. This could be in local sports or tourism businesses, or in event planning.

Figure 66: Concept of circular economy for learning and growth

The idea of this concept is that:

- People choose to come to the Snowy area to learn due to the education and sports facilities offered in the region.
- Hospitality and tourism specific training centres could upskill locals as well as attract students to the region, as alpine operations add unique considerations and require specific skills.
- Local partnerships encourage training opportunities within local businesses.
- Provide resources for co-working and start-ups to encourage entrepreneurship.

- New sustainable business opportunities are developed, which helps to grow the community and its attractiveness.
- The people who were attracted to the region to learn, now own/operate/work in local businesses and are fully integrated into the community.

9.4 Snowy Mountains SAP vision alignment

Given the currently limited approach to circular economy principles within the region there are opportunities for materials use, waste management, education, growth and connectivity. Circular Economy initiatives are aligned with the following Snowy Mountains SAP Vision topics:

Our proposed circular economy theme vision is:

Collaborating to share resources and knowledge

This compliments the Snowy Mountains SAP visions of 'Sustainability & Wellness' and 'Sport & Education' by considering opportunities to protect and regenerate the natural environment of the region.

9.5 Outcomes of the Structure Plan

The following key ESD opportunities are included in the Structure Plan:

- Support waste management and recycling infrastructure to improve waste separation and diversion.
- Develop circular economy relationships between Snowy Mountains SAP businesses.
- Consider opportunities to link learning and education facilities in the region with existing and new businesses, to allow skilled workers to stay in the region, creating a cycle of learning and development.
- Consider incentivising the use of recovered / recycled materials in construction, and also designing buildings for deconstruction and post-use recovery.
- Explore opportunities to align the Snowy Mountains SAP Structure Plan, future Delivery Plan and Precinct Design Guidelines with circular economy initiatives.

10 Water

10.1 Introduction

Water is precious in Australia, even more so after recent prolonged drought events. However, with careful design and use of water, it can be used to support the needs of development.

Water is an especially important resource for the Snowy region. Water is described in the Hill Thalis Regional Context Analysis as 'the foundational element of the region'. It has historical and geological importance, and is a huge economic contributor to the region through the Snowy Hydro project.

This section of the report explores the use of water in the Snowy Mountains SAP region, to align with the vision of providing green and blue infrastructure to support the development of the Snowy Mountains SAP.

10.2 Context analysis

Rainfall and snowfall are high in the area. The Thredbo village weather station records an annual average rainfall of 1406mm, with other rainfall stations recording slightly more (as summarised in the WSP Flooding Context Analysis report). The Snowy River, one of the largest ice melt rivers in Australia, rises near Mt Kosciusko, and joins the Tumut, Eucumbene and Murrumbidgee rivers to eventually join the Murray and Murrumbidgee valleys.

This abundance of water in the region led to the construction of the Snowy Hydro project in the area. Snowy hydro has operated in the region for almost 70 years, storing and diverting water from these rivers through a series of dams, power stations and hydro-electric turbines for the purposes of irrigation and electricity generation. It is an iconic infrastructure project in Australia, often referred to as a feat of modern engineering. Snowy Hydro own and operate the infrastructure, and are responsible for all water storage, environmental flows and electricity generation. The water captured from these major rivers has led to extensive agriculture development in the area, and the electricity generated helps to power the national grid.

Snowy 2.0 is underway, which will be the largest renewable energy project in Australia. The project involves linking two existing dams, Tantangara and Talbingo, through tunnels and a new underground power station. The project is a closed loop, which means it does not use any additional water from the scheme. The first power will be available from this project by 2025.

Snowy Hydro also operates a Cloud Seeding Program to increase precipitation by an average of 14%. The purpose of cloud seeding is to increase rainfall, which in turn increases water storage and energy generation. It also has the added benefit of increasing snowfall to the region.

Lake Jindabyne receives flow from the Snowy River. The lake levels vary depending on snow melt, rainfall levels and operational users. The Jindabyne dam holds 689,900ML and is the 4th largest in the Snowy Hydro system. Snowy Hydro is responsible for Lake Jindabyne water levels, which are managed to allow for recreation on the Lake. The lake is also used to manage environmental flows into the Snowy River. The Snowy River Local Environmental Plan 2013 was enacted to protect and enhance the ecological integrity, natural resources and environmental significance of Snowy River, and includes controls over development to protect the water quality and quantity for future generations.

Despite this abundance of natural water, there have been several water quality and quantity issues in the region. This includes poor water quality in the rivers and lakes, loss of environmental flows in the rivers leading to ecology and river health issues, and lack of usable water storage.

Water supply for the Jindabyne area is provided by the Snowy Monaro Regional Council primarily through intakes from Lake Jindabyne. Wastewater is also provided by Council.

Water and wastewater services to the resorts are managed individually by resorts with National Parks and Wildlife Service currently providing municipal services at perisher range, although this may change as a result of the Snowy Mountains SAP. All sewage treatment is licensed to the EPA and undertaken to tertiary level including U.V. treatment and solids are removed and used off park.

An Integrated Water Cycle Management Detailed Strategy Study was prepared in 2014 by Snowy River Shire Council to address issues of Council exceeding the volumetric limit requirement of the Lake Jindabyne extraction licence and water quality issues from Lake Jindabyne as an unprotected source.

The Go Jindabyne Utilities and Servicing Strategy (2019) notes that the current water extraction licence for Jindabyne is insufficient to meet demands and that 'there are substantial supply constraints regarding the potable water network, particularly regarding the amount of water that can be taken from Lake Jindabyne'. It also notes that there are environmental health issues from the sewer treatment plants and outflow into the river systems, including break of environmental protection licences.

The population forecasting included in this report is less progressive than the population forecast for the Snowy Mountains SAP, therefore the noted demand and capacity issues for water supply and wastewater treatment capacity are likely to occur sooner than predicted. This is further examined in WSP's infrastructure studies.

Within the KNP, emergency effluent overflow from the resort wastewater treatment plants is currently diverted into nearby streams. This is due to a lack of space in natural riparian areas to provide large scale emergency holding ponds. It is unrealistic to expect large emergency ponds to be built within the national park and as a result, improvements can only be made upstream and within the wastewater treatment plants, not downstream of the plants. Improvements to wastewater treatment and reuse should be considered as a high priority for the Snowy Mountains SAP and the resorts to reduce the likelihood of unplanned discharging effluent into mountain streams.

It should be noted that around 50% of inflows to Lake Jindabyne are received from snowmelt and spring rain. Climate change projections indicate a reduction in rainfall of 9% over the next 60 years, which will alter the water flow into Lake Jindabyne and may indicate that the releases from the Lake need to be carefully managed to both preserve environmental flows and ensure sufficient water storage for the townships needs.

10.3 Opportunities

Considering the abundance of water and its importance in the region, water should be celebrated as a precious resource, with the natural water cycle supporting the needs of the region. All water resources should be managed in accordance with the Water Management Act 2000, which includes requirements for the sustainable use of water resources whilst protecting, enhancing and restoring water courses, and providing equitable use of water resources.

10.3.1 Integrated water cycle

The draft Go Jindy Masterplan talked of Jindabyne's 'Blue Heart' as a central opportunity, to celebrate water through encouraging activities in and around the lake, but to also use the lake and its changing water levels as an opportunity to learn and enjoy the Lake's dynamic movements and the importance of water in the region for supply of fresh water to the wider region, and as a power source.

Opportunities are linked to the capacity of the Lake and its regulated releases through the Snowy Hydro scheme. Whilst there is plenty of water flowing into the lake, its varied uses downstream mean it's important to manage water demand in the region as much as possible. Implementing an integrated water cycle supported by water sensitive urban design (WSUD) principles will be key to ensuring that the region has sufficient water resources (both potable and non-potable) to expand beyond current population while minimising impact on the environment and adapting to a changing climate.

Whilst much of the precipitation in the winter falls as snow, the meltwaters provide an amazing opportunity to capture and reuse this water at source. The success of utilising water from the Snowy Mountains SAP area as irrigation for regional NSW should be able to be achieved whilst also ensuring that the local area has adequate water to meet all demands.

The following water supplies will need to be integrated in combination to provide a balanced outcome which reduces environmental impact (refer Figure 67):

- **Mains water:** Water from rivers and catchments is treated for potable water use (human consumption)
- **Harvested rainwater:** Rainwater is captured from large roof areas for non-potable reuse (e.g. irrigation, toilet flushing, wash down) and in the event that mains water is not available, additional water filtration is used to provide treated rainwater for potable purposes.
- **Stormwater management and harvesting**: Stormwater is treated to improve water quality in lake Jindabyne and maintain environmental water flows.
- **Wastewater treatment and re-use**: Wastewater is captured, treated and either returned to the water catchment or supplied for non-potable water uses.

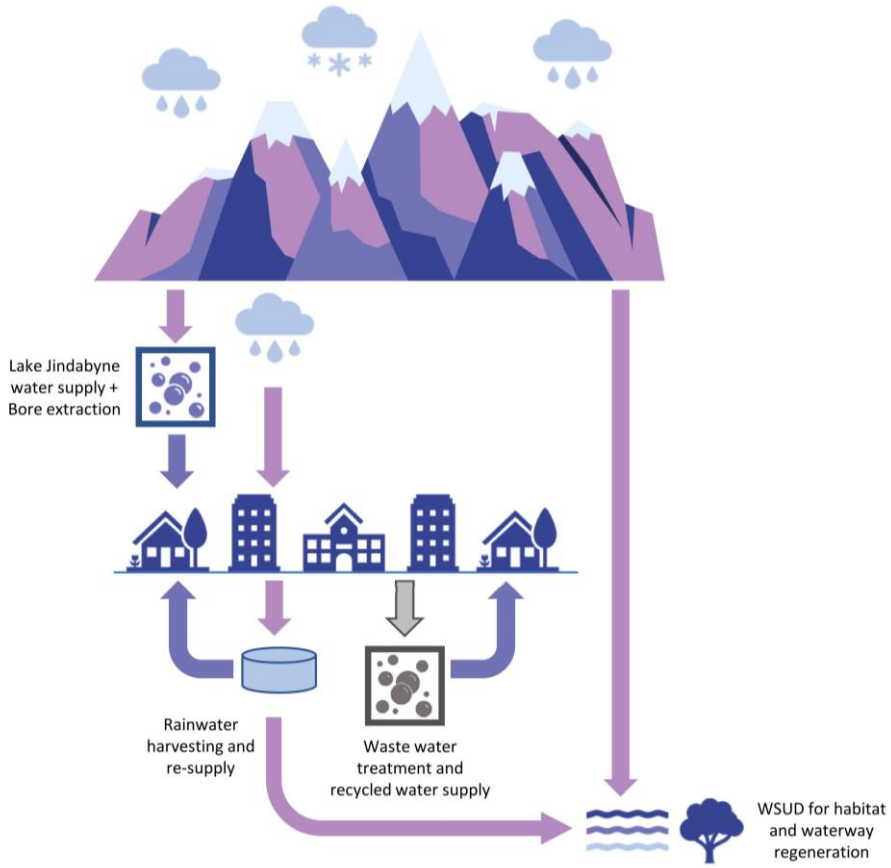


Figure 67: Integrated Water Cycle

All previous infrastructure studies note pressure on the water extraction limits from lake Jindabyne, and that this pressure may be partly alleviated by looking at alternative ESD opportunities.

WSP has provided further technical information on the water infrastructure upgrades for the Snowy Mountains SAP. This may include requirements to revisit current water extraction licences for the region to support future growth. The opportunities below focus on alternatives to mains water.

10.3.2 Rainwater

To minimise the use of mains water, rainwater can be captured for reuse. This should be harvested, stored, and used on site where possible. It is noted that rainwater harvesting can be problematic in the alpine areas due to snow inundation causing problems with gutter systems, therefore this is either not recommended for alpine areas, or gutter guards need to be installed to protect infrastructure from snow.

10.3.3 Stormwater

As much of the water for the region is provided from Lake Jindabyne, or from the rivers flowing into it, there seems to be little benefit in disrupting the environmental flows to the Lake. Stormwater management should focus on water quality to ensure that the stormwater runoff is not subject to high pollutant loads before entering the lake.

The WSP Flooding Context Analysis indicated that flooding can be problematic in the area, and that better WSUD infrastructure can help to alleviate this. Snow melt and storm water runoff in the resorts is also problematic with road and other pollutants easily entering the drainage systems from pulses in winter visitation and mechanised snow clearing. Bespoke solutions are required as outlined in the WSP hydrology report.

Green infrastructure to the public spaces and streets, such as swales, can help to ensure that runoff is captures cleanly and transferred to the stormwater systems for diversion to the lake.

10.3.4 Wastewater

Sewage management in the ski resorts is problematic due to the difficulty of achieving treatment in cold high elevations, the lack of areas for emergency discharge protection and the pulse characteristics of visitation. Wastewater treatment and reuse should be considered as a high priority for the Snowy Mountains SAP and the resorts to reduce the likelihood of discharging effluent into mountain streams.

Wastewater treatment and reuse should be considered as a high priority for the resorts as an alternative to discharging effluent into mountain streams.

Reuse of wastewater should be considered in line with the NSW Guidelines for Recycled Water Management Systems and the Australian Guidelines for Water Reuse.

All new development should consider opportunities for wastewater capture and reuse.

10.4 Snowy Mountains SAP vision alignment

Water initiatives are aligned with the following Snowy Mountains SAP Vision topics:

Our proposed water theme vision is:

Celebrate Snowy's founding natural resource

This compliments the Snowy Mountains SAP visions of 'Sustainability & Wellness' and 'Infrastructure and Connections' to provide abundant water resources for use in the region.

10.5 Outcomes of the Structure Plan

The following key ESD opportunities are included in the Structure Plan:

- New water infrastructure and urban planning to incorporate water sensitive urban design, including open space and waterfront areas. Increased green infrastrucutre will help manage stormwater entry to Lake Jindabyne.
- Wastewater treatment systems in the alpine areas to be upgraded to closed loop systems with no pollution to alpine streams.
- Build water capture and reuse infrastructure for all new developments.An integrated water cycle is estabilised based on water sensitive urban design (WSUD) principles, including better management of stormwater quality and quantity.
- Build infrastructure to capture alternative and sustainable natural water supply sources, including rainwater and recycled water.

11 Leadership

11.1 Introduction

One of the technical brief aspirations for the Snowy Mountains SAP is for it to be “a national leader in environmental resilience and sustainability”. The RGDC’s Snowy Mountains SAP Guiding Principles includes reference to the need to maintain “environmental integrity”.

This section of the report provides a summary of the potential frameworks, rating tools and accreditations that could be adopted as a means of attaining the national leadership aspiration, in a manner that maintains environmental integrity in practice.

11.2 Context analysis

An ESD Leadership framework has been established for the Parkes and Wagga Wagga Special Activation precincts which comprises an ISO 14001 Certified Environmental Management System (EMS) within which is embedded a series of precinct specific sustainability frameworks and rating tools.

Key components of the existing Snowy Mountains SAP sustainability frameworks are:

- an ISO 14001 EMS which sets targets and monitors the environmental performance for the Snowy Mountains SAP. The EMS connects to the Snowy Mountains SAP Delivery Plan, and references other frameworks and rating systems;
- a Delivery Plan that encourages and incentivises businesses within the Snowy Mountains SAP to establish and maintain their own EMS;
- the United Nations Development Goals, and specifically the United Nations Industrial Development Organisation (UNIDO) Eco-Industrial Parks framework;
- the rating of major infrastructure projects using ISCA;
- the option for building developers to rate individual building projects using Green Star as a means of demonstrating compliance with the Development Guidelines; and
- the future ability to obtain Climate Active (formerly NCOS) carbon neutral certification.

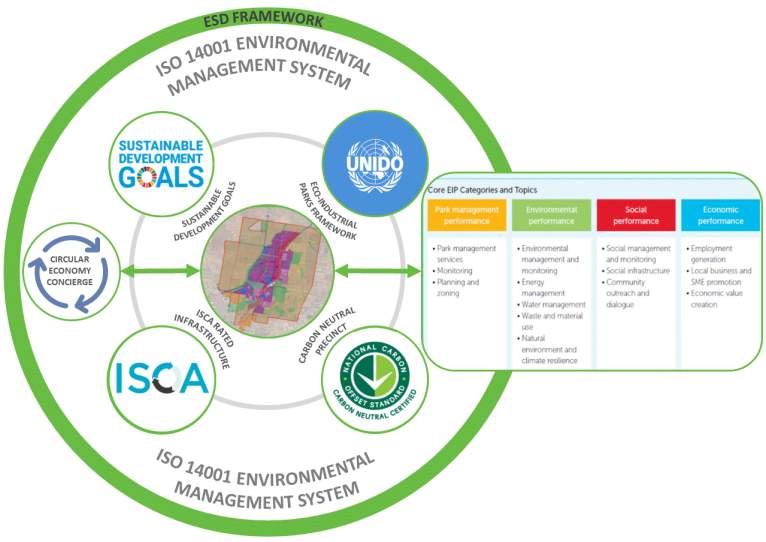


Figure 68: Wagga Wagga SAP ESD Framework

The EMS frameworks for both the Parkes and Wagga Wagga SAP are currently being documented and it is our understanding that the RGDC are seeking to continue the deployment of precinct scale Environmental Management Systems across all of the Special Activation Precincts.

The current SAP framework structure is relevant to eco-industrial parks and sites where the focus is predominantly on resource intensive industries with an industrial symbiosis model in place. As such, while the over-arching structure of an EMS with embedded leading sustainability frameworks can be adopted, for the Snowy Mountains SAP alternative frameworks and rating tools will be required with a greater emphasis on tourism, health, recreation, people, and nature.

11.2.1 Kosciuszko National Park and the Alpine Resorts

The Kosciuszko National Park is a significant part of the Australian Alps Bioregion, and in 1967 it was recognised as a UNESCO site as a 'International Biosphere Reserve', one of only two in NSW.

The Kosciuszko National Park Plan of Management (KNP PoM) is the principal document that forms the foundation of environmental management within the boundaries of KNP. It has been developed in accordance with the requirements of the *National Parks and Wildlife Act 1974* to provide a framework of objectives, principles and policies to guide the long-term management of the park and its values. The KNP PoM includes a requirement for the development of Environment Management Systems (EMS) for each Alpine Ski Resort. While this EMS exists, it is not accredited in accordance with ISO 14001 and as detailed in the WSP Context Report the effectiveness of the EMS reporting and target setting has been questioned.

In 2016 Kosciuszko National Park received Earthcheck Destination certification, the first in Australia to achieve this recognition.

The Thredbo resort has initiated the following additional green rating programmes:

- Greenfleet: since 2009, Thredbo has partnered with Greenfleet to offset resort vehicle emissions including all fuel used to run snow groomers and shuttle buses.
- EarthCheck: Thredbo measures its environmental performance using the EarthCheck benchmark, achieving a silver certification for three consecutive years, including a recertification in June 2020 at this level.

A number of businesses operating in the region have obtained Eco-Tourism Australia accreditation including Kosciuszko Thredbo Backcountry Adventures, Ecocrackenback, and Ecumbene Trout Farm.

11.2.2 The Snowy Mountains region

Snowy Hydro is a significant land-holder in the Snowy Mountains SAP study area and maintains an ISO 14001 certified EMS for its operations, which include the hydro power stations and land revegetation programmes.

There are no green rated or certified buildings in the Snowy Mountains region, or any other listed green accredited businesses, within the Snowy Mountains SAP study area.

11.3 Opportunities

The sustainability framework and green rating tools deployed should be appropriate for the land uses in the Snowy Mountains SAP.

The Snowy Mountains SAP is a nature-based tourism destination, with a focus on health and wellbeing, sport and recreation, and a carbon negative outcome for the region. The framework therefore needs to support the attraction of tourists and tourism related businesses to the region, while protecting the natural environment and effectively managing its carbon impact.

A summary of the available rating tools and frameworks is provided below.

Tool	Background	Further reference
Climate Active Carbon Neutral	Climate Active Carbon Neutral (formerly NCOS) is a national framework for managing, accounting, for and offsetting the carbon footprint of a precinct in order to secure a carbon neutral certification. It encompasses, energy, water, waste, transport, and refrigerants. Management requirements has synergies with inset energy and water networks, and can also create an off-site opportunity for investment in Australian offset projects (re-vegetation, renewable energy). https://publications.industry.gov.au/publications/climate-change/climate-change/government/climate-active/publications/climate-active-carbon-neutral-standards-precincts.html	There is currently only one certified carbon neutral precinct in Australia, the Barangaroo development in Sydney NSW https://www.climateactive.org.au/buy-climate-active/certified-members/barangaroo The Parkes and Wagga Wagga SAPs have carbon neutral certification as a project delivery objective within the EMS and the Delivery Plan.
Earth Check	Earth Check is a global scientific benchmarking, certification and advisory group for travel and tourism. Established in 1987, Earth Check has helped businesses, communities and governments to deliver clean, safe, prosperous and healthy destinations for travellers to visit, live, work and play. Modelled on successful clusters in Queensland, Tasmania and the Great Ocean Road, the Earth Check *Sustainability Cluster Program* helps tourism operators to work together through the assistance of a sustainability mentor to reduce their energy, water and waste usage, and to benchmark themselves against other similar businesses and regions in Australia and beyond. The *Earth Check Sustainable Destinations Program* is designed to empower local communities to take ownership of sustainability goals and build on local initiatives. It recognises the benefits of a Destination working together to achieve sustainable outcomes and should be used to underpin a clear vision for a Destination, as well as focussing on sound policy and action plans to help achieve the vision. https://earthcheck.org/	There are only three Earth Check certified destinations in New South Wales, of which Thredbo Resort is the only one in the Snowy Region. https://www.thredbo.com.au/

Tool	Background	Further reference
Green Star Communities	Tool focus is on the creation of a sustainable community, with the focus on people more so than infrastructure. Points attributable to energy, water, and greenhouse gas emissions are a small component. A rating is possible based on the master plan and structure plan. Green Star registration may be problematical or and potentially prohibited on land which is prime agricultural, or containing protected species. https://new.gbca.org.au/green-star/rating-system/communities/	While there are now more than 22 registered Green Star Communities in Australia, nothing at this scale has been attempted. The closest Green Star Community project to the Snowy Mountains SAP study area is at the ACT/NSW border, the Ginninderry development at Holt: https://suburbanland.act.gov.au/en/ginninderry
The Mohonk Agreement	The Mohonk Agreement was an informal consensus for the harmonization and development of a common baseline for sustainable tourism and ecotourism certification. It was developed by representatives of most of the world's certification programs at that time, who met at Mohonk Mountain House, New Paltz, New York in November 2000. It was the first consensus agreement that clearly differentiates between sustainable tourism, whose principles can be applied to any kind of tourism at any scale, and ecotourism, which is a subset of sustainable tourism with a clearly defined relationship of the business and its clients with nature, conservation, local culture, and interpretation. It has since served as a principal reference for the development of most sustainable tourism and ecotourism certification programs around the world, as well as a fundamental reference for the United Nations World Tourism Organization's (UN-WTO) indicators for certification. https://earthcheck.org/media/23533/mohonk.pdf	Earth Check have incorporated the requirements of the Mohonk Agreement in the Earth Check Sustainable Destinations Framework: https://earthcheck.org/media/50653/earthcheck-sustainable-destinations-2020_compressed.pdf
UN WTO	The United Nations World Tourism Organization (UN WTO) is a specialist agency promoting tourism as a driver of economic growth, inclusive development and environmental sustainability, and offering leadership and support to the sector in advancing knowledge and tourism policies worldwide. The UN WTO carries an extensive resource library and live tourism statistics dashboards.	Link to the UN WTO e-library: https://www.e-unwto.org/ The UN WTO provides advice on connecting tourism destinations with the UN Sustainable Development Goals. https://www.unwto.org/sustainable-development

Tool	Background	Further reference
Eco-Tourism Australia	Eco-Tourism Australia offers certification for tourism products such as tour operations. The ECO Certification program certifies tourism products (tours, accommodations, attractions) with a primary focus on nature Eco-Tourism Australia also offers an additional accreditation for business that promote reconciliation via the Respecting Our Culture (ROC) certification. https://www.ecotourism.org.au/our-certification-programs/eco-certification	Members operating in the Snowy region include: - Kosciuszko Thredbo Backcountry Adventures - Ecocrackenback - Ecumbene Trout Farm https://www.ecotourism.org.au/eco-experiences/green-travel-guide/?sStates=NSW&sCertificationDetailPages=&sExperienceTypes=&sSearchKey=#mapContents
Climate Action	Climate Action Certification is designed for all sectors of the tourism industry including hotels, attractions, tours, transport, restaurants, travel agents, tourism commissions and industry bodies. The Climate Action Certification program is dedicated to reducing carbon emissions and assuring travellers that certified products are backed by a commitment to sustainable practices related to addressing climate change. https://www.ecotourism.org.au/our-certification-programs/eco-certification-3/	See above
Enviro Development	Tool developed by the UDIA to help purchasers and investors identify ecologically sustainable developments for land or property purchase, geared predominantly towards the residential market. Could be considered a simplified tool, and not necessarily demonstrating world leadership, as its use is Australian-based only and predominantly in Queensland. http://envirodevelopment.com.au/	There a small number of Envirodevelopment rated sites in NSW: http://envirodevelopment.com.au/envirodevelopment-projects/
One Planet Living	This framework provides 10 guiding principles many of which could be applied at Snowy. The framework provides an important focus on human's impact being limited to one planet only, with a significant focus on wildlife and the protection of nature. https://www.bioregional.com/one-planet-living	One Planet Living principles have been adopted by many Governments and corporations as a reference framework. As a formal framework, one example is a community development, SALT, Torquay https://www.bioregional.com/bioregional-australia/bioregional-australia-our-work/salt-torquay

Tool	Background	Further reference
Living Building Challenge	Living Building Challenge, or Living Precinct Challenge, a tool developed by the International Living Futures Institute. Developments have to be energy positive, water positive, environmentally positive, and have no on-site greenhouse gas emissions (meaning no gas or direct emissions). This may therefore be appropriate for the Snowy Mountains SAP. http://living-future.org.au/	So far there are no communities in Australia, but a retail shopping centre in development by Frasers: Burwood Brickworks, VIC http://living-future.org.au/the-brickworks-living-building-challenge-design-competition/ The University of Wollongong also developed the Sustainable Buildings Research Centre with Living Building Challenge certification: https://living-future.org/lbc/case-studies/sustainable-buildings-research-centre/
WELL Community	The International Well Building Institute promotes the creation of buildings and communities that promote health & wellbeing. The deployment of this tool in a Snowy Mountains SAP looking to promote health & wellbeing would appear to be an appropriate choice for consideration. https://www.wellcertified.com/en/communities	The tool is still at PILOT stage with only one project registered in Australia, which is the Lot Fourteen Innovation Precinct in Adelaide, SA: https://renewalsa.sa.gov.au/projects/lot-fourteen/
ISCA	Infrastructure Sustainability Council of Australia Infrastructure Sustainability (IS) Tool. Focus is on infrastructure more than people and is being used nationally on road, rail, and industrial precinct projects (such as airports). Ratings are given as "Commended", "Excellent" or "Leading". https://www.isca.org.au/infrastructure_sustainability	ISCA is in use by NSW Government on multiple road, rail, and air projects, and may be suited for example to the Jindabyne bypass: https://www.isca.org.au/Ratings-Directory/The_Northern_Road_Stage_5_%7C%7C_6
UNIDO Eco-Industrial Parks	The United Nations Industrial Development Organization provides a framework and guidance for the creation of Eco-Industrial Parks. The EIP programme provides a framework and tools for implementation rather than a rating system. The structure supports business synergies, sustainability, circular economy, and resource efficiency principles. https://www.unido.org/our-focus-safeguarding-environment-resource-efficient-and-low-carbon-industrial-production/eco-industrial-parks	There are multiple case studies of UNIDO's work in countries outside of Australia: https://www.unido.org/stories UNIDO Eco-Industrial Parks is the adopted framework for the Parkes SAP and the Wagga Wagga SAP.

11.4 Initial analysis

We have considered the choice of frameworks, rating tools, and certification in detail for the Snowy Mountains SAP. The following summarises our initial analysis on the deployment of the potential tools and frameworks available:

Tool	Position for Snowy Mountains SAP
Climate Active Carbon Neutral	This provides a relevant, practical, and valuable certification framework for both the Snowy Mountains SAP and for businesses within it, and also provides the framework necessary to support the sustainability targets for the region. **Recommendation: Include in framework**
Earth Check	This provides a relevant framework with options to deploy this at a business level only (for example, at each alpine resort), as a business cluster (for example, all resorts working together) or as a Sustainable Destination. **Recommendation: Consider further for inclusion in the framework**
Green Star Communities	Green Star Communities may be an appropriate option for the Snowy Mountains SAP, although other rating tools such as Earth Check Destinations and the Living Community Challenge may offer a closer correlation to the Snowy Mountains SAPs aspirations. **Recommendation: Consider further for inclusion in the framework**
The Mohonk Agreement	The tenets of the agreement are important and relevant and should be incorporated in the Snowy Mountains SAP framework. **Recommendation: Include in framework**
UN WTO	The UN WTO framework and guidance provides world leadership in the tourism and ecotourism fields and an important reference for the ESD framework. As with UNIDO Eco-Industrial Parks, the UN WTO does not offer an accreditation or rating. **Recommendation: Include in framework**
Eco-Tourism Australia, Climate Action, Respecting Our Culture	This is an accreditation for individual businesses. It is recommended that the ESD framework and Snowy Mountains SAP Delivery Plan encourages and incentivises businesses to carry this accreditation. **Recommendation: Include in framework**
EnviroDevelopment	EnviroDevelopment is a simplified residential focussed tool that does not have any international recognition. It is not likely to provide any added value to the development of the Snowy Mountains SAP as a working framework. **Recommendation: do not consider further**
One Planet Living	The framework is appropriate and relevant to the Snowy Mountains SAP. The need to pursue a One Planet Living Accreditation needs to be considered in comparison to the other precinct rating systems. **Recommendation: Consider further for inclusion in the framework**

Tool	Position for Snowy Mountains SAP
Living Building Challenge	This tool is appropriate and relevant to the Snowy Mountains SAP, and establishes a framework which supports the environmentally positive aspects of the Snowy Mountains SAPs aspirations. The use of this tool will need to be considered in comparison to the other precinct rating systems. **Recommendation: Consider further for inclusion in the framework**
WELL Community	This tool is appropriate and relevant to the Snowy Mountains SAP, and establishes a framework which supports the health and wellbeing aspects of the Snowy Mountains SAPs aspirations. The use of this tool will need to be considered in comparison to the other precinct rating systems. **Recommendation: Consider further for inclusion in the framework**
ISCA	ISCA provides a relevant and practical framework for the sustainability rating of new infrastructure projects, which could include the new Jindabyne bypass road and an extension to public transport infrastructure. **Recommendation: Include in framework**
UNIDO Eco-industrial Parks	UNIDO has been established for eco-industrial parks and sites with an industrial symbiosis focus. It is not likely to provide any added value to the development of the Snowy Mountains SAP as a working framework however does provide some useful tools for tracking environmental, economic and social performance which can be integrated into a potential ISO 14001 EMS. **Recommendation: do not consider further**

11.5 Precinct framework and rating tools

A number of frameworks are required to maintain the delivery requirements of the Snowy Mountains SAP, with others not incurring a cost or specialist input to include, and so these are recommended for adoption as key components:

The key frameworks recommended for adoption include:

1. An over-arching ISO 14001 Environmental Management System (EMS).
1. Referencing the UN Sustainable Development Goals and in particular the UN World Tourism Organisation framework.
2. Climate Active Carbon Neutral certification.
3. Referencing the Mohonk Agreement.
4. ISCA rated infrastructure.

The inclusion of the following business accreditations to be incentivised in the Delivery Plan: Earth Check for Business, Eco-Tourism Australia, Climate Action, & Respecting Our Culture.

In addition, there are a number of precinct rating tools available and a detailed assessment and cost-benefit analysis has been undertaken of the following:

1. Green Star Communities.
2. Earth Check Destination.
3. Living Building Challenge Precinct.
4. WELL Community.
5. One Planet Living Precinct.

Note that the One Living Planet framework is not technically a rating tool however it is provided a recognised designation by Bioregional Australia.

Figure 69: Snowy Mountains SAP ESD Framework

11.6 ISO14001 Environmental Management System

It is recommended that a certified precinct ISO 14001 Environmental Management System is implemented to embed a holistic framework which integrates the carrying capacity framework and KNP PoM. The following image (refer Figure 70) illustrates how the various aspects of the Snowy community will be required to engage with the EMS framework. This ranges from mandatory organisations, including Government, Council and the larger resorts, to differing scales for businesses, residents and tourists. The aim is to apply this framework in a sensible and robust manner, without placing undue reporting requirements on the smaller businesses and residents, who can benefit from and contribute to the framework, but are less able to influence the larger scale environmental outcomes.

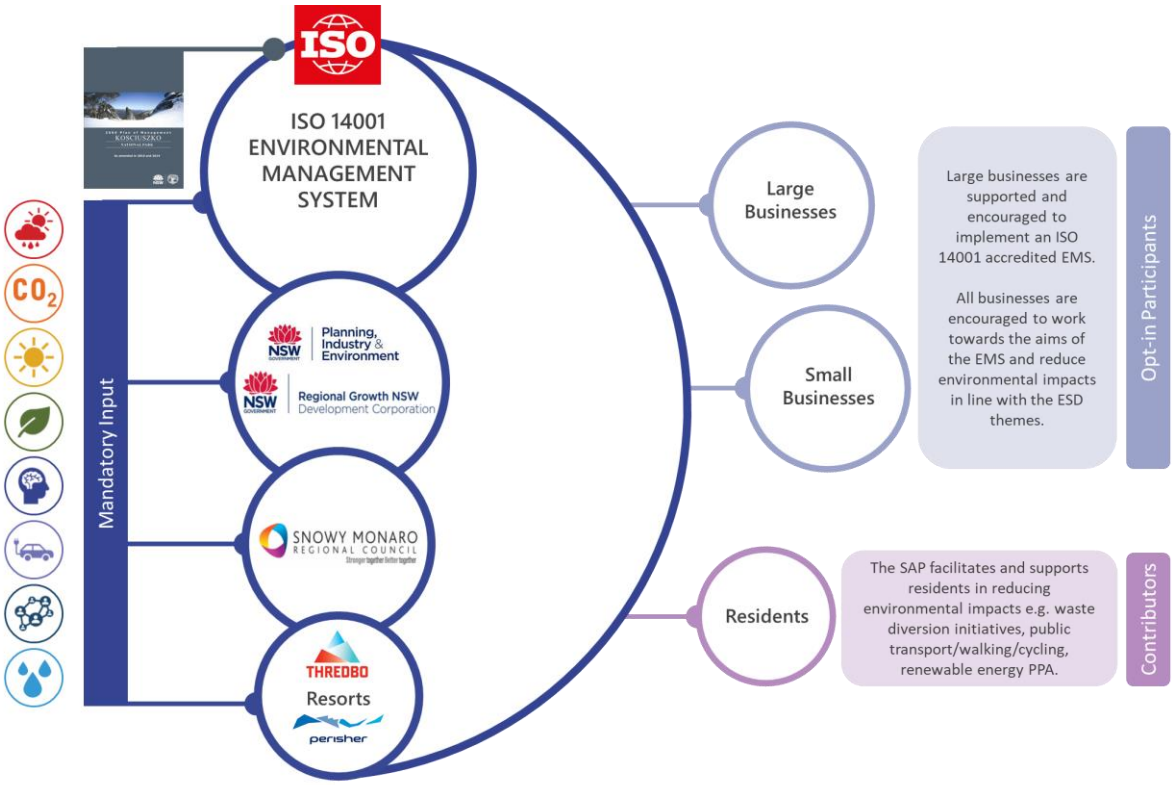


Figure 70: Environmental management system inputs and stakeholders

The following table outlines initial environmental impacts and risks that should be incorporated, as well as key stakeholders (refer Table 13). The environmental impacts, risks and controls and stakeholders will need to be further developed as part of the development of the EMS.

Table 13: EMS inputs and stakeholders

	Mandatory				Opt-in		Contributor
Org.	**RGDC**	**DPIE (NSW Parks)**	**Snowy Monaro Regional Council**	**Resorts**	**Major Businesses**	**Small Businesses**	**Residents / tourists**
Summary	Monitoring, reporting and targets for Snowy Mountains SAP inputs and outputs that the RGDC procure / control	Monitoring, reporting and targets for Snowy Mountains SAP inputs and outputs that the DPIE procure / control	Monitoring, reporting and targets for inputs and outputs that the council procure / control in the Snowy Mountains SAP	Certified ISO 14001 EMS in place with monitoring, reporting and targets for their own environmental impacts	Support / resourcing in developing an EMS or contributing to the precinct EMS environmental improvement programs	Contributing to the precinct EMS and environmental improvement programs	Consider ways to reduce environmental impacts - Precinct systems and initiatives to support residents
Certified ISO 14001 EMS	✓	KNP PoM		✓	Precinct EMS has a target for large business to adopt an EMS e.g. 20% by 2025	-	-
Reporting	✓	✓	✓	✓	Provide annual EMS report if in place Contribute to surveys and data requests	×	×
Climate resilience	Incorporate climate resilience measures into Masterplan, Delivery Plan and Design Guidelines		Support organisational and community measures to mitigate and adapt to climate change	Provide annual EMS report and recertify annually EMS to be developed in line with precinct EMS to align reporting			
Electricity	Report total electricity consumption in the Snowy Mountains SAP		Support community in reducing consumption (not tracked)		Improve energy efficiency and reduce electricity consumption/emissions (and costs). Precinct systems and initiatives provide support		
Renewables	Collate % of renewable energy generated / procured Target 100% by xx year		Support community in installing / using renewables (not tracked)		Opt-in to Snowy Mountains SAP renewable energy PPA		

	Mandatory				Opt-in		Contributor
Org.	**RGDC**	**DPIE (NSW Parks)**	**Snowy Monaro Regional Council**	**Resorts**	**Major Businesses**	**Small Businesses**	**Residents / tourists**
Summary	Monitoring, reporting and targets for Snowy Mountains SAP inputs and outputs that the RGDC procure / control	Monitoring, reporting and targets for Snowy Mountains SAP inputs and outputs that the DPIE procure / control	Monitoring, reporting and targets for inputs and outputs that the council procure / control in the Snowy Mountains SAP	Certified ISO 14001 EMS in place with monitoring, reporting and targets for their own environmental impacts	Support / resourcing in developing an EMS or contributing to the precinct EMS environmental improvement programs	Contributing to the precinct EMS and environmental improvement programs	Consider ways to reduce environmental impacts - Precinct systems and initiatives to support residents
Natural Gas	Report total gas consumption in the Snowy Mountains SAP Support transitions to lower emission options (hydrogen)		Support community in reducing consumption (not tracked)		Improve energy efficiency and reduce gas consumption/emissions (and costs). Precinct systems and initiatives provide support		
Water	Support alternative water supplies and improved water management (rainwater, recycled water, stormwater management / harvesting, Water Sensitive Urban Design (WSUD))	Monitor water quality	Report total water consumed in Snowy Mountains SAP Monitor water quality		Improve water efficiency and connect to/use alternative water supplies where available (rainwater, recycled water) – Precinct supplies and initiatives to facilitate		
Wastewater	Improve / upgrade wastewater treatments facilities	Report total wastewater treated Monitor and report wastewater quality	Report total wastewater treated Monitor and report wastewater quality				
Waste to landfill	Support and monitor circular economy initiatives		Report total landfill waste and diversion rates for waste generated in the Snowy		Reduce waste to landfill by supporting waste diversion initiatives implemented by Snowy Mountains SAP and the council		

	Mandatory				Opt-in		Contributor
Org.	**RGDC**	**DPIE (NSW Parks)**	**Snowy Monaro Regional Council**	**Resorts**	**Major Businesses**	**Small Businesses**	**Residents / tourists**
Summary	Monitoring, reporting and targets for Snowy Mountains SAP inputs and outputs that the RGDC procure / control	Monitoring, reporting and targets for Snowy Mountains SAP inputs and outputs that the DPIE procure / control	Monitoring, reporting and targets for inputs and outputs that the council procure / control in the Snowy Mountains SAP	Certified ISO 14001 EMS in place with monitoring, reporting and targets for their own environmental impacts	Support / resourcing in developing an EMS or contributing to the precinct EMS environmental improvement programs	Contributing to the precinct EMS and environmental improvement programs	Consider ways to reduce environmental impacts - Precinct systems and initiatives to support residents
			Mountains SAP				
Procurement	Mandate ISCA for major projects and report on outcomes Support local procurement in tender specifications		Support local procurement in tender specifications		Support procurement of local content and services		
Mobility	Implement sustainable transport options Monitor number of vehicles that travel to the Snowy Mountains SAP incl. type and distance Monitor use of mobility services provided in the Snowy Mountains SAP (Gondola, MaaS)		Monitor community transport within the Snowy Mountains SAP		Reduce personal vehicle use by using improved transport systems provided by the Snowy Mountains SAP (public transport Mobility as a Service, gondola, etc.)		
Emissions	Implement emission reduction programs and monitor emissions Embed emission reduction measures in		Implement and support emission reduction measures		Reduce emissions in line with Snowy Mountains SAP aims		

	Mandatory				Opt-in		Contributor
Org.	**RGDC**	**DPIE (NSW Parks)**	**Snowy Monaro Regional Council**	**Resorts**	**Major Businesses**	**Small Businesses**	**Residents / tourists**
Summary	Monitoring, reporting and targets for Snowy Mountains SAP inputs and outputs that the RGDC procure / control	Monitoring, reporting and targets for Snowy Mountains SAP inputs and outputs that the DPIE procure / control	Monitoring, reporting and targets for inputs and outputs that the council procure / control in the Snowy Mountains SAP	Certified ISO 14001 EMS in place with monitoring, reporting and targets for their own environmental impacts	Support / resourcing in developing an EMS or contributing to the precinct EMS environmental improvement programs	Contributing to the precinct EMS and environmental improvement programs	Consider ways to reduce environmental impacts - Precinct systems and initiatives to support residents
	Snowy Mountains SAP Master Plan, Delivery Plan and Design Guidelines						
Society	Track health and wellbeing outcomes from Snowy Mountains SAP programs via annual survey and engagement program Survey to cover a range of health/wellbeing topics (e.g. education, employment, inclusive / diverse workforce) Implement cultural heritage programs (indigenous and non-indigenous)		Track community health and wellbeing via survey and engagement program		Respond to annual survey – take advantage of improved community facilities		
Biodiversity	Implement programs to improve biodiversity and monitor biodiversity loss / threatened species				Engage with and support biodiversity improvement programs		
Biosecurity	Implement weed and pest management programs and monitor invasive pests / species				Support weed and pest management programs as part of operations and daily lives		
Land resilience	Implement systems to improve land resilience						

11.7 Precinct rating tool analysis

An analysis of the above precinct rating tools has been undertaken and considered the following:

- **Tool focus**: What is the core focus of the rating tool with the following types identified:
  - **Emissions:** Tools which directly address emissions.
  - **Sustainable Development**: Tools which take a holistic approach to environmental, social and economic sustainability.
  - **Sustainable Tourism and Travel**: Tools which use sustainable development opportunities to create a sustainable tourism and travel industry.
  - **Infrastructure:** Tools which focus on infrastructure development.
- **Rigour and Accountability:** How the tool certifies and audits projects including the auditor's independence.
- **Awareness and Marketability:** Whether the tool is nationally or internationally recognised.
- **Scope:** What topics the tool covers and whether this is aligned with the Snowy Mountains SAPs aspirations.

Refer to Appendix E for a summary of the above analysis.

11.7.1 Rating tool scale

To ensure the rating tool is appropriate for the Snowy Mountains SAP, the scale of the various rating tool options has been assessed, along with whether it is an internationally or nationally recognised tool. This has been used to identify a framework which can interconnect multiple levels of development while aiming to achieve international recognition.

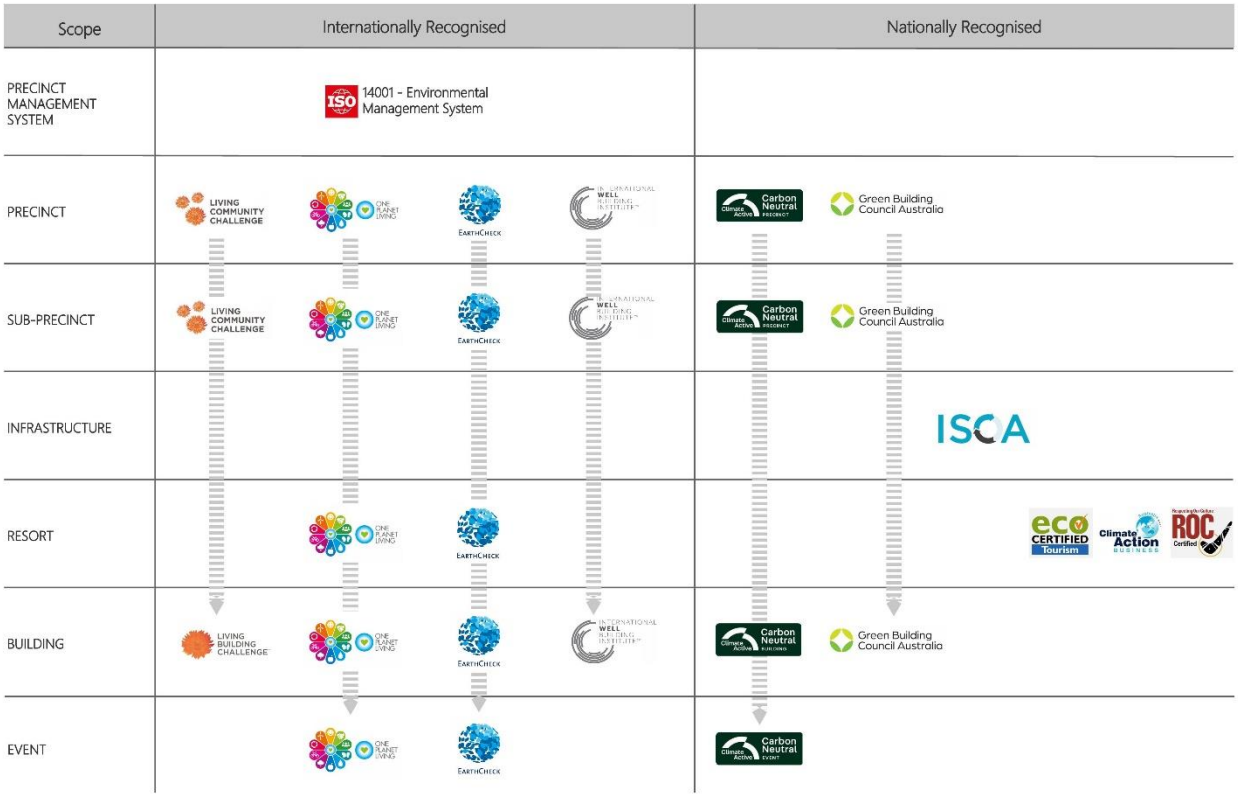


Figure 71: Rating tool scales and recognition

11.8 ESD theme alignment

An analysis of the rating tool categories against the proposed ESD Themes has been undertaken to identify frameworks and tools most suited to the Snowy Mountains SAP (refer below).

Table 14: ESD Theme alignment

ESD Themes	Green Star Communities	Living Community Challenge	EarthCheck	WELL Community	One Planet Living
Climate Resilience	Resilience	Multiple points			Multiple points
Emissions	Positive	Net positive energy/water	Greenhouse gas emissions		Zero carbon
Energy	Positive	Net positive energy	Energy efficiency		Zero carbon
Environment	Nature	Equity	Eco-system conservation and management		Land use and wildlife
Water	Positive + Nature	Net positive water	Management of freshwater resources	Water quality only	Sustainable water
Health and Wellbeing	Healthy + Community + Places	Health and happiness	Cultural and social	Whole tool	Health and happiness + Culture and community
Mobility	Places	Human Power Living	Transport	Movement	Sustainable transport
Circular Economy / Waste	Responsible	Materials	Solid waste management		Zero waste + Sustainable materials
Additional Topics	Prosperous	Beauty	Air quality, light pollution, noise control, Economic management	Nourishment Air Light Temperature Sound	Local and sustainable food, Equity and local economy
Assessment	Meets all themes Aligned with Snowy Mountains SAP aspirations Master plan certification	Zero fossil fuels and water positive required	Meets most themes but better suited at resort level Not as well recognised	Focussed on health and wellbeing only	Meets all themes Provides a good framework
Recommended	**Yes**	**No**	**No**	**No**	**Yes**

Legend

	Category fully aligned with ESD Theme
	Category partially meets the ESD theme
	Rating tool does not specifically target the ESD theme
	Rating tool includes additional categories
	Unable to meet preconditions

The following provides a summary of the strengths and challenges of the Green Star Communities and One Planet Living framework for consideration:

Framework / Rating	Green Star Communities	One Planet Living
Strengths	+ Based on existing/established rating tool + Nationally recognised + Combines sustainability and health & wellbeing + Can be used at the master planning stage to provide a framework and gain a recognised certification + Rating tool and credits provide a clear pathway to certification + Has associated building rating tool for new buildings, as well as performance ratings for existing	+ Based on existing/established framework + Bioregional Australia is seeking a tourism destination as part of their latest strategic plan + Internationally recognised however further development with Bioregional UK required + Strong focus on sustainable development (UN SDGs) and has been used for tourism industry worldwide + Flexible framework instead of specific credits + Transparent publicly available reporting
Challenges	- Existing tool has been used for the analysis - New tool not due for consultation release until early 2021 – will require immediate engagement with GBCA to potentially be a pilot project - Not internationally recognised however this may not be a major constraint considering an ISO 14001 EMS is being proposed	- Provides endorsement of the masterplan/action plan, not certification - Official recognition ("National" or "Global" leader) is not granted until the Snowy Mountains SAP is in operation - Not currently well known / represented in Australia - Does not have associated green/well building ratings but can be used in tandem or as a framework to assist with the design and operation
Certification Timing	Masterplan certified	Action Plan recognised at Masterplan stage. National / Global designation once in operation. Global is likely a longer-term commitment

11.8.1 Rating tool prerequisites

An analysis of Green Star Communities and One Planet Living prerequisites and performance indicators has also been undertaken and has confirmed that the Snowy Mountains SAP will be able to achieve all prerequisites.

11.9 Outcomes of the Structure Plan

It is recommended the following precinct frameworks and rating tools are incorporated into the Structure Plan (refer Figure 72):

- **A precinct 6 Star Green Star Communities rating** which demonstrates world leadership.
- **The One Planet Living framework is embedded the accredited ISO 14001 Environmental Management System (EMS).** This is in line with the Parkes and Wagga Wagga SAP which have embedded the UNIDO Eco-Industrial Framework, but has the potential for gaining a One Planet Living designation once in operation.
    - The EMS will also be aligned with and support the KNP PoM, carrying capacity framework and resort EMS's.

Figure 72: Precinct framework and rating tool recommendation

12 ESD Destinations

12.1 Introduction

A key driver of the Snowy Mountains SAP is to increase economic growth to the Snowy region through increased visitation, creating 'Australia's Alpine Capital', a destination of choice for sporting and adventure activities, and a year-round destination.

The Snowy Mountains SAP area is a located in a central segment of Australian Alps Bioregion, with the highest mountain in Australia, the largest National Park, unique alpine plant diversity along with threatened ecological communities and endemic species. Promoting these aspects could attract environmentally conscious tourists for increasingly popular immersive nature experiences.

The visitation workshops have identified that destinations and experiences can drive visitation. In this section of the report we will summarise opportunities that ESD offers to create destinations and experiences to contribute to this increased visitation.

12.2 Context

Ecotourism is defined by the Global Ecotourism Network as '*responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and creates knowledge and understanding through interpretation and education of all involved (visitors, staff and the visited)'*

In Australia, nature-based has been increasing by roughly 4% per annum since 2010. In 2016, 68% of international visitors engaged in some form of nature-based tourism, which directly impacts employment and local economies, at the time of visitation and for periods after visitation.

Given the interest in nature-based tourism and growing environmental awareness, ecotourism can provide a sustainable and viable opportunity for nature conservation whilst delivering experiences that benefit both the region and visitors. Spreading the impact of tourism over multiple seasons can reduce seasonal impacts whilst also providing important benefits to the area and an improved offering reputation.

Encouraging longer stays can further reduce impacts (due to less travel emissions compared to shorter stays) and tapping into diverse tourism potential can open additional opportunities. This may include offering infrastructure and activities for older generations who may no longer have capacity to engage with active tourism or offering calming experiences and sensitive facilities for differently abled people to enjoy.

12.3 ESD destination attractions

The following is a summary of the ecotourism and ESD destinations that could be considered to support growth in ecotourism and therefore visitation to the region (refer Figure 73):

Figure 73: Destination Opportunities

- Considering the scale of renewable energy in the Snowy area, there would be an opportunity to open a visitor centre at the Jindabyne dam to allow visitors to learn about hydroelectric power, the scale of Snowy and Snowy 2.0, and other forms of renewable energy. Whilst there is an existing Snowy Hydro Discovery Centre in Cooma, this new centre could be more about the physical infrastructure and the alpine hydrology.
- The Snowy region could become known for being an International leader in zero emissions transport, with electric and hydrogen powering all cars and buses once you are within the Snowy Mountains SAP region. The RGDC could engage with industry to test autonomous and future transport options in the Snowy Mountains SAP, for example hydrogen vehicles including those about to be built at Port Kembla, and the trialling of electric and electric/hydrogen aircraft.
- The Snowy Mountains SAP could be a destination for learning about future mobility. Zero emission hydrogen aircraft would be a tourist attraction. Electric helicopters powered by renewables could be used for scenic flights, or transporting tourists between adventure locations as a 'bucket list' experience.
- The region could offer a wider variety of ecologically sensitive accommodation options, including glamping and eco cabins. These can scale from off-grid glamping tents to secluded glass cabins for immersive experiences in nature.
- All buildings within the Snowy Mountains SAP could be designed to be exemplars of sustainable design, using natural and local materials in construction, and being self-sustainable in energy and water where possible. This will showcase a building style unique to Snowy, generating growth in tourists who want to stay in sustainable and interesting built environments. The planning and

future development of Jindabyne could include a design aesthetic which reinforces the image of sustainable building design.

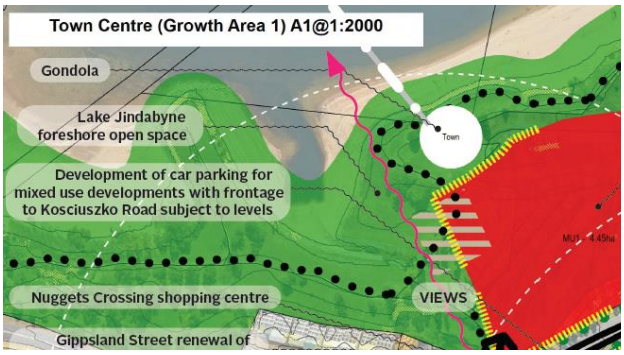
- A new resort in the area could be developed in accordance with the Living Building Challenge tool, which would be the first resort of this calibre in Australia. This would be energy, carbon and water neutral in operation, and would be required to offset all embodied emissions associated with its construction.
- Develop new wellbeing tourism offerings, as further explored in section 7 of this report. Activities include walking, hiking, yoga, meditation, wellness retreats and wellbeing events. Immersive eco- and wellbeing tourism experiences, like heritage tours, indigenous experiences, forest retreats.
- Create an eco-tourism visitor information and education centre, to focus on education and learning from ecotourism in the area. A focus on sustainable and carbon neutral practices and buildings, responsibly sourced materials, active and adventurous activities and regeneration can be showcased, to ensure that visitors are not only aware of what is on offer, but what the Snowy Mountains SAP is doing to ensure sustainability and how they can personally play a positive role. This is engaging, educational and empowering, adding to the overall experience.
- Attract high adrenaline adventure sports that are zero carbon, such as pedal prix or the solar car challenge.
- Expand on the NPWS Kosciuszko Education Centre located at Sawpit Creek, which currently runs education programs for school groups throughout the year, but could be expanded to include Aboriginal cultural, heritage, sustainable design, etc. This makes good use of the existing infrastructure located at Sawpit Creek.

12.4 Outcomes of the Structure Plan

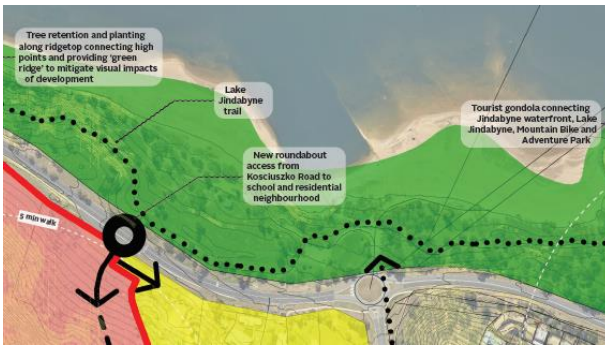
The majority of these ESD destination ideas have been integrated into the Structure Plan, including:

- Increased physical connection, open space, views and enhancement of the natural environment in the Jindabyne area. A 20 minute town with walking and cycling infrastructure prioritised.
- Focus on year round outdoor activities, sports and wellbeing.
- Tourism opportunities in eco and wellbeing opportunities, including increased camping, multi-day walking routes and mountain biking activities.
- Transitioning to public transport and zero emissions options over time.

Some examples from the Structure Plan are shown here:



Revitalised public foreshore with walking and bike trails, and open space



Outdoor tourism promoted with gondola and bike connections

Figure 74: Snowy Mountains SAP ESD Vision

13 Calculators

13.1 Introduction

To ensure that the Snowy Mountains SAP is able to achieve its goal of being a carbon negative precinct, a number of calculators are in development by dsquared, which will enable baselines to be set and key performance indicators (KPIs) developed.

The following provides a summary of the potential emissions data sources and methodologies to inform the development of the Snowy Mountains SAP emissions calculators.

13.2 Energy and water calculators

Energy and water calculators have been developed which enable various precincts and sub-precincts to be created and scenarios to be developed. This includes setting a baseline for various building types and renewable energy integration.

The energy and water calculator incorporates:

- Annual electricity consumption (kWhr)
- Peak electricity demand (kVA)
- Annual gas consumption (MJ)
- Annual potable water consumption (kL)
- Annual non-potable water consumption (kL)

The energy and water baseline data is a combination of:

- Benchmark data collated by the ESD and Infrastructure Technical Consultant
- Existing benchmark data for the Parkes and Wagga Wagga SAPs to ensure consistency
- Specific building types and uses within the Snowy Mountains SAP e.g. sports centre.

All data has been verified for accuracy and appropriateness jointly by the ESD and Infrastructure Technical Consultants so that all master plan stage demand calculation results and precinct calculator results are repeatable. Below is an example of the energy and water calculator metrics (refer Table 15: Energy and water metrics).

Table 15: Energy and water metrics

Identifier	Description	Electricity (kWhr/ m^2/Yr)	Electricity Demand (kVA/m^2)	Gas (GJ/m^2/Yr)	Non-Potable Water Consumption (kL/m^2/Yr)	Potable Water Consumption (kL/m^2Yr)
Commercial: Alpine Resort	Alpine Resort Accommodation	150	0.030	0.06	0.53	0.30
Commercial: Eco-Tourist Accommodation	Low Impact, Low Intensity Eco-Tourist Accommodation	50	0.010	0.02	0.18	0.20
Commercial: Hotel/Motel	Hotel, Motel	200	0.040	0.08	0.70	0.40
Commercial: Office and Admin	Office Buildings, Administration	150	0.032	0.08	0.30	0.10

Identifier	Description	Electricity (kWhr/ m^2/Yr)	Electricity Demand (kVA/m^2)	Gas (GJ/m^2/Yr)	Non-Potable Water Consumption (kL/m^2/Yr)	Potable Water Consumption (kL/m^2Yr)
Commercial: Emergency Services	Emergency Services Facility	150	0.032	0.08	0.30	0.10
Retail: Shopping Centre/Light Commercial	Retail, Shopping, Shopping Centre, Light Commercial Buildings	190	0.040	0.08	0.50	0.30
Retail: Cafes/Speciality Shops	Speciality Retail, Independent Shop, Cafes	150	0.032	0.08	0.30	0.10
Residential: Detached Dwellings	Residential Single Detatched Dwellings (quantity required)	6,200	6.250	11.5	0	348
Residential: Apartment Dwellings	Residential Apartment Dwellings (quantity required)	4,400	4.440	9.4	0	209
Education: Primary/Secondary School	Primary or Secondary school / education and training building	120	0.026	0.08	0.56	0.30
Education: TAFE/University Education & Training	TAFE or University education and training building	150	0.032	0.08	0.70	0.30
Education: TAFE/University Laboratory	TAFE or University research and laboratory facility	180	0.045	0.08	0.90	0.20
Sports Centre	Sports Hall, Community Gym, Mixed-use sporting facilities, Swimming Pool	215	0.28	0.86	4.70	0.20
Airport	Airport, terminal building, hangar and aviation services	150	0.19	0.08	0.70	0.40
Low Impact Industry: General Industry	General Industry, light manufacturing	250	0.130	3.00	0.30	0.10
Warehouse & Distribution	Warehousing and distribution, storage and logistics, non-refrigerated	16	0.053	0	0.04	0.06

Refer to Appendix F for the Energy and Water Calculator Summary and Guide which provides further detail.

13.3 Emission calculator options

The following emissions calculator options and data sources have been explored.

13.3.1 Community emissions

Snowy Monaro Council has developed their own community emissions inventory with an estimated 741,800 tCO_2-e in 2018/19 and incorporates the following emission sources for community-based emissions:

- Stationary Energy (electricity and gas)
    - Residential
    - Commercial
    - Industrial
- Transport
- Waste (landfill and wastewater)
- Agriculture
- Land Use and Land Use Change

The majority of the community emissions data is based on tier 1 emission data, which is state, national and international modelled data with minimal local data, as explained in Table 12 below. It does not include tourism impacts, with emissions such as transport emissions from visitation to the region not included.

The following summarises the emissions data sources used in the community emissions profile.

- **Tier 1:** Largely modelled data, with little or no local activity data available (these methods will take state, national, or international data, and scale them to the municipality using a relevant metric).
- **Tier 2:** Local activity data, with conversion factors sourced from state, national, or international references.
- **Tier 3:** Local activity data and locally sourced conversion factors, or actual activity-specific local carbon emissions data.

Table 16: Emissions source data and inclusions

Category	Tier/Inclusion
Stationary Energy – Grid-Supplied Electricity	Tier 1
Stationary Energy – Gas	Tier 1
Stationary Energy – Fugitive Emissions	Not included
Stationary Energy – Additional Networked Energy	Not included
Transport – On Road	Tier 1
Transport – Aviation	Tier 1
Transport – Water	Not included
Transport – Off Road	Included in On Road

Category	Tier/Inclusion
Transport – Trains	Included in On Road (for diesel) and Stationary Energy – Grid Supplied Electricity (for electric)
Transport – Buses	Included in On Road
Waste – Landfill	Tier 1
Waste – Other solid waste	Not included
Waste – Wastewater	Tier 1
Agriculture – Livestock	Tier 2
Agriculture – Crops	Tier 2
Agriculture – Rice Cultivation	Not included
Agriculture – Liming	Not included
Agriculture – Crop Residues	Not included
Agriculture – Urea Application	Not included
Land Use and Land Use Change – Cropland to Forestland	Tier 2
Land Use and Land Use Change – Grassland to Forestland	Tier 2
Land Use and Land Use Change – Forestland to Cropland	Tier 2
Land Use and Land Use Change – Bushfire	Not included
Industrial Processes and Product Use	Not included

This emissions profile is not considered appropriate to be accurately scaled to the Snowy Mountains SAP boundary, due to its reliance on tier 1 data and exclusion of tourism emissions.

13.3.2 Snowy Mountains SAP emissions and circular economy calculator

The Wagga Wagga SAP emissions calculator was based on a different methodology to the above community emissions, with 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).

For the Snowy Mountains SAP, the closest LGA data is based on the Snowy Mountains Statistical Area Level 3 (SA3) and Jindabyne – Berridale SA2 datasets. Due to there being limited residential, commercial or industry sectors outside of the Snowy Mountains SAP boundary but within the SA2 boundary, and the main economic centres being in Jindabyne and the resorts, the SA2 dataset is expected to be relatively accurate for the Snowy Mountains SAP (refer Figure 75).

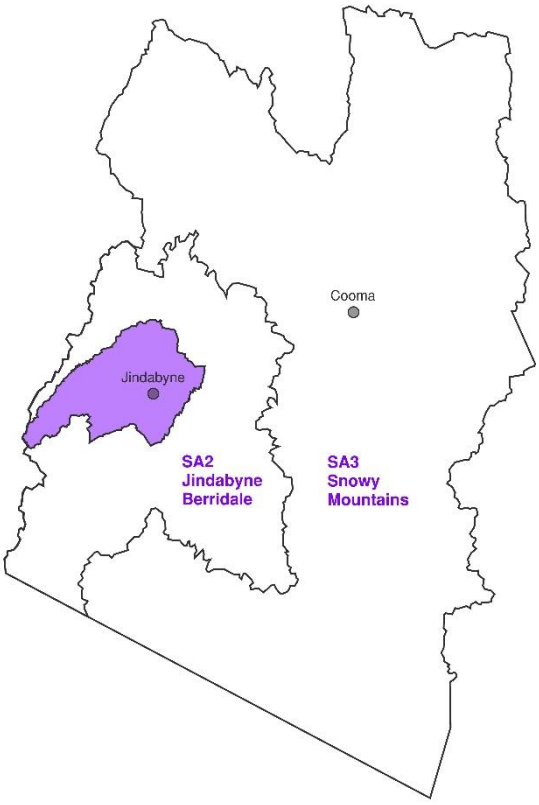


Figure 75: Snowy Mountains SAP Boundaries

The SA2 data would include all emissions associated with the region which are not in direct control of the RGDC including the existing community, resorts and agriculture. This needs to be taken into account when considering emission reduction programs and carbon offset ownership. This method may not be the most appropriate for the Snowy Mountains SAP however data inputs from the SA2 area can be integrated into an emissions calculator.

13.3.3 Climate Active Carbon Neutral Standard for Precincts

The emissions boundary and scope in the Climate Active Carbon Neutral Standard requires all emissions that are a direct result of the precinct's operations (e.g. assets and infrastructure owned by the RGDC) and indirect emissions that are result of the precinct operations but are not owned or controlled by the RGDC, to be accounted, reduced and offset.

As a result, it can be argued that although there are residential and private operations in the Snowy Mountains SAP including townships and resorts, their emissions are not currently a direct or indirect impact of the Snowy Mountains SAP. These emissions currently fall under the Snowy Monaro Regional Council's emissions inventory, with the council implementing emission reduction programs as part of their operations.

However, as the Snowy Mountains SAP invests in the region and has a direct impact on increasing and decreasing emissions through infrastructure and investment programs, the Snowy Mountains SAP will need to account for and offset these emissions. This includes any infrastructure and operations under the ownership and control of the RGDC, emissions associated with the infrastructure and facilities procured and constructed by the RGDC as part of the Master Plan delivery and developments facilitated by the Snowy Mountains SAP e.g. new housing developments where the RGDC fud infrastructure works and a private developer develops the site.

A physical boundary therefore may not be the most appropriate method for setting the emissions boundary in the Snowy Mountains SAP as this will create conflicts between the emissions for the RGDC,

community and private operators. It is therefore recommended that an emissions boundary is based on a non-physical approach where only emissions which can be accurately associated with the RGDC's operations are captured. This will meet the requirements of the Climate Active standards while allowing flexibility in assigning responsibility to the emissions.

13.4 Emissions calculator

A custom calculator has been developed to allow RGDC to test various scenarios based on different growth scenarios. This includes setting a baseline for various building types and renewable energy integration, transport strategies, waste reduction measures and alternative water supplies.

The emissions calculator incorporates a number of inputs including:

- **Visitation projections**: Projections provided by CIE have been incorporated and used to project increases in emissions associated with visitor numbers.
- **Energy:** Increased energy use associated with residential, commercial, educational and industrial developments have been incorporated including timeframes for the development. The calculator will allow developments to be added progressively to gain an understanding of emission over time.
- **Water:** Increased water use associated with residential, commercial, educational and industrial developments will be incorporated including timeframes for the development. This will include projections for both potable and non-potable water where applicable. The calculator will allow developments to be added progressively to gain an understanding of emission over time.
- **Transport:** Transport emissions within and to the Snowy Mountains SAP have been incorporated based on the population and visitation projections. This will enable the transition to various low and zero emission transport systems to be evaluated against a baseline.
    - **Low emission vehicle transitions:** Existing projections for low and zero emission vehicle transitions (e.g. electricity vehicles, hydrogen powered planes) have been incorporated to demonstrate the expected emissions reduction based on a business as usual pathway versus the Snowy Mountains SAP investing in initiatives to accelerate the transition.
- **Waste:** Waste per capita and visitor have been incorporated to allow projections on waste to landfill and diversion rates to be evaluated.
- **Agriculture:** Existing SA2 agricultural emissions data has been applied relative to the agricultural land in the Snowy Mountains SAP.

Refer to Appendix G for the Emissions Calculator Summary and Guide which provides further detail.

13.4.1 Emission projections

The emissions calculator incorporates initiatives that have been included in the Snowy Mountains SAP Structure Plan and referenced technical reports and will allow new initiatives to be added as additional projects and initiatives are identified.

An initial scenario test of the calculators has been developed and incorporated into Section 4.4 of this report.

14 Conclusion

14.1 ESD Vision

The Structure Plan has been developed to fully align with the Snowy Mountains SAP ESD Vision. The following diagram summarises this vision:

Figure 76: Snowy Mountains SAP ESD Vision

14.2 Masterplan, SEPP and Deliver Plan

The following table summarises the ESD aims, performance criteria and provisions to be considered in the development of the Snowy Mountains SAP Masterplan, Activation Precinct SEPP and Delivery Plan:

ESD Themes	Recommended Aims and Performance Criteria – Masterplan	Recommended Objectives and Controls – AP SEPP	Recommended Provisions – Delivery Plan
Climate resilience	The precinct is adaptable and resilient to climate change impacts. Current climate change projections are used to inform the development growth scenario's and ensure sustainable development can occur to align with the UN Sustainable Development Goals.	Ensure the development land uses are permitted under the SEPP.	• Provide development controls that encourage alternatives to snow-based tourism. • Implement urban design, infrastructure and building design guidelines to increase climate resilience. • Consider infrastructure upgrades and funding opportunities to ensure the provision of climate resilient infrastructure.

ESD Themes	Recommended Aims and Performance Criteria – Masterplan	Recommended Objectives and Controls – AP SEPP	Recommended Provisions – Delivery Plan
	Prioritise developments that focus on alternatives to snow-based tourism.		• Ensure economic resilience and the role of business continuity planning with regards to considering climate resilience.
Emissions	The precinct's greenhouse gas (GHG) emissions are monitored and reduced in line with the Climate Active Precinct Standard. This includes precinct wide emission reduction programs focussed on a carbon negative outcome, which will create investment opportunities for low carbon industries.	None identified	• An emissions reduction strategy is developed and initiatives are integrated into the Delivery Plan. • The development is carbon neutral certified in line with the Climate Active Precinct Standard (or equivalent). • GHG emissions data is reported annually.
Energy	The precinct is powered by renewable energy, taking advantage of the natural resources of the region and proximity to the Snowy Hydro development.	Ensure renewable energy land uses are permitted.	• Develop a renewable Power Purchase Agreement (PPA) with Snowy Hydro to supply 100% renewable energy to the Snowy Mountains SAP. • Integrate energy efficiency and productivity into development design guidelines, with both embodied energy and lifecycle emissions considered. • Energy consumption is reported annually.
Environment	The precinct allows for growth and economic activity to thrive whilst minimising environmental impact, through initiatives that 'touch the ground lightly'. Development within KNP is controlled by the Snowy Carrying Capacity framework, which is integrated into the precinct's ISO14001 Environmental Management System (EMS).	The precinct's environmental impacts are effectively managed and reduced in line with the Precinct ISO14001 Environmental Management System (EMS).	• All development is assessed against the Snowy Mountains SAP EMS prior to approval. • The Snowy Carrying Capacity framework is applied to all development within KNP. • Implement urban design, infrastructure and building design guidelines to maximise environmental conservation. • Environmental impacts are reviewed annually, with performance improvement mechanisms identified. These impacts will be publicly reported annually.

ESD Themes	Recommended Aims and Performance Criteria – Masterplan	Recommended Objectives and Controls – AP SEPP	Recommended Provisions – Delivery Plan
Society	Development in the precinct expands on the regions focus on the outdoors and physical activity, to ensure the health and wellbeing of the community. The unique culture and history of the region is celebrated.	None identified	• Implement design guidelines for buildings and community spaces that focus on wellbeing. • Create social infrastructure focussed on equity. • Recognise and celebrate history and heritage in developments, including the Snowy Discovery Centre. • Track health and wellbeing outcomes for tourists and community via annual survey and engagement program. Survey to cover a range of health/wellbeing topics.
Mobility	A fully integrated transport model is developed which provides a seamless transport service across the precinct. Develop zero emission transport and infrastructure, prioritising public transport options within the Snowy Mountains SAP.	None identified	• Prioritise walking and cycling infrastructure to create a 20-minute connected Jindabyne town. • Redesign streetscapes to facilitate walking and riding including reduced speed limits and narrower streets. • Provide park and ride facilities to travel to and from ski resorts and tourist attractions. • Create southern connector road to reduce congestion and vehicle numbers in main town centre, facilitating a pedestrian and bike friendly environment. • Implement supporting infrastructure for zero emission vehicles (electric vehicle charging) and Mobility as a Service (MaaS) provisions. • Implement new gondola to provide mass transport experience to mountain bike park.
Circular economy	The precinct supports the expansion of resource recovery and recycling industries and embeds circular economy	None identified	• The development has identified resource flows, both within and outside the precinct, that will contribute to reducing waste to

ESD Themes	Recommended Aims and Performance Criteria – Masterplan	Recommended Objectives and Controls – AP SEPP	Recommended Provisions – Delivery Plan
	principles into planning and operations. This includes precinct wide resource sharing networks such as waste and recovery centres.		landfill and increase resource productivity. • Waste management is effectively managed throughout the precinct in accordance with the SMRC Waste Management Strategy. • Council to report total landfill waste and diversion rates for waste generated in the Snowy Mountains SAP. Landfill diversion are reviewed annually, with performance improvement mechanisms identified. These results will be publicly reported annually.
Water	The precinct celebrates the abundant natural water resources of the area, with all development focussed on water quality and stormwater management, through capture, reuse and water sensitive urban design (WSUD).	Ensure water infrastructure is permitted.	• New water infrastructure and urban planning to incorporate water sensitive urban design. • Wastewater treatment systems in the alpine areas to be upgraded to closed loop systems with no pollution to alpine streams. • Build water capture and reuse infrastructure for all new developments. • Ensure water quality of the lake is maintained and improved where possible.
Leadership	Leadership in sustainable development is demonstrated through a Green Star Communities rating from the Green Building Council of Australia (GBCA). The precinct's environmental impacts are effectively managed and reduced in line with the Precinct ISO14001 Environmental Management System (EMS).	None identified	• All development is monitored against its ability to contribute to the Green Star rating and EMS outcomes. Reporting and implementation of these frameworks is applied at mandatory, voluntary and opt-in scales depending on scale of development and impact. • EMS controls are reported annually and report is made available to the public.

Term	Definition
Australian Energy Market Operator (AEMO)	AEMO manages electricity and gas systems and markets across Australia and is made up of state and federal governments as well as private industry.
Carbon Capture and Storage (CCS)	Technology that captures and stores CO_2 from large sources, including power generation or industrial facilities.
Carbon Offset	A carbon offset (or carbon credit) is generated from an activity that prevents, reduces or removes greenhouse gas emissions from being released into the atmosphere to compensate for emissions occurring elsewhere.
Climate Active Carbon Neutral Standard	A standard for making carbon neutral claims; maintained by Australian Government Department of the Environment and Energy; sets rules for measuring, reducing, validating and reporting emissions. The standard is available for organisations, products and services, buildings, precincts and events.
Climate Change	Refers to any change in climate over time, whether due to natural variability or as a result of human activity.
Carbon negative	Going beyond carbon neutral to offset more emission than are generated (also referred to as carbon positive)
Decarbonise	Decarbonisation refers to the significant reduction of greenhouse gas (GHG) emissions through improved energy efficiency, moving towards lower-carbon sources of energy, and switching from fossil fuels to lower carbon fuels.
Electric Vehicle (EV)	Electric vehicles (EVs) refers to cars or other vehicles with motors that are powered by electricity rather than liquid fuels.
Emissions Abatement or Carbon Abatement	Either the removal of one or more greenhouse gases from the atmosphere or the avoidance of emissions of one or more greenhouse gases.
Enquiry-by-Design (EbD)	Enquiry-by-Design is an intensive and interactive workshop format used to explore scenarios and designs.
Environmentally Sustainable Development (ESD)	Environmentally Sustainable Development is the philosophy of designing the built environment, and services to comply with the principles of ecological sustainability.
Greenhouse Gas (GHG)	A gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect.
Power Purchase Agreement (PPA)	A contract between an electricity generator (provider) and a power purchaser (buyer).
RGDC	Regional Growth NSW Development Corporation
Sequestration	The removal of atmospheric carbon dioxide, either through biological processes (e.g. photosynthesis in plants and trees) or geological processes (e.g. storage of carbon dioxide in underground reservoirs).
UN SDG	United Nations Sustainable Development Goals
National Electricity Market (NEM)	The NEM is a wholesale electricity market and the physical power system which operates in New South Wales, the Australian Capital Territory, Queensland, South Australia, Victoria and Tasmania.

Appendix A Context Analysis Summary

1 ESD Context Analysis

1.1 Purpose

The purpose of this context analysis report is to ensure that ecologically sustainable development (ESD) principles and opportunities are identified and integrated into the Snowy Mountains Special Activation Precinct (SAP) throughout the planning stage.

This document summarises the preliminary research undertaken to identify sustainability and ESD opportunities and constraints for the region. The research is used to inform the Sustainability Technical Report and will continue to be developed as the project progresses.

1.2 Trend Analysis

To consider trends and opportunities for the region, macro environmental factors have been identified for consideration and analysis to support project direction and goals. These are summarised below:

Demographic
• 19,949 working age population[1] with 1.9% unemployment (Aus.: 5.2 in 2010-19)[2]. • CIE draft population forecast shows an increasing ageing population over time but DPIE projections show an overall declining population. • Over 80% of residents live in separate houses, mostly families and lone person households. • Home to around 35,000 locals (6000 residents) and attracts over 1.3M visitors annually. • Highly seasonal workforce with local workforce consisting of double FTE to PTE. • Majority of visitors are from NSW/Sydney (lack nearby ACT & VIC) staying only a few nights. • The majority of visitors are in the young-midlife age groups and older visitors comprise 21% of total visitation[3]. • International visitors make up only 1.4% of total visitation to the region, with the majority from Europe, followed by Asia.[2] • 98% of visitors use self-drive transport.[2]
Political
• Federal government initiative. • Government led studies, development and business concierge. • Current local and state government legislation for development approvals is not user friendly with SAP's providing an opportunity to simplify and streamline the process.
Social
• Focus on connection, collaboration and circular economies. • Desire to streamline development for ease of operations. • Connection to first nations and settler heritage can add a rich cultural layer.
Economic
• NSW government investing in infrastructure to facilitate economic growth.

[1] https://itt.abs.gov.au/itt/r.jsp?RegionSummary&region=10103&dataset=ABS_REGIONAL_ASGS&geoconcept=REGION&measure=MEASURE&datasetASGS=ABS_REGIONAL_ASGS&datasetLGA=ABS_REGIONAL_LGA&regionLGA=REGION&regionASGS=REGION

[2] CIE draft economic context report

[3] Snowy Mountains Experience Implementation Plan p13

• Commitment to the Regional Investment Attraction Fund to attract businesses to relocate to precincts in regional areas (grants, incentives and interest free loans including relocation grants for skilled workers) • Tourism is dominant, comprising >50% of the local economy, ~$500M/yr. & employs >3200[4]. • Accommodation followed by hospitality and transport are biggest economic contributors. • SAP employees receive a minimum wage. • Projected costs of SAP (Cooma AP, Tourism infra & new AP) = $1, 192, 535, 262.28.[5]
Technological
• Embrace new technologies with a focus on renewables and digital connectivity.

[4] Snowy Mountains Facts: Satellite Account 2015-16

[5] Snowy SAP Strategic Design Report and P50 Estimate

2 SWOC Analysis

2.1 Methodology

A desktop review of key regional documentation was analysed to identify areas related to environmental sustainability under key themes. Findings are detailed herein.

A Strengths, Weaknesses, Opportunities and Constraints (SWOC) analysis has been collated for the region to inform the sustainability strategy and identify levers for embedding sustainability into the region. The SWOT analysis will be used to identify sustainability and ESD initiatives that can respond to opportunities or constraints in the region, instead of attempting to lead with sustainability without considering the context.

2.2 Circular Economy

A circular economy model redesigns current linear systems (take-make-waste) to closed loop or circular systems which maximise resource efficiencies, reduces waste and improves natural systems. Creating a circular economy within the region will provides 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.

Strengths
• Proximity to ACT research institutions can drive research, development and innovation. • Proximity to major cities is good with the potential to develop markets from surrounding ACT and VIC as well as from the south eastern coastal areas. • There is a diversity of skills and knowledge within the region which can help drive development. • The area is already seeing some improvement in out-of-peak season tourism which confirms that the current offerings are appropriate and could be further developed. • Major resorts within the SAP already have a focus and goals for better waste management and local processing, including some on-site recycling. • Nearby examples provide a good business case for sustainable businesses/precincts in the region. (Tumut VISY paper mill utilises waste water and links with local agriculture for waste water agricultural use. Certified to ISO 14001 EMS with energy predominantly generated on-site)[6]. • Leesville industrial estate supports light industry like trade supplies, mechanics and workshops (52 businesses currently on a space of 27,844sqm)[7]. Could be expanded.
Weaknesses
• The area is currently known as a winter destination, with limited branding for year-round offerings. • Limited industry and work diversity, with tourism forming the backbone of the economy. • No FOGO (food organics garden organics) waste and limited local recycling options within the area currently.

[6] https://www.visy.com.au/pulp-and-paper/paper-mills/tumut-kraft-mill and https://sdgs.org.au/project/sustainable-water-use-for-paper-manufacture/

[7] https://www.planning.nsw.gov.au/-/media/Files/DPE/Plans-and-policies/Go-Jindabyne-Masterplan_Infrastructure-and-Services-Study-2020-03-03.pdf?la=en

- Limited technical professionals reside in the area which may necessitate external agencies for development of the project. This may risk losing community confidence and may present a perceived barrier as locals could view external agencies as disconnected threats.

Opportunities[8]

- Utilising the ACT/NSW Regional Collaboration MOU[9] (Memorandum of Understanding) can facilitate stronger connections to Canberra, attracting additional businesses, residents and tourism.[10]
- The ACT/NSW MOU could also facilitate defence industry development with the alpine region presenting excellent training grounds for search and rescue and special forces.
- Partnering with coastal region and surrounding towns for tourism and trade (Eden now receives cruise ship visitation) can bolster regions.
- Connecting local businesses to surrounding regions can expand business operations and offer employment diversity whilst strengthening ties and collaboration between communities.
- Linking businesses via complementary activities and cross promotion may encourage additional spend and lengthen visitor stays.
- Shared SAP resources such as bikes, snow equipment etc can offer a convenient service to visitors whilst sharing purchase and maintenance costs.
- Resort infrastructure that is sensitive to the natural environment; designed and built sustainably to the conditions, could showcase the areas commitment to the environment and become a tourist attraction in itself, whilst supporting other values of the region.
- To ensure environmental sustainability, targeting longer stay, high spend tourism rather than short term stays, could decrease transport impacts, cleaning services, resource consumption etc, whilst positively contributing to the economy and providing less disruption to the community.
- Dedicated ecotourism operations training and practical experiences can grow the ecotourism movement whilst providing locals with skills, boosting the economy and further benefitting the community with strong employment prospects.
- Hospitality and tourism specific training centres could upskill locals as well as attract students to the region, as alpine operations add unique considerations and require specific skills. This could be via built-for-purpose educational facilities, similar to the Blue Mountains' Le Cordon Bleu.[11]
- Educational and training facilities including aged care, journalism, ecotourism, hospitality, agri & agro-tourism and permaculture could add value to the SAP.
- Offering backpacker experiences that educate and up-skill can attract international visitors. (appropriate accommodation is required).
- Facilitating entrepreneurial and/or think tank hubs to encourage the community can help problem-solve and drive a sustainable future. This could be in partnership with local businesses or research institutions, engaging the broader community and aiding development.
- Promoting and supporting green start-ups at a local level encourages entrepreneurship.
- Supporting, utilising and producing local resources within the SAP can foster economic, environmental and employment benefits whilst reducing reliance on imports.
- Providing and promoting a local business rewards scheme or local trading currency can ensure ongoing economic resilience.

[8] https://issuu.com/alpconv/docs/green-economy-action-programme_2019
[9] http://www.cmd.act.gov.au/__data/assets/pdf_file/0004/265225/ACT-NSW-MoU-regional-collaboration.pdf
[10] https://www.cmtedd.act.gov.au/policystrategic/regional/nsw
[11] https://www.cordonbleu.edu/sydney/home/en

- Local markets can be supported by Council (i.e. by waiving site fees etc) and showcase products and services to support the economy.
- Sports training in the area can foster athletic achievement, marketing the region, hence attracting talent and supporting the future generations. A training centre would also offer operational and service jobs, diversifying employment options in the area.
- An Olympic institute training hub can increase snow sports as well as related training sports (competitive advantage to VIC). Sustainability within the hub speaks to the International Olympic Committees (IOC) commitment to sustainability and builds on Australia's reputation for 'Green Olympics.' The IOC's leadership could be followed by adopting the UN sports for climate change action initiative, which aims to drive climate action across the sports community.[12]
- Additional sports training (not limited to winter sports) could diversify the training opportunities in the region.
- Connecting the expansion of the school with a new aged care facility can share local skills and knowledge whilst building resilience and reducing childcare needs.
- Public place waste bins are generally landfill only in the region and materials are often sent for processing outside of the SAP. Locally processed materials can offer multiple benefits including the utilisation of valuable resources within the area and a reduction of transportation.
- There are some waste education events and campaigns in the area including Clean Up Australia Day event, Hey Tosser TV campaign, Boomerang bags in Jindabyne and Plastic free July voluntary activities. [13] It has been shown that linking waste back to resources can encourage good waste management behaviour, which presents an opportunity for local processing.
- Local agricultural waste like straw, could be used for resort heating or gardening.
- Pest fish species caught in the river may be dropped off to a composting facility or central collection to make fertiliser locally for sale back to the community.
- Facilitating economies of scale with shared buying power for materials utilised by multiple businesses can reduce costs, establish connections and reducing packaging and waste.
- Branding and marketing of year-round activities in the region can encourage tourism.
- Local food miles can be incorporated as a branding piece for the region.
- Increasing local products and services for year-round trade can showcase the region.
- Catering to the growing caravan tourism market with appropriate infrastructure can attract a diversity of travellers, requiring a diversity of offerings which boosts employment options.
- Expanded offerings opens opportunities for local and national/international events which can be exemplar sustainable events within the region.
- Reducing the impact on infrastructure and resources by implementing efficiency and resource saving measures can lessen environmental impacts and become recognised elements of the region. I.e. incentives for resource savings (businesses and residential), educational campaigns and local challenges, hospitality initiatives like removing single-use items and encouraging guests to reuse towels/bedding etc.

Constraints/Challenges

- Dependence on tourism may reduce resilience of a diversified local economy.
- Without adequate and appropriate promotion, development may not attract the economic impacts proposed, burdening the local region.

[12] https://www.olympic.org/news/ioc-takes-leadership-role-in-the-un-sports-for-climate-action-initiative
[13] https://www.snowymonaro.nsw.gov.au/289/Events-and-Campaigns

• Increased tourism may introduce more waste streams and necessitate more imports and exports if not managed well in advance. • Surrounding towns may offer reduced cost products/services, decreasing the visitor spend within the SAP. • Extreme weather events may impact tourist accommodation and experiences. [14]

2.3 Climate & Community Resilience

Strengths
• Strategic development proposals must now include a Strategic Bushfire Study. This is in preparedness for more complex, frequent and severe fire seasons.[15] • Risk based land use planning has been identified as a means to reduce natural disaster risk which can be implemented within the SAP.[15] • NSW Fire Brigades are responsible for response to structural fires in the alpine resort areas and the National Parks and Wildlife Service protects and conserves the Park.[15]
Weaknesses
• The National Park is in a high bushfire danger area, impacted in 2003 & 2020, showing that the SAP is bushfire prone land. Most of the accommodation is Special Fire Protection Purpose Development but much of the existing building stock has not been constructed to bushfire building requirements.[15] • Climate modelling suggests a decline of rainfall of up to 9% by 2060-79 (winter-spring).[16] • Climate modelling also predicts an increase in mean maximum temperatures with the greatest increase in winter, a decrease in annual rainfall and fewer moderate to heavy rainfall events, more dry days due to large precipitation reduction in spring and more hot days over 30 degrees C and fewer cold nights, less than minus 2 degrees C.[17] • Current accommodation does not cater for the needs of the growing trend towards lone person/ couple households and an ageing population. • Accommodation is limited in quantity and types and is expensive in winter, impacting the tourist experience as well as affecting local expenditure.
Opportunities
• Ecotourism training can enhance local climate resilience, encouraging practical actions that can reduce energy consumption and waste generation etc. in the region. • Future developments can be multi-purpose and adaptable, future proofing their utilisation. • Engaging and empowering the community with interactive motivational and educational workshops and events, can foster a clear vision and commitment for a transition to eco-tourism and sustainable futures. (Transition movement)[18].
Constraints/Challenges

[14] file:///C:/Users/sarah/Downloads/IRVASthEastNSWVol1web.pdf p 13
[15] Blackash draft bushfire report
[16] WSP draft flooding report
[17] WSP draft hydrological report
[18] https://transitionnetwork.org/wp-content/uploads/2018/08/The-Essential-Guide-to-Doing-Transition-English-V1.2.pdf?pdf=essential-guide-to-transition-v-1

- Fuel reduction access pathways require consideration within the natural environment, to reduce bushfire risk within the SAP. These can be constrained by the topography of the region and access near developments.
- A greater need for buffer zones in and surrounding developments may compete with land use and planning objectives.
- Snowfall events and depth will be affected by climate change and the number of hours available for snowmaking are projected to reduce by 20-60% which threatens winter tourism.[17]
- Climate changes may reduce habitat for species which may induce migration and increase the number of threatened species. This may also change the impacts of development within the area, potentially requiring changes to development regulations which may challenge existing development approvals.[17]
- Increased temperatures may reduce the viability of some farming crops in the region, potentially unsettling food security and local economy.[19]
- Climate change risks can overburden local health and emergency services, requiring more skilled employees in need of training, accommodation and infrastructure.
- Increased temperatures may also harbour increased vector-borne diseases, presenting a health risk for the region (especially due to the large water bodies available which provide breeding grounds).
- Changes to available water may impact water availability and infrastructure, which requires consideration, especially with regard to industry.
- Loss of local small-town character and natural environments which locals wish to retain may constrain the types of development and risk community unease.
- Capacity constraints in winter: lifts, ski areas, accommodation & roads are difficult to address given that this is only a challenge 20% of the year.
- High visitation areas may impact heritage sites however historically low artefact density may reduce significance (OzArk draft heritage report).
- Given the biodiversity findings, development is recommended in existing developed areas. This does not allow for additional infrastructure and threatens the opportunity for roads and accommodation to support growth.
- Premium offerings may reduce low-cost options for seasonal workers and visitors, challenging social equity.
- High land values may make some land practices unviable.

2.4 Emissions

Strengths
• The KNPPoM (Kosciuszko National Park Plan of Management) has provisions for Environmental Management Requirements and reporting, (including each Alpine Management Unit having an EMS) which could provide important data for any carbon claims (WSP draft Carrying-capacity report p19). • Vail Resorts (Perisher) tracks GHG emissions and reports annually. • The Jindabyne and Cooma landfill sites have a Scrap Mart: a reselling centre for second hand items that are still in good condition. This reduced materials to landfill and associated impacts.
Weaknesses

[19] IRVA OEH 2012

• Current transport is car-based due to lack of public transport, resulting in higher carbon emissions. • Airport may increase shorter trips which can have environmental impacts.
Opportunities
• Methane from the Jindabyne landfill could be captured for energy use rather than flared, to reduce emissions. • Cooma has a FOGO system in place which is processed into compost at the Cooma landfill site.20 The facility is currently being assessed for expansion which could allow for surrounding areas to utilise FOGO in the future, which can reduce organics in landfill that emit methane. (Sawpit Creek may have been assessed for suitability)[21] • Construction regulations may mandate the use of recycled content to reduce impacts and emissions i.e. roads may use glass fines from the glass waste from alpine bars. If local products can be utilised in new developments, this will further support the economy and reduce embodied emissions. • Biodiversity offsets within the region can support local work and connectivity, whilst addressing the SAP's emissions impacts. • Encouraging an SAP reporting system can introduce consistent measurement and monitoring which can aid with marketing as well as ongoing competition and support.
Constraints/Challenges
• Limited current electric vehicle charging infrastructure may hinder lower-emissions vehicle choices.

2.5 Energy

- Estimated electrical demand for 2021 for the lower bound projection is 8.59MVA. The upper bound projection demand is projected to be 11.45MVA (WSP draft renewable energy report p6).

Strengths
• There are two existing renewable hydro-electric power projects within the SAP: Jindabyne dam mini-hydro (1.1MW) and Guthega (60MW) power stations.[22] • The Snowy Monaro Regional Council has a renewable energy target of 50% RE and 50% energy use reduction by 2020. To work towards this, they have solar power on multiple Council buildings, between 15-30 kw. [23] • The Snowy Hydro owns and operates three gas-fired power stations with a total capacity of 1.290MW (Laverton North VIC, Valley Power VIC & Colongra NSW). • The Council has a Southern Lights Project which aims to replace over 75,000 street lights with LED lighting and smart controls.[24]
Weaknesses
• Biomass & Biofuel initial assessments show a low scope for biomass energy projects in the SAP region due to low quantities of available biomass. Transportation of materials adds additional environmental impacts and may not be feasible.[22]

[20] https://www.snowymonaro.nsw.gov.au/726/Food-Organics-Garden-Organics
[21] https://slopes.org.au/wp/wp-content/uploads/2017/03/PRREMSOC-Outcomes-Actions-26-Nov-12.pdf
[22] WSP draft renewable energy report
[23] https://www.snowymonaro.nsw.gov.au/291/Renewable-Energy-Sites
[24] https://www.snowymonaro.nsw.gov.au/1324/Southern-Lights-Project

• Biogas (energy from waste) is not recommended due to the insufficient feedstocks available. Small-scale utilisation is unlikely to be cost effective. Livestock waste is challenging mainly due to collection and transport.[22] • Geothermal energy is not likely to be feasible in the region due to insufficient temperatures for power generation. [22] • Power in the area is currently seen as unreliable, mainly due to weather challenges.
Opportunities
• Solar energy has a moderate scope for the region, restricted by availability and preferences for land use. The north eastern SAP area is the most suitable, however undulating terrain may cause construction and shading challenges. Small-scale solar PV/satellite micro-grids could be encouraged for residential and community owned property and small land areas.[22] • There is a potential opportunity for hydrogen gas to play a role within the SAP, with hydrogen sourced through renewable energy offering a pathway to net zero carbon emissions by replacing natural gas.[22] • Agricultural processes/materials could be utilised for small-scale energy production however large-scale bioenergy is constrained due to a lack of local resources.[22] • Thredbo recycles cooking oil into biodiesel which may be expanded.[25] • A PPA option or 100% green power procurement is recommended for exploration within the SAP alpine village area.[22]
Constraints/Challenges
• Hydro energy: conventional and pumped hydro, run of river and a PPA were considered. Conventional and pumped hydro is already largely exploited in the region and small-scale is not typically viable. Run of river (small-scale) has potential on the Thredbo river however this is currently used for tourism activities and a scheme could deplete amenity as well as ecosystem functionality. [22] • Wind energy has potential as reported wind speeds are favourable, particularly in the areas north and west of Lake Jindabyne and in the National Park. These areas are restricted for development/construction due to environmental considerations and may be challenging to build due to the terrain. Wind turbines also affect the aesthetics of the region which may pose challenges to acceptance.[22] • Unreliable/limited power in some areas may constrain development.

2.6 Water

Strengths
• The SAP lies at the top of the Snowy River Catchment, one of the largest ice melt rivers in Australia. • The Snowy hydro project captures the headwaters of the Tumut, Eucumbene and Murrumbidgee rivers and consists of 16 major dams with a storage capacity of 7000GL. 9 power stations and one pumping station connected with 145kms of tunnels and 80kms of aqueducts complete the system which generates power from 33 hydro-electric turbines (capacity: 4,100MW).[26]

[25] https://www.thredbo.com.au/about-thredbo/environment/

[26] Snowy SAP regional context analysis

- There are four major dams and multiple weirs that divert water to the Murrumbidgee and River Murray valleys. The major dams in the SAP are Lake Eucumbene & Jindabyne. These are major storage areas for the Snowy-Hydro Scheme. Guthega dam is smaller (1550ML).[16]
- Tributaries include: Eucumbene, Thredbo and Snowy rivers, Perisher, Wollondibby, Rushes, Widows and Lees creeks. [16]
- Downstream of Jindabyne Dam are significant tributaries of Cobbin creek and Mowamba river. [16]
- Active water storage in the Snowy Scheme in 2018-19 was 1,268GL (23.9%)[27]
- Around 50% of inflows are received from snowmelt and spring rain.[28]
- Average rainfall for the area is approximately between 1771-1785mm/year with approximately 600mm/year evapotranspiration.[16]
- Snow can be up to 2m deep in winter but does not accumulate evenly across the site area. [16]
- Major watercourses support riparian corridor land and act as core habitat. [16]
- Bores indicate that groundwater levels are approximately 50m below ground level, with 95 registered bores in the area. [17]
- The Snowy Hydro currently has a Cloud Seeding Program to increase precipitation (and snowfall) by an average of 14%.[29]
- The region is part of the South Coast Groundwater sharing plan which includes alluvial aquifers.[17]
- There is provision within the Water Sharing Plan for the South Coast Groundwater Sources for additional water access licences.[17] Water extraction within the Park is licenced by the Natural Resources Access Regulator in accordance with the Water Management Act 2000.
- The existing Sewerage Treatment Plant uses UV disinfection prior to discharging into the Perisher Creek. Capacity is 2ML/day which is exceeded during peak flows. Average of 1.25ML/day.[30]

Weaknesses

- Current practices consider the management of all forms of water (dam, storm, recycled, aquifer) separately, which may not provide a good overall approach and context for best practice water management, especially during times of limited water.[31]
- Most buildings do not capture rainwater as gutters can freeze in winter. This reduces resilience in times of water scarcity.
- Greywater does not seem to be captured systematically currently.
- Improved storm-water runoff management is required to ensure good downstream water quality.[16]
- Urban water has historically been poor quality due to pollutants. The Lake Jindabyne water in 1980-86 studies showed high phosphorous loading and retention and low dissolved oxygen concentrations. A Snowy River Drinking water study in the 2000's notes that reported exceedances of chemical parameters were not considered of great health concern as they were only marginally outside the 2004 national guidelines or were not health-based values. [32]Updated and ongoing studies could inform appropriate actions.[16]
- Increased hard surfaces in developed areas may increase stormwater runoff and pollution however WSUD (Water Sensitive Urban Design) could assist.

[27] https://www.snowyhydro.com.au/generation/water/
[28] https://www.snowyhydro.com.au/generation/live-data/
[29] https://www.snowyhydro.com.au/generation/cloud-seeding/
[30] SAP Strategic design report
[31] IRVAS Vol. 1
[32] http://reports.envcomm.act.gov.au/SoE2004/SnowyRiver/drinkingwaterquality.htm

Opportunities
• Water sports and recreation has the potential to attract more tourism if marketed and supplied for (infrastructure) appropriately. I.e. paddling and rafting experiences, paddlers festivals, fishing access points, adventure hubs and dam viewing tours are some possibilities. • Groundwater extraction is currently underutilised and if good yields are secured, could supply construction and operational activities. [17] It is noted that many bores have been abandoned, potentially indicating a limited supply. • Given that winter is short in the region, rainwater capture could be encouraged from roofs with appropriate gutter guards installed during cooler periods. • Greywater may be recycled in the region on a larger scale and used for irrigation and other non-potable applications, reducing the use of potable water.
Constraints/Challenges
• It is noted that current extraction exceeds allocations which may constrain future growth. The maintenance of natural flow regimes is essential and also requires consideration, as does the viability of additional extraction.[17] • Climate modelling shows that reduced rainfall will affect the availability and quantities of groundwater.[17] • Reduction of rainfall will stress the environmental allocations of water and compete with human utilisation, potentially impacting residential developments. [33] [19] • Threats to water quality include sedimentation, treated sewage, road-de-icing, industrial discharge and litter.[34] • Increasing saltwater intrusion into groundwater threatens potable water supply. [19] [33] • Thredbo access roads may be susceptible to some water inundation in regular flooding events and culverts would be required to mitigate negative effects.[16] • Flood risk zones in areas downstream of dams could limit access and development within these areas and new areas may require on-site detention basins and infrastructure upgrades. [16] • If salt sensitive receptors are found downstream, new roads may require different surface treatments for ice melt traffic flow practices. [16] • Further development may necessitate further infrastructure updates (water piping, electricity etc), which may pose environmental threats. • Water availability changes due to climate change can affect ecosystem function with flow on effects to ecosystem services and amenity. For example, reduced rainfall can reduce flows through waterways which impacts available oxygen, riparian vegetation and the supported fauna. This can lead to ecosystem collapse, polluted waters, odours and unsightly areas. • Water quality may be affected due to reduced snow-melt dilution. [16] • 'The majority of natural and remnant vegetation within the investigation area is listed as being moderate to high potential terrestrial Groundwater Dependent Ecosystems.'[17] • The Water Sharing Plan allocates 100% recharge that occurs in areas of high environmental value as environmental water which may compete with residential and industrial allocations, especially in times of water shortage. [17] • Daily water releases are required from Jindabyne Dam into the Snowy river for environmental purposes.[16]

[33] Go Jindy Environment & Heritage Report
[34] WSP draft carrying-capacity report

- Sewage management is a particular challenge due to high seasonal visitation, with current sewage treatment facilities already reaching capacity at peak times, with climate affecting the treatment process. [35]

2.7 Mobility

Strengths
• Access to the SAP area is generally through gateways of Cooma in the east, Bombala in the South and Tumut in the west, offering good connectivity. • Existing airports include Cooma (16km SW) & Jindabyne. • Connections to the ACT, VIC and coastal regions of NSW can ensure visitation from multiple areas as well as improved transportation in emergencies. • The existing ski tube offers two-way train services, mostly underground, during peak season as a connector between alpine areas. Current capacity is 225 people per carriage with 11 carriages built, totalling a capacity of 2475. • Cooma has existing tanks for fuel at the airport. • E-bikes allowed on cycling trails in the area allows for capturing the growing e-bike market & millennials.
Weaknesses
• There is around 5 times more traffic in the peak season than in the low season with the vast majority of transport by private vehicles. • A variety of buses and shuttles operate in the peak season however outside of this, shared/public transport is very limited and no car/bike sharing companies operating in the area currently. • There are currently limited areas for chain installation, vista viewing, car-pooling and car parking. • Freight via road transport is restricted to major roads and heavy vehicles make up approximately 7-14% of daily traffic on Kosciuszko Road and Barry Way. The region is a net importer which affects freight and associated infrastructure. Freight may become constrained with the addition of extra road visitation. • Road capacities vary between locations and traffic volumes fluctuate with tourism visitation. Current flowrates are high, in excess of theoretical capacity. • Air travel is under social scrutiny, Flygskam (flight shame) regarding environmental impact and whilst there are advances in technology, limited investment may mean decades before cleaner options are realised. • Due to airline's preferred off-peak period allocations, the SAP may see tourists arriving in the middle of the day, which may discourage some visitors. This would also affect tourist infrastructure.[5] • Climate conditions in the region may impede airport viability (fog making landing challenging in winter, the peak season. • Transport-connectivity and infrastructure inadequacies present costs. • Seasonal congestion and impacts with solutions that are often only viable for the peak season. • Poor public transport and connectivity with car-oriented centres which has environmental, economic and health and wellbeing impacts.

[35] WSP draft infrastructure context report

Opportunities
• Low impact hiking trails in particular offer sustainable tourist options and attract adventurous long-hikers. Travelling stock routes including the Bundian way and Black Allen Line provide long-distance options with significant opportunity for local businesses.[36] • Walking and cycling trails can be leveraged to grow the touring visitor economy. Four major regional trails already pass through the region with further connections possible for low-impact experiences. • Emergency facilities at the airport may include Aviation Rescue and Fire Fighting Services to better support the area. • There may be an opportunity to invest more in sustainability measures if Cooma airport is upgraded as it requires less redevelopment. Short-term costs can be minimised by utilising prefabricated facilities on-site for the first 10-15 years, which also allows for flexibility. • Airlines may offer visitor transport as well as freight when capacities are available to support business and ensure efficiencies. • Adventure valley-active tourism like cycle touring and hiking (Bundian way) can attract diverse visitation. [37] • The NSW Future Transport 2056 plan's highway access improvements to Cooma (Monaro highway and Snowy Mountains highway including Brown mountain) offer greater connectivity. • Potential for a seasonal ferry can open up transport options around Eucumbene and Jindabyne lake as this transport route is generally circular navigating around these features.[26] • Active transport links and pathways like cycling training, championships and touring can embrace natural waterways and features. • A tourism drive could link regions and areas, offering access to a diversity of opportunities for visitation and could include unique architectural elements and facilities for scenic viewing and experiences. • An electric bus shuttle linking the airport to resorts, key attractions and transport links can reduce emissions and road congestion. • Park and ride and increased public transport offerings could avoid traffic congestion and parking problems within the SAP. Comfortable waiting areas are required (heated bus stops), as are large luggage storage spaces to accommodate snow sport equipment. • Carparking spaces could be utilised for other activities in off-peak times: i.e. markets, cycle training facilities etc. • Support working from home to reduce commuting impacts where appropriate could benefit the community. • Electric/hydrogen charging stations could future proof transport infrastructure and encourage uptake of more sustainable transport options. • Smart parking connected to apps and real-time displays could provide convenient planning for drivers and encourage update of public transport. • Dedicated public and shared transport lanes could encourage uptake of these modes of transport. • Bike sharing within town centres/resorts could encourage active transport within locations (with improved cycle infrastructure). • Walkable town centres that are well connected with good wayfaring would increase pedestrian access. This may also encourage increased business visitation along pathways.

[36] Snowy Mountains experience implementation plan
[37] https://bundianway.com.au/map/

Constraints/Challenges
• The Park contains around 800km of public roads which may require expansion but has topographical challenges. [34] • 'The ski tube (Via Bullock Flat) is unable to be easily increased'. [34] • An airport may increase shorter trips which can have environmental impacts, potentially negatively viewed and not supported. • Airport social licence may be challenged by environmental concerns (flygskam) and multiple stakeholders may make airport operations unviable/unprofitable. • A lack of public and active transport infrastructure necessitates ongoing car-reliance which may increase carbon impacts. • 4WD and animal tours off established accessways may degrade environmental assets. • Bushfire risks regarding access and egress requirements and environmental impacts to provide these present significant challenges. • Increased transport costs may inhibit visitor movement if more sustainable public transport is not provided within the area. • Additional roads and infrastructure could inhibit biodiversity movement, requiring corridors which may be challenging. • The proposed Jindabyne Option 3 airport is closer to the slopes, reducing visitor commuting however it may be prone to climactic challenges which may reduce viability.

2.8 Environment

Strengths
• The SAP is a central segment of Australian Alps Bioregion with the highest mountain in Australia, the largest National Park, unique alpine plant diversity along with threatened ecological communities and endemic species. This presents a unique opportunity to promote these aspects, attracting conscious tourists for increasingly popular immersive nature experiences. • Activities in the region include: climbing, caving, cycling, fishing, water sports, air sports, hiking, horse riding, skiing, flying and ball sports. • Nature-based experiential tourism market is growing and the SAP region is perfectly positioned to support this market. • Site surface geology is mainly comprised of Palaeozoic intrusive rock (435-390Ma and Late Ordovician sandstone, siltstone and shale (>435Ma).[38] • The Alpine Resorts State Environmental Planning Policy aims to protect and enhance the natural environment of the resorts by ensuring that development is managed to conserve and restore ecological processes, systems and biodiversity as well as other principles of ecologically sustainable development.[34] • Leases granted to private organisations such as the alpine resorts are administered by NPWS and DPIE. Each resort area has a management unit.[34] • 'The Geotechnical Policy-Kosciusko Alpine Resorts sets out structural and geological requirements for development within the Alpine resort areas'.[38] • Surrounding regions have rich basal soils which can support primary production. [39] • Visitor numbers within each Alpine management unit are currently managed by bed limits which are set by service infrastructure considerations, not environmental considerations. [34]

[38] WSP draft geological report

[39] Snowy Monaro local strategic planning statement

- Vail Resorts (Perisher as well as Falls Creek & Hotham) have a 'Commitment to Zero', a bold pledge to reach a zero net operating footprint by 2030 which could be implemented more broadly within the SAP.[40]

Weaknesses

- There are several fault lines in the area: Jindabyne and Crackenback and several earthquakes have been recorded.[38]
- The regions acid-sulphate soils have a natural tendency for erosion and sedimentation, providing challenges to area access, development and utilisation.[38]
- Seasonal challenges resulting in environmental degradation such as increased pollution.[41]
- The current KNP POM links carrying capacity to bed numbers which overlooks environmental factors and casual visitation.
- Current lack of lakeside infrastructure and waterfront activation. Future infrastructure along the lake must be considerate of environmental impacts as well as aesthetics.
- Current development is 2-3 storeys which residents aim to retain; however, this would result in urban sprawl which is likely to have greater environmental impacts.

Opportunities

- Allocating a percentage of revenue as conservation funding to be reinvested into the Park's environmental projects could support local businesses to deliver environmental outcomes.
- Treating the entire region as a National Park with regard to encouraging responsibility for actions (leave no trace) can support ecotourism.
- Sustainable events can further highlight and encourage environmental stewardship of the natural surroundings, whilst contributing to the economy, in turn funding sustainability initiatives.
- Local biodiversity should be supported and built into development design to ensure ongoing support.
- Development regulations (for resorts and more broadly) can support construction and development in the area, sensitive to site specific environmental considerations and climate risks.
- Carrying capacities may be reviewed and monitored to ensure that they are not exceeded during peak periods. These can be marketed to showcase the areas commitment to caring for the environment. (Bhutan is famous for having tourism restriction numbers to preserve the natural environment).
- An arboretum on degraded land can act as a tourist attraction, education centre and a carbon sink.
- Regenerative agroforestry in the SAP and/or surrounding regions could support primary production, biodiversity conservation and sequester carbon whilst providing ecological services.
- New developments could showcase climate resilient building techniques (bushfire/thermal), becoming a sustainable urban design exemplar and eco-tourism building destination.
- New buildings may wish to add to the natural aesthetic of the area by installing green rooves which can also assist with thermal comfort.
- Providing infrastructure to facilitate environmentally conscious fishing along appropriate water courses can reduce recreational impacts. (may include access trails, fishing line waste capturing pods, pest fish composting pits and fly-fishing lure repair drop off stations).

[40] http://www.epicpromise.com/media/2202/epic-promise-progress-report-fy2019_final.pdf?INTCMP=C2Z_REPORT

[41] NSW alpine resorts environmental performance report 2014-16

Constraints/Challenges
• Most resorts are constructed near water courses which offers amenity but presents environmental challenges. • Development to locally significant places like Yarrangobilly Caves thermal pool could reduce amenity and introduce environmental threats if not managed appropriately. (Embedding the National Parks philosophy of 'leave no trace' can assist). • Increased development without appropriate regulations for vegetative retention can reduce canopy cover, exacerbating the heat island effect and reducing climate change resilience. • A focus on tourism and land development may reduce farming land for production. • Minor earthquakes and fault-lines in the region present slope instability risks. • Landslides and rockfall events are common in the SAP area which constrains development placement. [38] • Acid-sulphate soils require management plans to reduce ground disturbance. • Granitic rocks in the region may release Radon above safe levels. [38] • Local soils have a natural predisposition to erosion so soil stabilisation and sedimentation are factors for consideration. It is also noted that soils have poor drainage and low fertility.[33] • Recreational hunting and fishing in the area may threaten the 'green' image and proposes potential conflict if not managed appropriately.

2.9 Health and Wellbeing

Strengths
• There is a diversity of recreational activities on offer in the region for all seasons, with a strong focus on nature-based activities supporting health and wellbeing outcomes. • Kosciuszko National Park was the first in Australia to become an *Ecotourism Destination Certification.* • Curiosity Rocks is a significant place for first nations peoples of the area (Ngarigo & Walgal) and is rich in stone resources and hence should be retained for cultural connection. [42] • The Bogong moth ceremony was an important annual gathering for the region and could be incorporated into cultural development to retain this connection. • There are 128 Aboriginal sites and a declared Aboriginal Place recorded in the Study area. [33] These sites support the wellbeing of first nations peoples and other visitors and offer important educational opportunities. • The Southern Kosciuszko Aboriginal Working Group are the key SAP consulting group. [33] A strong relationship with this group will ensure shared benefits. • Multiple cultural groups live within the region with many having historical influences in the region (mostly during mining and Snowy Hydro construction). These groups can offer important insights and rich additions to the SAP. • There is an increasing number of development approvals throughout the area suggesting an increase in investment. The majority of development approvals relate to tourism activities and residential development. [43]
Weaknesses
• The rich first nations heritage is not currently publicly acknowledged through art and spaces however locals have expressed a desire to improve this for a greater connection.

[42] https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5063428
[43] Ramboll draft legislative context report

- Current engagement with a diversity of cultural groups may be seen as limited.
- Current development application process seen as inefficient, costly and not conducive to appropriate development for the SAP which may discourage the community.
- Lack of infrastructure for ageing population, community connection and accommodation.
- Losing residents who seek tertiary education, employment or medical care elsewhere.
- Other cultural groups outside of first nations peoples of the region do not appear to have been consulted separately.
- Despite Kosciuszko National Park being designated as an *Ecotourism Destination,* only three activities within the SAP area are listed as Ecotourism accredited.

Opportunities

- Active tourism hubs can share facilities, reducing environmental impact, whilst creating convenient tourism hotspots that can be accessed by efficient and sustainable mass transport.
- Connecting town centres with walking/cycling trails increases community connectivity, health and wellbeing.
- Encouraging re-wilding for tourists can complement ecotourism, offering immersive natural experiences for tourists (mental health & wellbeing) whilst fulfilling ecotourism goals. This may include natural tent accommodation in summer, cooking classes with local native foraged produce and plastic free products etc.
- Volunteers may wish to support ecotourism and/or environmental activities, providing a sense of purpose and valuable connections.
- Community days and ecotourism experiences can engage local residents and tourists alike, encouraging new initiative developments and ongoing support as well as personal/household community actions in the area and surrounds.
- To support athletes in the region, rehabilitation facilities and training could be further encouraged and supported, as could nutrition and other supportive therapies.
- Community and education precincts and/or health care precincts/hubs can connect community members and support population growth and skill retention.
- Celebrating historical and cultural events and diversity with a heritage centre and events can foster community cohesion and social inclusion. [44]
- Sustainable events in the region, facilitated with appropriate infrastructure, can foster networks and collaboration, whilst showcasing the areas environmental commitments.
- Addressing the needs of an ageing population can ensure strong community connection and retain local residents.
- Encouraging locals to participate in the local economy via training and professional development can enhance wellbeing and reduce health challenges.
- The provision of community grants for resilience building and sustainability can foster connections and improve support and practices for SAP goals.
- The provision of a local branding scheme to promote and educate as well as foster support can provide an important tool for attracting trade.
- Future proofing buildings, infrastructure and services should include consideration of the growing ageing population, to ensure a diversity of generations within the region.
- The provision of new resident and business welcome packs provide engaging opportunities to introduce values, resources and connections and set the tone for the area.
- A new or expanded education facility in Jindabyne could assist with skill retention and stabilise the residential population with students no longer required to look outside the area for education.

[44] https://learningforsustainability.net/pubs/Building%20Resilience%20in%20Rural%20Communities%20Toolkit.pdf

• Establishing mentoring and leadership groups can assist with knowledge sharing and action implementation. Perhaps sister city partnerships could be explored. • Celebrating local first nations culture and heritage can engage the community and offer educational experiences (art, interpretive signage & trails and local indigenous employment). • Celebrating the rich multicultural heritage of the area links post-war migration and the creation of a multicultural Australian society with diverse cultures.
Constraints/Challenges
• Median house pricing increases stressing residents and seasonal workers who have a minimum wage (CIE draft economic report). • Ongoing employment challenges due to fluctuating tourism can be challenging. • Tourism trends can greatly affect a tourism-based economy.

2.10 Measurement/Assurance

Strengths
• Ecotourism is growing in Australia and globally. • There is community and government engagement and commitment to sustainability within the SAP region. • The practical mindset of the SAP community understands that environmental actions often produce economic benefits, fostering support for initiatives. • Social perceptions currently value the natural environment and climate change is topical, so environmental initiatives and branding is likely to be well received. • Resorts within the SAP are working towards good environmental outcomes and are marketing their actions to tourists.
Weaknesses
• Green wash regarding certification and product credentials is increasing, with information numerous and often confusing to consumers.
Opportunities
• Mapping the natural ecosystems and their services can inform development and regulations. • Developing a standard EMS (Environmental Management System) and associated digital platform, sharing information and streamlining reporting for all resorts can encourage ongoing improvement. • Introducing a 'commitment to zero' like Vail resorts' to all alpine villages can share marketing of achievements and bring economies of scale whilst offering strong SAP branded consistency. • An Ecotourism certification should be encouraged for utilisation within the SAP to provide appropriate accountability and branding that visitors understand and trust. This can market the region as an ecotourism hotspot, which can be assessed over time. • The European Green Economy Action Programme[45] can encourage eco-innovation and local actions to benefit the broader region. • Embracing first nations knowledge and skills in tourism operations can further foster environmental stewardship whilst providing important community connection and employment as well as social benefits. This may also be a unique offering for the region with outcomes monitored and continually improved. • Tourist and tourism operator education is key to delivering best practice ecotourism. Stakeholder engagement during initial stages and from there onwards is important, as is

[45] https://issuu.com/alpconv/docs/green-economy-action-programme_2019

ongoing marketing and engagement with tourists. This should be monitored with both quantitative and qualitative information recorded.

- Ecotourism activities must be sensitive to the National Park environment, considering long term improvement, not just sustainability for best outcomes. This includes the type of operations with golf courses or large consumptive attractions avoided. Monitoring activities over time could assist with carbon accounting and certification claims.
- Conservation activities may become ecotourism options such as revegetation projects where tourists can learn about the natural environment and have a stake in the area by planting vegetation with locals.
- Encouraging the implementation of the Living Building Challenge approach of being carbon and water neutral as well as energy and environmentally positive can set the tone for tourism offerings in the region, as well as offering promotional opportunities.
- Setting regulations around tourism operations may further foster and support ecotourism in the region, offering guidelines and a level playing field. [46]
- Encouraging tourism operators to measure and monitor carbon footprint and marketing the outcomes can foster friendly competition to continually improve environmental initiatives.
- Aligning offerings to the Sustainable Development Goals can ensure tourism is supported sustainably into the future with good environmental protection and education to engage communities.
- Celebrating achievements with annual 'green awards' can foster continued support both locally and from external parties.

Constraints/Challenges

- Certification can be costly and requires monitoring, measurement and reporting with appropriate resources.
- Seasonal employment may affect resourcing available for appropriate measuring and reporting.
- Lack of a shared certification standard can cause confusion, lead to competition and dilute the marketing potential.

[46] https://www.ecotourism.org.au/assets/Resources-Hub-Ecotourism-Plans/Best-Practice-Ecotourism-Development-Guidelines-2015.pdf

3 References

The following resources were consulted in preparing this ESD context analysis:

- Enabling Adaptation in the South East 2017
- Australian snowpack in the NARCliM ensemble: evaluation, bias correction and future projections 2017
- NSW Alpine resorts environmental performance report 2014-16
- Impact of Climate Change on Australia's alpine areas 2008
- Integrated Regional Vulnerability Assessment: South East NSW Pilot Study 2012
- State Environment Planning Policy (Kosciuszko National Park-Alpine Resorts) 2007
- Southeast and Tablelands Regional Plan 2017
- Snowy Mountains SAP Regional Context Analysis 2019
- Snowy Mountains SAP Strategic Design Report and P50 estimate 2020
- Snowy Mountains SAP Strategic Infrastructure Assessment 2020
- Snowy Mountains SAP Tourism in Jindabyne/ Kosciuszko National Park Report 2020
- Future Transport Strategy 2018
- Snowy Monaro Local Strategic Planning Statement 2020
- Snowy Monaro Destination Management Plan 2019
- Snowy Monaro Regional Economic Development Strategy 2018-2022
- Snowy Mountains Experience Implementation Plan 2013
- Snowy Mountains Factsheet 2015-16
- Kosciuszko National Park Plan of Management 2006
- Kosciuszko National Park cycling strategy 2017
- Australian Alps National Parks Cooperative Management Strategic Plan 2019-2022
- Jindabyne Growth Structure Plan 2011
- Jindabyne open Space and Recreational Land use Strategy 2007
- Go Jindy Environment and Heritage Report 2019
- Draft Go Jindabyne masterplan
- Go Jindabyne Technical Reports including airport pre-feasibility, demographic projections, economic development and tourism, environment and heritage, housing and demographics, mobility and connectivity, social infrastructure and utilities and services.
- Snowy Mountains SAP Technical Context Analysis reports

Appendix B Case Studies

Snowy Mountains Special Activation Project

NSW Department of Planning, Industry and Environment

Alpine resort sustainability case studies

1 July 2020

Introduction

Environmental sustainability is being embedded in many areas, often in response to climate change, specifically in regions that rely on the natural environment. Alpine resorts around the world are taking bold moves to operate more sustainably, educate and empower their staff and visitors alike. Case studies from some of these can provide valuable insights into what may be possible for the Snowy Mountains SAP. A selection of case studies is presented in the following table to inform the SAP team on sustainability outcomes.

Key sustainability actions

The case studies highlight multiple actions which could be investigated for implementation within the Snowy Mountains SAP including:

- Best practice resource use, waste avoidance and management
- A systematic approach to capture and utilise recycled water
- Self-sufficient for energy and water
- Well-designed centres connected for increased active and public transport
- Environmental care programs
- Environmental sustainability messaging, engagement and education
- Measurement, monitoring and reporting

Resort	Waste	Water	Energy	Transport	Buildings	Environment	Accountability/Resilience
Australia: Perisher Owned and managed by Vail resorts. Vail have an 'Epic Promise' which is their 'commitment to zero,' a goal to achieving a zero net operating footprint by 2030. Perisher resort is the largest alpine resort complex within the Park in terms of skiable terrain and number of lifts. It has 2 ski-tube terminals and is an access point for hiking trails. Accommodation, retail & hospitality facilities are available as well as a medical centre, pharmacy, post office and supermarket.	• A waste transfer station is nearby and a waste water treatment plant is in the valley. • Improving waste diversion across all operational areas, including a focus on organics composting. • Removal of personal waste bins with utilisation of centralised waste separation stations. • Replacing single-use items with alternatives. • Expanding specialty waste collection services.	• Increased the number of water stations to encourage BYO drink bottles and reduce single-use plastic bottles.	• Retrofitting lighting to reduce energy consumption. • Members of the CERES Business for Innovative Climate and Energy Policy as well as RE100.	• The resort engages with vendors and suppliers to identify and collaborate on opportunities to reduce emissions and impacts.	• Incorporating habitat connectivity features in development proposals, with three new fauna crossings installed in the last 2 years • Using innovative construction techniques to avoid or minimise disturbance to biodiversity	• Fauna crossings for habitat connectivity and minimal environmental disturbance	• Information is published with progress shared in their annual report. Vail Resorts measures GHG footprint and in 2016, calculated a per skier footprint of 0.0127T CO2 per visit.[1]
Australia: Hotham Hotham is a Vail Resorts own and managed resort in Victoria and was recognised among world leading destinations in the Global Top 100 Sustainable Destinations 2019 for their sustainability efforts. (One of only two Australian destinations, the second being Douglas shire in Queensland).[2]	• The Mount Hotham Alpine Resort Management Board (MHARMB) works in partnership with RevRwaste and the community for best practice management. • Organics recycling is offered across the resort. • Environmental cleaning days. • Currently on track to achieve a 50% recycling target by 2021.[3] • Specialty recycling collections exist for polystyrene foam boxes and used cooking oil.3	• Snowmelt and waterways are valued and are key features in 'clean-up' day activities. • In 2009, a wastewater recycling program for snowmaking was completed. • Recycled wastewater is also allocated as discharge to the environment to support ecosystems.3	• The updated Environmental Management Plan (EMP) has set new targets for achieving a reduction of fossil fuel energy by 2021.	• A free intra-village bus was introduced in 2018. • Tracking of buses assists visitor travel through the resort with updated bus arrival times and location tracking.	• The Environmental Management System (EMS) for construction sites in the area aims to promote preventative rather than reactive approaches to project planning and implementation. [4] • All construction must appropriately manage site, spoil, drainage and vegetation. [4] • Site EMPs have been prepared for all developments within the resort.4	• An EMP is utilised by the MHARMB.4 The plan classifies 5 themes of: Production, waste and consumption, Atmosphere, Land management, Biodiversity and threatened species and Water. • An EMS was implemented in 2017 with environmental studies informing these. • 5747 plants have been used in revegetation and landscape projects.3 • 'Love tunnels' for wildlife (Pygmy possums) have been installed as bio-links.3	• Hotham is currently working towards attaining its Ecotourism Australia ECO Destinations Certification. • There are several offset sites within the resort managed by the MHARMB. 4 • Greenhouse gas emissions have been measured and are noted to have reduced by 38T. 3 • A Municipal fire management plan has been developed through a risk-based planning process (ISO 3100:2018).

[1] https://www.perisher.com.au/how-we-get-to-zero/
[2] https://www.ausleisure.com.au/news/mount-hotham-named-a-global-top-100-sustainable-destination/
[3] https://www.parliament.vic.gov.au/file_uploads/Mt_Hotham_Alpine_Resort_Management_Board_2018_Annual_Report_KTxft0QJ.pdf
[4] https://www.developmthotham.com.au/development-planning/environmental-management/

Resort	Waste	Water	Energy	Transport	Buildings	Environment	Accountability/Resilience
New Zealand: Remarkables Queenstown is renowned for it's natural landscape and adventure activities. It offers diverse options throughout the year for a diversity of visitors and attracts both local and international tourism. As part of New Zealand's environmental focus, Queenstown is also known as an environmentally responsible destination[5]	• Coronet peak has a large-scale glass crusher reusing 40% of ski fields waste.[6] • Local markets are working towards becoming waste free.[7] • Single-use items are replaced with alternatives.8 • A cardboard baler compacts material for more efficient recycling • Compostable materials are composted locally.8	• Recycled water (snowmelt and/or rain water) is used for snowmaking.8 • Drinking fountains have been installed to reduce single-use bottles8	• Extensive site energy monitoring for improved efficiency measures.	• Visitors are encouraged to ride-share or take buses up the mountain. • Snow making machines are energy efficient. • Electrified waste management fleet.6 • E-bike waste management in summer to reduce emissions.	• Construction must guarantee the least amount of impact on the environment as possible as well as restoring and enriching the landscape.8	• Ski areas are revegetated with native seeds.8 • A Kea conservation trust is established to bring back the Kea (only alpine parrot in the world).8 • Any modifications in the natural environment must replant species post development and or propagation is added in other areas of the environment.8	• Katiakitanga is used as a commitment for the region, stemming from the word Kaitiaki meaning people recognised as guardians of an area.[8]
Canada: Banff Banff is part of the famous Rocky Mountains, offering natural assets for all seasons. It is one of Canada's most popular tourist destinations, known for adventure and leisure with mountains and hot springs. This also makes it a year-round destination [9]	• Measure and monitor waste generation and disposal. • Single-use item ban trial. • Wastewater treatment plant utilises biosolids and food waste for composting. • Residential recycling and compost bins are in place and 'pay as you throw' has been assessed. • Responsibility programming is implemented. • Construction & Demolition waste accounted for in reports. • Appropriate infrastructure at town facilities at events is required. • Trialled rate disincentives & material bans.	• Water resources are responsibly managed and assessed to ensure efficiency and quality • Rebate programs are in place for best practice water management. • Consumption charges with annual increases are in place to act as financial mechanisms. • Land-use bylaw requires low-flow fixtures. • Block tariff water pricing system (consumption based) is in place.	• Responsible use (efficiency) is encouraged and implemented with incentives to support. • Some energy is sourced from renewables (with a target of 100% by 2050). • Community GHG emissions monitoring is undertaken.	• Measurement & monitoring is undertaken. • Focus on active and public transport with pathways and infrastructure. • Examining bus electrification. • Private vehicle trips disincentive. • Encouraging e-vehicle use (incentives & charging stations) & bans on high-emission vehicles. • Piloted car-free days. • Idling bylaws are in place. • Snow-clearing prioritised to encourage walking. • Vehicle advantage is actively decreased by reducing speed limits.		• Ongoing data collection and ecological carrying-capacity benchmarking and education. • Wildlife attractant and pest control. • Limiting tourist numbers & access to areas. • Active environmental education is offered. • Indigenous guardianship is practiced and encouraged. • Fruit tree replacement program is underway. • A human wildlife coexistence initiative is implemented to reduce conflicts. • There is a focus on increasing forest diversity.	• The area has an EMP with a 10-year vision. • Air quality is included as a key focus area with restricted wood-burning devices within the townsite. • There is a circular economy change lab.

[5] https://www.queenstownnz.co.nz/plan/sustainable-tourism/
[6] https://www.queenstownnz.co.nz/stories/post/coronet-peak-queenstown-cares/
[7] https://www.queenstownnz.co.nz/stories/post/remarkables-market/
[8] https://www.theremarkables.co.nz/sustainable-slopes/
[9] https://banff.ca/DocumentCenter/View/6263/Environmental-Master-Plan?bidId=

Resort	Waste	Water	Energy	Transport	Buildings	Environment	Accountability/Resilience
Canada: Whistler Whistler Blackcomb has a goal of being zero waste, zero carbon and zero net emissions in operations. The peak season is winter however the area is recognised as a premium summer destination, offering an acclaimed mountain bike park, hiking trails and scenic experiences.[10]	• Composting facility for processing biosolids from wastewater treatment plant & organic material. • Committed to Vails' zero-waste to landfill goals. • Conference centre focuses on green events. • Working to eliminate single-use items.[11]	• High quality water provided to discourage single-use water bottles.	• 32GW/yr. micro-hydro energy project. • Hybrid heating used to reduce natural gas consumption. • Improved measuring and monitoring informs utility usage. • Energy efficiency embraced with extensive retrofitting and education.[12]	• Offer carbon neutral helicopter flights (offsets). • Cycling association promotes sustainable travel and trail building. • Shuttle buses and public transport readily available. • Village is pedestrian only. • EV charging available. • Encouraging 'idle free'.[13] • The size of fleet reduced with more efficient vehicles utilised and company travel reduced.	• Lost Lake Passivhaus showcases sustainable design to visitors. • Museum & archives educate visitors about environmental sustainability.	• Ecosystem monitoring program to inform actions. • Proactive education including documentaries.13	• Measure, monitor and report activities and educate and engage with community. • Vegan/vegetarian local restaurants reduce environmental footprint. • Farmers markets support the local community and circular economy.10
Switzerland: Zermatt Zermatt sits underneath the famous Matterhorn peak and due to the natural assets, attracts visitors year-round. The alpine resort is Europe's largest and highest lying summer skiing region, attracting numerous training teams. A multitude of hiking trails and adventure activities make the area legendary amongst mountaineers. [14]	• 'Earth Plastic View' art project visualises the world's plastic problem.[15]	• Wastewater from kitchen and bathrooms is reused.	• Solar panels are on valley facades for on-site energy generation. • PV panels are thicker and steel re-enforced to account for snow loading. • Natural lighting prioritised (extensive windows). • Fuel efficient, low pollution snow machines are utilised.	• Unique, locally made electric bus fleet. • Car-free site with road closed to normal traffic. • Ample undercover parking in arrival to area. • Pedestrian rights are prioritised. • Regular shuttle trains. • Horse drawn carts in use. • E-taxis are available.	• Natural materials are used in buildings. • Decommissioned cables sent to Myanmar for bridge use. • Buildings made with renewable resources, designed and built to conditions for thermal comfort.	• Renaturation projects. • Damage inventory. • 85% of priority areas are now repaired. • All construction supervised by environmental experts. • Sanctuaries and nature reserves established to protect species. • Education: "flower walks'	• Environmental monitoring is undertaken with a qualified environmental expert overseeing activities. • Zermatt invests up to CHF $1M/ year for environmental projects.

[10] https://www.whistlerblackcomb.com/explore-the-resort/about-the-resort/whistler-in-summer.aspx
[11] https://www.whistler.com/about-whistler/environment/
[12] https://www.whistlerblackcomb.com/explore-the-resort/about-the-resort/environment/energy.aspx
[13] https://www.whistlerblackcomb.com/explore-the-resort/about-the-resort/whistler-in-summer.aspx
[14] https://www.myswitzerland.com/en-au/destinations/zermatt/
[15] https://www.whistler.com/about-whistler/environment/

Resort	Waste	Water	Energy	Transport	Buildings	Environment	Accountability/Resilience
America: Aspen Aspen Snowmass resort area is world renowned as a luxurious ski resort as well as being an area for cycling, outdoor adventures, arts and culture. It has a focus on service and premium offerings including prestigious wine cellars, premium accommodation, dining experiences and wellness spas. [16][17]	• Banned plastic straws. • The Aspen skiing company recently partnered with the Elk Creek coal mine, Holy Cross Energy and Vessel Coal Gas on a $5.5M investment to capture waste methane vented from a neighbouring coal mine to generate carbon negative electricity.		• Retrofitted light bulbs. • Hydroelectric plant. • Methane capture from coal mine for energy. • The Aspen Skiing company built the first solar array in the ski industry in 2004 (2.3kW) on the ski patrol headquarters.[18] • Commit to 70% renewable energy by 2030.	• Expanded local food offerings (reducing import). • Public transport via buses is encouraged. • Parking lot app allows visitors to consider transport methods in advance. • Bike rental is popular for in village transport and the area is pedestrian friendly.		• The Environment Foundation supports environmental projects in the region which educate, upskill and create positive change. Fund of $3.3M)[19]	• Annual tracking and reporting of Co2 emissions.[20] • The Aspen Global Change Institute commissioned reports into climate change for the region (2006).[21] • A campaign to support the natural environment was launched called 'who gives a flake', which was taken to Washington to lobby parliament. [22] • Advocacy & education.

[16] https://www.forbes.com/sites/rogersands/2019/07/07/the-best-ski-resorts-in-aspen/#62c07d3e57b2
[17] https://www.aspensnowmass.com/we-are-different/programs-and-practices/green-operations
[18] https://www.aspensnowmass.com/inside-aspen-snowmass/stories/advancing-solar-in-the-roaring-fork-valley
[19] https://www.aspensnowmass.com/inside-aspen-snowmass/stories/environment-foundation-grants-update-spring-2019
[20] file:///C:/Users/sarah/Downloads/CO2_Footprints_2000_to_Present_wo_SMC_or_Xcel.pdf
[21] https://www.aspensnowmass.com/we-are-different/take-action
[22] https://www.aspensnowmass.com/inside-aspen-snowmass/give-a-flake

Appendix C Rating Tools Summary

Snowy Mountains Special Activations Precinct (SAP)

Rating Tools: Information Paper

Introduction

Appropriate certification tools and frameworks add rigour and integrity to the assessment of operations and progress, including for environmental sustainability. There are multiple options globally, applicable at various levels, and this document provides a summary of a selection of tools and frameworks. These have been recommended for further investigation for SAP framework inclusion and are summarised herein, to inform project planning.

Commonalities include the integration of active research and industry engagement, access to resources and support, the ability to track and submit data via online platforms and independent third-party assessments.

Context

The Snowy SAP aspires to be a national leader in environmental resilience and sustainability whilst maintaining environmental integrity. To appropriately reflect these efforts, recognised third-party verified certifications and frameworks offer assurance and marketing opportunities. These can be employed by various methods including individual entities, clusters, communities or the precinct as a whole.

Given the scale and diversity of the SAP, there may not be one single solution. In fact, the use of multiple options may offer the best outcomes, being inclusive, driving continual improvement and covering a diversity of important themes. Any options selected should provide measurable, tangible benefits to visitors and the local community, that can be verified and promoted, imbuing trust and recognition.

Tools/Frameworks

Earth Check - Destination[1]

EarthCheck was established in 1987 as a scientific benchmarking, certification and advisory group for travel and tourism. They work internationally with leading research centres and universities to address key sustainability and climate issues facing tourism destinations, communities and enterprises. The foundation for certification is scientific-based evidence with strong industry engagement and support to fast-track change and ensure continual improvement.

Benchmarking and certifications cover destinations, cities, precincts, supply chains, events, operators, parks and protected areas.[2] They have partnered with South Pole Group to offer tailored emission reduction services and carbon and community projects to offset impacts. Programs are mapped to the Sustainable Development Goals and take into account multiple international compliance standards.

There are only three Earth Check certified destinations in New South Wales, of which Thredbo Resort is the only one in the Snowy Region.[3]

[1] https://earthcheck.org/ & https://earthcheck.org/media/50653/earthcheck-sustainable-destinations-2020_compressed.pdf

[2] EarthCheck applies to travel and tourism: accommodation, activities, administration, aerial cableway, airline, airport, attraction, beverage, buildings, casino, catering services, convention centre, communities, cruise liner, cruise vessel, display & retail, exhibition hall, farm stay, gold course, laundry, marina, precincts, railway, restaurant, school, spa, theme park, tour company-wholesale, tour operator, trailer park, vehicle/rental, vineyard, visitor centre and winery. https://earthcheck.org/media/49345/earthcheck-benchmarking-sectors.pdf

[3] https://earthcheck.org/news/2019/july/thredbo-an-earthcheck-sustainable-destination-powered-by-renewable-energy/

The *EarthCheck Destinations Standard* underpins the EarthCheck Leading Destinations of the World Program and offers a framework to benchmark, certify and improve performance, whilst empowering local communities to take ownership of sustainability goals and build on initiatives. A 'Destination' is a defined precinct, neighbourhood or region under the jurisdiction of a locally elected or appointed body.

The Destinations standard deals with environmental regeneration and improvement, as well as conservation of existing heritage assets. It recognises the benefits of a destination working together to achieve sustainable outcomes, underpinning a clear vision for a destination, and focussing on sound policy and action plans to help achieve the vision. It establishes a framework for environmental, social, cultural and economic performance for communities and provides guidelines intended to connect stakeholders.

The standard is supported by EarthCheck benchmarking, certification and performance improvement systems, to address environmental and social problems. This is based on measurement and accountability, reflecting their emphasis on a scientific approach.

Members of the program can access training, support and resources, benchmarking, data tools, reports and audits for leading environmental initiatives and promoting outcomes. Additional (paid) options include marketing and communication, visioning, community engagement, planning development, cluster support, experience relationship management and training.

Certification is awarded in status levels based on length of commitment: Silver (1-4 years), Gold (5-9 years), Platinum (10-14 years) and Master (15+ years).

The *EarthCheck Sustainable Destinations Standard* is applicable to the SAP.

Preconditions/conditional requirements

The standard requires a Destination Authority to provide leadership, using an integrated and inclusive approach to support sustainable outcomes. This authority is typically the designated collector and authoriser of all the information used for meeting annual benchmarking and certification requirements.

Performance must be measured using quantitative benchmarking indicators.

After registration, a self-assessment must be completed with mandatory requirements to provide full and detailed commentary/documentation.

A Sustainability Policy for the Destination that addresses the environmental, cultural, social and economic performance is required.

Organisations with low environmental and/or social impact are required to document a Risk Assessment and Sustainability Action Plan suitable to the scope of operations. Organisations with high impacts must have a documented Environmental Management System.

After certification submission, an on-site certification audit is mandatory to demonstrate compliance annually.

Tool themes/ key features

- Energy efficiency, conservation and management
- Greenhouse gas emissions
- Air quality protection, noise control and light pollution
- Management of freshwater resources
- Wastewater management, drainage and streams
- Ecosystem conservation and management
- Land use planning and development
- Transport
- Solid waste management

- Management of environmentally harmful substances
- Cultural and social management
- Economic management

Costs

EarthCheck Destination involves an annual membership fee which is based on population size plus certification audit fees. Rates are stated as:

- **Small destination: <150,000 population= AUD$10, 000**
- Medium destination: >150,000, <500,000 population= AUD$18, 000
- Large destination: >500,000 population= AUD$POA

Annual audit fees are AUD$2,420 for the first day and AUD$1,650 for subsequent days.

The population is for the fixed destination population. Given that the draft population forecast details the Snowy Monaro region as around 20,000, it would fall under the small destination category. EarthCheck have advised that a large area may take 3-4 days to audit, resulting in a maximum cost of $17,370 + GST and auditor travel expenses.

Process

The EarthCheck Destination Standard annual certification process comprises benchmarking and certification phases as shown in figure 1.

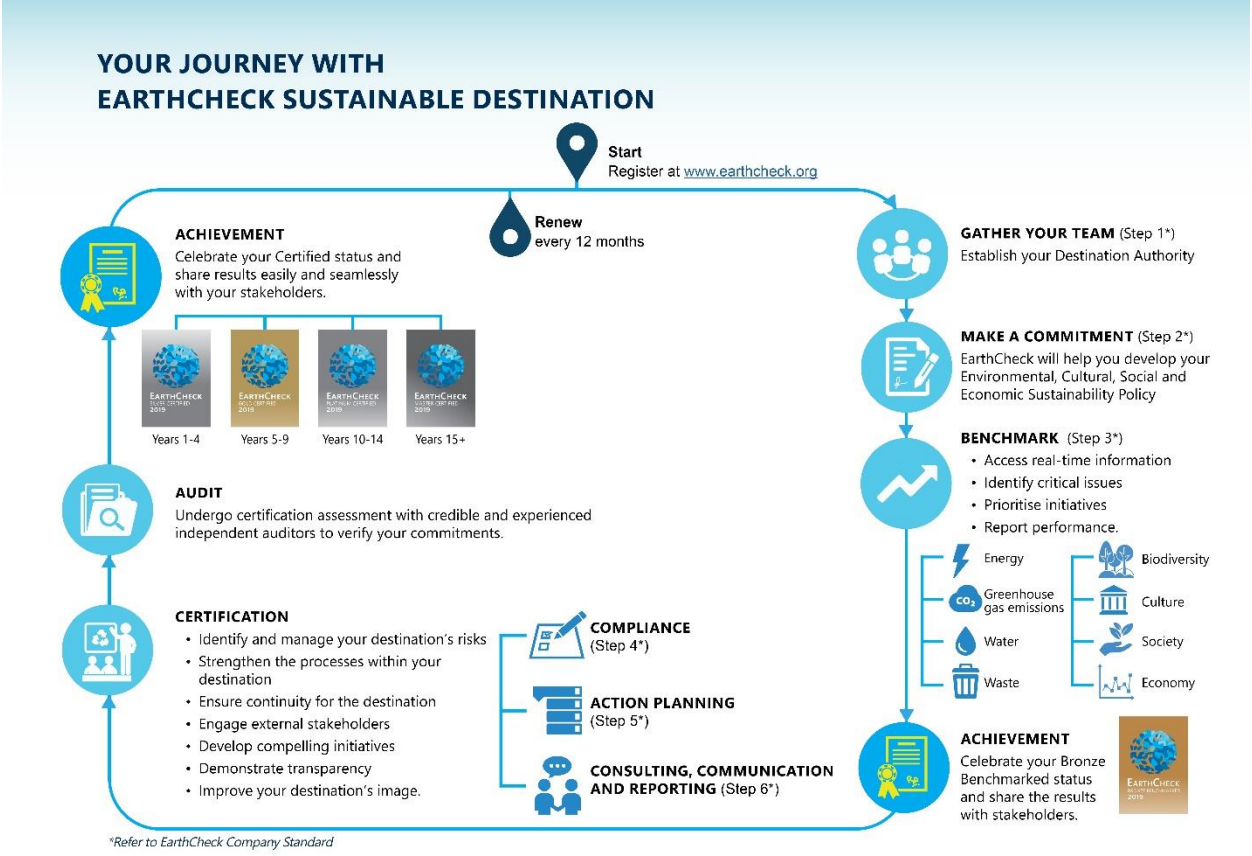


Figure 1: EarthCheck Sustainable Destination process map

Rigour

EarthCheck science was developed by the Australian Government Sustainable Tourism Co-operative Research Centre over a 10-year period and is reviewed annually to ensure it meets international standards relative to greenhouse gas protocols, responsible tourism, and certification.

It complies with the Mohonk Agreement and is aligned with the Global Reporting Initiative, which provides widely adopted global standards for sustainability reporting. EarthCheck Certified is accredited by the Global Sustainable Tourism Council.

EarthCheck science and reporting is aligned with the IPCC Guidelines for National Greenhouse Gas Inventories, WBCSD Greenhouse Gas Protocol, ISO14064 range of standards for greenhouse gas accounting, ISO14001, ISO50001, ISO26000, ISO9001, the GRI Guidelines, the HCMI, the SDG's and is a verified program of the CDP.

Given the strong science-based framework and partnerships with research organisations, the tool is well informed with current changes and advancements. There are a number of quality control measures in place and the standards are periodically reviewed by an independent EarthCheck International Advisory Panel. Organisations are encouraged to report inaccuracies or provide feedback.

Self-assessment forms the basis of a submission however auditing may be subject to the complexity of the organisations scope and level of environmental impact.

Green Star-Communities[4]

The Green Building Council of Australia (GBCA) is a not for profit industry association that was established in 2002 to lead sustainable transformation of buildings, cities and communities as healthy, resilient and positive places.

Green Star ratings cover communities, buildings, interiors and performance.

The *Green Star Communities* framework was informed by assessment of leading international rating tools and is a vision with principles and aspirations to guide and support the development of sustainable communities. The rating tool focuses on the creation of a sustainable community, with the focus on people more so than infrastructure. It takes into account respect for ecological limits and natural resources and encourages prosperity and wellbeing, focussing on liveability, resilience, diversity and adaptation. The framework and assessment of submissions is based on industry expertise, with the GBCA conducting thorough research and industry testing, as well as on-site audits.

Within the framework, a Community encompasses precincts, places, neighbourhoods or other geographical areas that may be used by stakeholders to describe their projects. Attributes of a community include infrastructure, buildings, public realm, people, ecology, economy, governance and services. Each project can set its own boundary of influence to apply the principles and seek a rating.

A rating evaluates the attributes of planning, design and construction and is possible based on the master plan and structure plan. The rating system is based on 6 stars, with certification only awarded above 4 stars for Communities. A rating lasts 5 years, after which recertification is required. Ratings must be submitted by accredited Green Star Professionals who can access training, resources and support from the GBCA.

[4] https://new.gbca.org.au/green-star/rating-system/communities/

While there are now more than 22 registered Green Star Communities in Australia, nothing at this scale has been attempted however the principles and categories are scalable.

The closest Green Star Community project to the SAP study area is at the ACT/NSW border, the Ginninderry development at Holt: https://suburbanland.act.gov.au/en/ginninderry

The Green Star Future Focus tool is in development, and will be released for consultation late 2021. There is an opportunity for the SAP to be a pilot project for this new tool. Costs and process will remain similar to the current tool.

The *Green Star Communities* rating is applicable to the SAP.

Preconditions/conditional requirements

A qualified Green Star Accredited Professional (GSAP) must complete the rating submission on behalf of the project.

To achieve a certified rating, a project must:

1. Develop at least four buildings
2. Be a clearly distinct project with a clear site boundary/study area
3. Be able to achieve at least a four-star Green Star rating and receive written approval in cases where the project is subject to approval under the Environmental Protection and Biodiversity Conservation Act as a controlled action.
4. Initial certification must be achieved within three years of registration and recertification must be within five years of initial certification or within five years of the project's last recertification date and every five years thereafter until the project is built-out.

Projects must meet all four of the eligibility criteria: space use, spatial differentiation, conditional requirements (not on prime agricultural land, old growth forest or containing protected species) and timing of certification.

Tool themes/ key features

- Enhance liveability
- Create opportunities for economic prosperity
- Foster environmental responsibility
- Embrace design excellence
- Demonstrate visionary leadership and strong governance

Costs

A certification fee for rating tools cover the certification services, access to a technical coordinator, a certification certificate, licence to use the trademark (once certified) and marketing material. Discounted fees and other benefits are offered for GBCA members including additional training and support.

Current fees for a single government project certification are $36,600 for GBCA members or $41,600+GST for non-members. This does not include the engagement of a qualified GSAP for the submission.

Additional fees of $200 per technical question may be accrued, licencing agreements of $800 each or Novation agreements of $400+GST each may be accrued.

It is possible to complete a credit by credit assessment, ranging from $1000-$3000 per credit, depending on the credit being reviewed. Therefore, total costs approximate may range from $40,260-$50,000, not including facilitation.

Process

The formal certification process is managed by the GBCA, who provide a portal for submission management and facilitate independent third-party assessment. The process has two rounds of assessment as shown in figure 2.

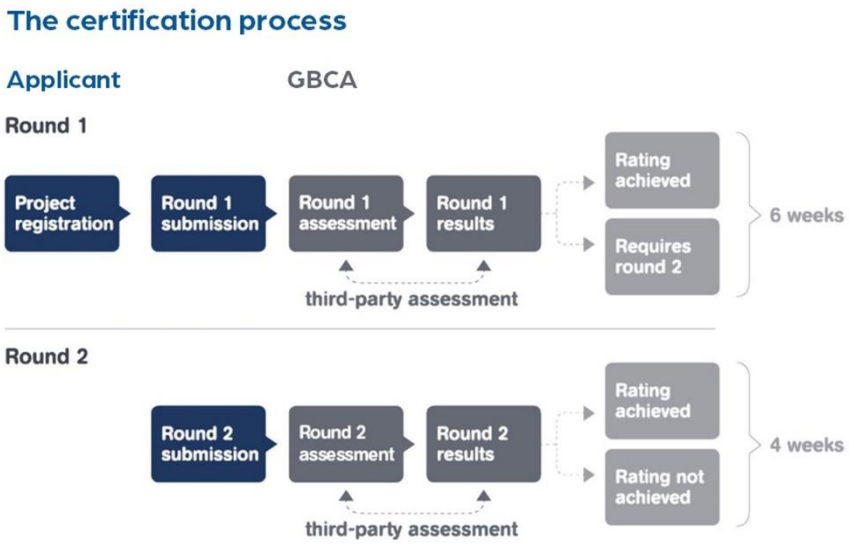


Figure 2: Green Star certification process map

Rigour

Rating tools are updated regularly via annual revisions and major updates via new versions every three years. These revisions are informed by industry professionals and practical research.

The Green Star Advisory Committee and supporting advisory groups ensure that the Green Star rating system continues to improve and engages industry for robust and relevant certifications. Expert reference panels assist with defined topics of engagement to further support the industry input.

Results of an assessment of submission are determined by third party certified assessors who award points in accordance with set credit criteria.

GBCA operates a quality management system which complies with the requirements of ISO 9001:2015 for the development, upkeep and delivery of Green Star certification.

Living Building Challenge - Living Community Challenge[5]

Living Building Challenge (LBC) is an international sustainable building certification program created by the noon-governmental organisation International Living Future Institute in 2006. The institute works towards socially just, culturally rich and ecologically restorative communities. The challenge is a tool to focus visions, catalysing new models of building design, reinventing cities and campuses.

LIVING BUILDING CHALLENGE

[5] https://living-future.org/lcc/

Developments are energy positive, water positive, environmentally positive, and have no on-site greenhouse gas emissions (meaning no gas or direct emissions). It attempts to raise the bar for building standards and acts to diminish the gap between current limits and the positive outcomes sought by pushing stakeholders out of comfort zones.

Ratings cover buildings, products and communities and are seen as ever-evolving programs shaped by project teams over time and experiences.

The *Living Community Challenge* launched in 2014 reflects the original building challenge by being focussed on regenerative/positive impact, rather than simply reducing negative impacts. Metaphors of nature are used to connect back to basics, and Communities is related to forests; rooted in place yet adapted, functional, resourceful, symbiotic, diverse and beautiful.

The framework allows the creation of communities that are holistically healthy, nurturing, regenerative, accessible, multipurpose, net positive, generate their own energy and capture and treat their own water, hence supporting resilience.

Performance areas are shown as petals in a flower: place, water, energy, health/happiness, materials, equity and beauty. Within these petals are 20 imperatives. All imperatives are mandatory for the development to be holistic and certification is based on actual, rather than modelled/anticipated performance.

There are four typologies for project teams to select which determine applicable imperatives. Typologies are Renovation, Landscape/infrastructure, Building or Neighbourhood. (The SAP would select neighbourhood). Acknowledging that the ideal scale for solutions is not always within the project boundary, the tool accommodates 'scale jumping' which allows multiple projects to operate in a cooperative state, sharing green infrastructure and allowing for status to be achieved as efficiently as possible.

Members of the LBC can access an online platform for guidance and support including resources and technical advice.

So far there are no communities in Australia (majority in the US), but a retail shopping centre in development by Frasers Burwood Brickworks, VIC is a Living Building Challenge project:

http://living-future.org.au/the-brickworks-living-building-challenge-design-competition/

The University of Wollongong also developed the Sustainable Buildings Research Centre with Living Building Challenge certification:

https://living-future.org/lbc/case-studies/sustainable-buildings-research-centre/

The *Living Community Challenge* is applicable to the SAP however would require the SAP to have zero fossil fuels for energy and heating (diesel generators) and be water positive (harvest all required water). As a result, the Living Community Challenge is not recommended for the Snowy Mountains SAP.

Preconditions/conditional requirements

Certification is based on actual performance so projects must be operational for at least 12 consecutive months before evaluation.

Projects may only be constructed on previously developed sites.

The Living Communities Challenge criteria are a diversity of uses, multiple buildings, at least one multi-modal street and ideally shared infrastructure. Not all buildings must be LBC certified but at least 50% of the community owned development must apply for LBC certification.

Limits to growth restricts placement of new projects to reduce impacts of development on intact ecosystems and to eliminate encroachment on agricultural land. It also requires site condition surveys to determine the most appropriate solutions towards improvement.

The Inspiration and Education Imperative must be met including providing educational materials about the performance and operation of the project to the public.

There is a minimum amount of area that must be used to support agriculture; a set percentage relative to the gross square meters of the development compared to the size of the overall site. (As the density of the project increases, the roof area become more valuable as a source of renewable energy production or stormwater reclamation. Projects with significant density in the middle of large cities have no minimum requirement for food production).

Proposed developments may not impede another projects ability to access daylight or compromise air or water quality through their function. Imperatives are either met or not met and certification is not awarded if imperatives are not fully achieved.

Tool themes/ key features

There are seven performance areas and twenty imperatives:

Performance area	**Imperative**
Place	1. Limits to growth
	2. Urban agriculture
	3. Habitat exchange
	4. Human powered living
Water	5. Net positive water
Energy	6. Net positive energy
Health & Happiness	7. Civilised environment
	8. Healthy neighbourhood design
	9. Biophilic environment
	10. Resilient community connections
Materials	11. Living materials plan
	12. Embedded carbon footprint
	13. Net positive waste
Equity	14. Human scale & human places
	15. Universal access to nature & place
	16. Universal access to community services
	17. Equitable investment
	18. Just organisations
Beauty	19. Beauty & spirit
	20. Inspiration & education

Costs

To register a project, a premium membership must be purchased for $150 (USD). Registration costs $1,200 (USD) with certification costs based on area. 25-100 acres cost around $35, 000 (USD) For a large area like the SAP, price is upon application. Audit fees are additional.

Converted under Mid-July's exchange rates, the currently known costs are approximately $1926. Adding minimum certification costs of around $50,000 brings it to $51, 926 plus audit fees.

Process

The project is registered after 12 months of consecutive operation. Once the fee is paid, performance data gathered during the first 12 months is submitted for auditing by independent auditors. A preliminary audit is completed and this is checked by a final auditor who also completes a site visit, see Figure 3.

1. Registration, planning, implementation and certification.
2. Compliance review for vision and master plan

Figure 3: Living Community Challenge certification map

There are three performance pathways to Community certification: zero energy, petal (3 or more, one of which must be materials, water or energy) and living community challenge (all 20 imperatives/7 petals).

Certification is available in two stages: Living Community Masterplan compliance or Living Community Challenge Certification.

Rigour

The International Living Future Institute manages the rating tool with the Living Future Institute Australia supporting local projects.

There are crosswalks between other internationally recognised standards such as WELL, Passivhause and LEED.

There are some criticisms that life cycle analysis would add value, the energy measurement should change to carbon emissions and that regional considerations should be encompassed. Building code regulations

may also affect response to climate change however this is often outside of the scope of certification frameworks.

It is assumed that to achieve the progressive standards of this certification that typical best practice is being met within the planning context.

Independent third-party assessment by accredited auditors are undertaken.

WELL Community[6]

The International Well Building Institute (IWBI) promotes the creation of buildings and communities that promote health & wellbeing. This includes improving comfort and driving better choices, which incorporates multiple environmentally sustainable options. Their foundation is active scientific and medical research via partnerships with industry and leading professionals, to better understand building design, performance and operations that influence health. This information is disseminated and used to advance design, construction and maintenance practices.

The WELL rating was launched in 2014 after six years of research and development and was the first tool to be focussed exclusively on the ways that buildings and everything within them can improve our comfort, drive better choices and generally enhance health and wellness. The WELL program constitutes performance metrics as well as design strategies and policies.

Ratings of silver, gold or platinum are available for buildings, portfolios and communities. As a response to COVID19, a Health and Safety rating is now also available. Ratings are third party verified, administered by the Green Business Certification Incorporation (GBCI). IWBI has proactively developed crosswalks demonstrating alignment with other green building rating systems and has established relationships with green building councils to support localised WELL efforts.

The *WELL Community Standard* is an adaptable district-scale program to support community health and wellness across all aspects of community life. It applies to definable boundaries that may contain public infrastructure as well as future proposed or existing infrastructure, buildings and landscapes. It may also include renovations, infill or new construction.

The vision for a WELL community is inclusive, integrated and resilient, fostering high levels of social engagement. The principles of the WELL Community standard are: evidence-based, broadly relevant, equitable, transparently developed and resilient. The features of the Community standard do not specifically address the design or conditions within buildings, but the way they interact with each other and the landscape.

To ensure that all parts of the community are addressed, the standard requires some buildings to be certified under a qualifying health and wellness building standard and the rating assessed performance.

To support certification, multiple resources and tools are available via a WELL coaching contact.

The tool is still at PILOT stage with only one project registered in Australia, which is the Lot Fourteen Innovation Precinct in Adelaide, SA: https://renewalsa.sa.gov.au/projects/lot-fourteen/

The *WELL Community* rating is applicable to the SAP.

[6] https://www.wellcertified.com/certification/community/

Preconditions/conditional requirements

To be eligible for the WELL Community Standard, projects must meet at least two of the following conditions:

- Planned daytime or night time population of 500 people or more
- Planned total floor area of 50,000m2 or more
- Planned total building count of 10 or more
- Total land area of two hectares (5 acres) or more

AND

At least two of the following:

- Multifamily residential: at least one building with five or more dwelling units
- Office and/or retail: at least one space, employing a total of at least five people.
- Public use recreation or leisure, accessible from dawn to dusk: at least one space, of at least 0.4 hectare [one acre]

There are mandatory preconditions in each concept of WELL with failure of a single precondition preventing a project from becoming certified.

All projects must contain at least one health and wellness certified building with new developments requiring at least 15% of total building count or total gross building area that is owned, operated or managed by the project owner. This certification must be awarded before the review of WELL documentation.

Certification is awarded on performance, with data gathering over 12 months required for some elements. This may mean that certification may not be gained for at least one-year post project completion. Recertification is required after 5 years to attest that all designs, operations and policies still exist.

Tool themes/ key features

There are ten concepts:

- Air
- Water
- Nourishment
- Light
- Fitness/Movement
- Temperature/Thermal comfort
- Sound
- Materials
- Mind
- Community

Within these concepts are 110 features made up of 200+ parts and over 700 requirements. Parts and features can be either design, policies or performance based.

Costs

Certification fees are based on the total project area being approximately $400/acre for projects over 100 acres. There is a registration fee of $20,000 USD.

The total SAP area is approximately 178 410 acres, resulting in an estimated fee of $70,506.263 USD which equates to $98,235.67 AUD + consultant fees. (This price estimate includes a cornerstone discount).

Additional fees may apply for optional extras like review of requests for alternative compliance paths, innovation features or curative action plans or appeals.

Process

The standard allows for innovative and alternative solutions to meet requirements and project teams may propose alternative paths for review, so long as they meet the intent of the requirement and are supported by cited scientific, medical or industry research.

The certification process requires the following:

- All preconditions are met
- One or more optimisations in each concept
- Minimum size requirements are met
- Minimum of one healthy building certification
- Certifications awarded for silver, gold and platinum.

There are four steps within the certification process:

1. Registration
2. Review
3. Performance verification
4. Certification and recertification

Projects can target interim awards prior to completion via the WELL D&O or phase certification however this does not guarantee/imply final certification will be awarded as certification is still performance based.

For Silver certification, a minimum of 50 points is required. Gold requires >60 and Platinum requires >80.

Rigour

The WELL standards are informed by scientific, medical and industry research and application. This includes literature, behavioural factors, health outcomes and demographic risk factors that affect health. Ongoing engagement including peer review and partnerships ensure currency and innovation.

The GBCI is responsible for reviewing the projects documentation and performance data to ensure compliance. Submissions are assessed according to operation so documentation for review is submitted after project construction and occupancy, ensuring actual operations rather than projections are assessed.

Assessment is completed by independent third parties administered by IWBI's collaboration with the GBCI.

Advisories inform continuous development and ongoing implementation of the standards and the research agenda. Advisories consist of leading subject matter experts, researchers, practitioners and a diversity of industry leaders.

Bioregional Australia - One Planet Living[7]

One Planet Living is a framework developed by Bioregional, a charity and social enterprise founded in 1994 by two environmental entrepreneurs in the UK. The framework was created in collaboration with the World Wide Fund for nature in 2003 after planning and operational experiences were gained from the BedZED eco-village in South London.

The framework is informed by scientific evidence and hands-on experience and prides itself on being highly flexible and adaptable. It is based on what science reports as necessary for living within Earth's means and utilises ecological and carbon footprinting as headline indicators.

It provides support for the development of a 'One Planet Action Plan' which acts as a three-year roadmap towards a more sustainable future. There is a focus on human's impact being limited to one planet only, with a significant focus on wildlife and the protection of nature. The One Planet Living vision is of a world where we can live happily within the Earth's resources, leaving space for wildlife and wilderness. This includes meeting needs from local, renewable and waste resources.

Ten guiding principles make up the framework which cover social, environmental and economic sustainability and offer detailed goals and guidance documents to inform actions.

The program supports community transformation to achieve sustainability goals through the framework which can be used as a tool by individuals, organisations, groups and communities. It focusses on cities and regions, communities and destinations, companies and organisations as well as schools and educational facilities. There is an emphasis on engagement, simplicity and co-creation, as it is recognised that lasting change is most successful when hearts and minds are committed and people feel empowered.

Bioregional Australia is a not for profit organisation promoting One Planet Living and offer support including assistance with One Planet Action Plan creation, training within organisations and strategies for plan implementation. A trained One Planet Living expert (One Planet Integrator) leads stakeholders through trends analyses, visioning sessions and context analysis, benchmarking and opportunity analysis before leading strategic workshops for the development of the One Planet Action Plan and submitting the projects application for recognition.

Where One Planet Action Plans are considered to be an ambitious response to the challenge of One Planet Living, One Planet Community recognition will be received. Whilst this is not a certification or accreditation, recognition helps to create a culture of innovation and motivation to enable flexible systemic responses and rapid progress. Recognition can be either National/Sector Leadership or Planetary Leadership.

One Planet Living principles have been adopted by many Governments and corporations as a reference framework. As a formal framework, one example is a community development, SALT, Torquay

https://www.bioregional.com/bioregional-australia/bioregional-australia-our-work/salt-torquay

Additional case studies can be found here: https://www.bioregional.com/bioregional-australia/bioregional-australia-our-work

The *One Planet Living* framework is application to the SAP.

[7] https://www.bioregional.com/ https://www.bioregional.com/bioregional-australia/bioregional-australias-one-planet-living-program

Preconditions/conditional requirements

Before publicly stating One Planet Living use, T&C's must be acknowledged including publishing overall vision, aims and a full plan. Recognition is date-stamped and must be maintained with annual review information.

Tool themes/ key features

- Health and happiness
- Equity and local economy
- Culture and community
- Land use and wildlife
- Sustainable water
- Local and sustainable food
- Sustainable materials
- Sustainable transport
- Zero waste
- Zero carbon

Costs

Costs depend on project size in terms of economic value.

In July 2020, the estimated AUD value of a large project such as the SAP could incur:

Max $30K annual fees + $5000 membership fee + consultation & One Planet Living Integrator facilitation.

Peer reviews can be requested to get an independent perspective. An initial peer review of $54,000 with subsequent reviews of approximately $27,000.

Process

The recommended process for One Planet Living is made up of five steps:

1. Get buy-in
2. Create a One Planet Living Action Plan
3. Implement the plan
4. Monitor progress
5. Report

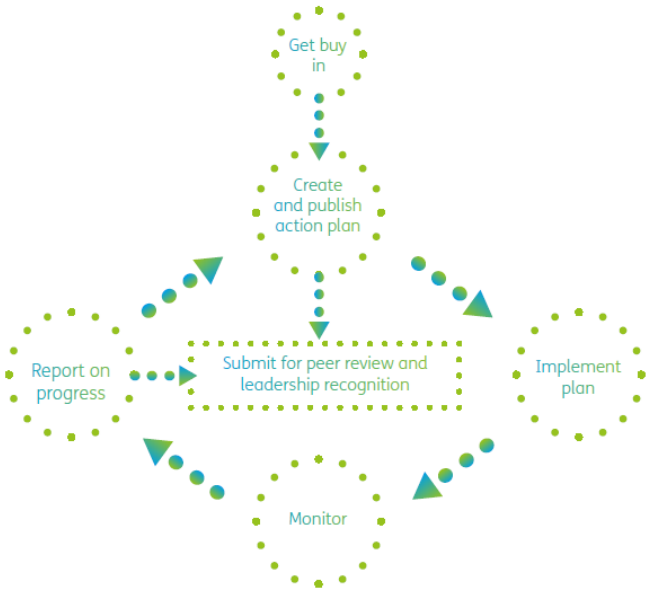


Figure 4: One Planer Living Process

The program is a three-year commitment to develop, implement and report, with recognition possible in year one and impacts measured and reported in year two and three. As such, the process can be broken down into the following timeframe:

Year	Step	Details
One	Preparation	Getting buy-in and engaging with the One Planet Integrator to develop the One Planet Action Plan
Two	Implementation	Implement the action plan and measure, monitor and report actions and impacts achieved. Annual review
Three	Review	Continue to measure, monitor and report actions and impacts achieved. Review the outcomes.

Recertification is every three years.

Rigour

One Planet Integrators are trained professionals which are CPD certified.

The project's One Planet Integrator submits the One Planet Analysis and Action Plan along with supplementary documentation for review by an Australia assessor, Bioregional Australia Board and Bioregional UK.

A peer review and third-party verification may be completed before awarding recognition.

This framework is not a certification/accreditation system and reporting is optional.

Rating Tools Comparison

For quick comparison of the tools and frameworks, they key elements for application to the SAP are outlined in Table 1.

Table 1: Tool/framework comparison for SAP application

Tool/framework	Conditions	Costs (Incl. GST)	Pro's	Con's
EarthCheck	•Requires a Destination Authority •Sustainability Policy required •Risk Assessment/Sustainability Action Plan/Environmental Management System may be required •Mandatory on-site assessment	~$19K+	•Tourism/destination specific •Facilitates offsets •Mapped to SDGs •Thredbo certified	•May not be holistic due to industry specialisation •Status based on length of commitment rather than performance
Green Star Communities	•A GSAP must complete the submission for a project •The project must be clearly distinct and have at least four buildings must be developed •Project must be able to achieve at least 4-star Green Star rating and have approval under EPBC Act •Certification must be achieved within 3 years of registration & recertified within 5 years. •Land cannot be agricultural or protected land	~$50K+	•Well known rating tool but undergoing refurbishment (Future Focus: end of 2021) •Tool applicable to all of SAP •Credit by credit assessment possible	•May not take area/industry specific attributes into account
Living Community Challenge	•Applies to completed project with certification based on performance •Project may only be constructed on previously constructed sites •Criteria require diversity of uses, multiple buildings, of which 50% must be LBC certified, and at least one multi-modal street •Inspiration and education mandatory •Minimum area for agriculture •Development cannot impede other projects	~$52K+ (TBC)	•Very clear credits •Very detailed criteria •Challenges industry to continually improve •Incorporates aesthetics •Scale-jumping allows for flexibility •Three performance pathways	•Very difficult to achieve •Energy is not currently aligned with carbon emissions
WELL Community	•Must meet at least two conditions that relate to population, area or building count and at least two usage types •Mandatory preconditions within each concept •At least one health & wellness certified building/15% of total building count prior to WELL certification •Applies to completed project with certification based on performance •Recertification required after 5 years	~$99K+	•Flexibility with credits, allowing for alternate pathways that meet intent •Can target interim awards •Gaining popularity (Due to COVID19)	•Affects processes and behaviours
One Planet Living	•Annual review is required •Overall vision, aims and plan must be published	~$35K+	•Flexible •Inclusive •Recognition possible after 1 year	•Not an official certification •No accountability

+ = All costs are exclusive of consultancy fees. The Living Community Challenge fees are still to be confirmed.

Appendix D Strategic Framework ESD Workshop

dsquared

Snowy Mountains Special Activation Precinct

Sustainability Workshop Presentation

29th July 2020

ESD Vision

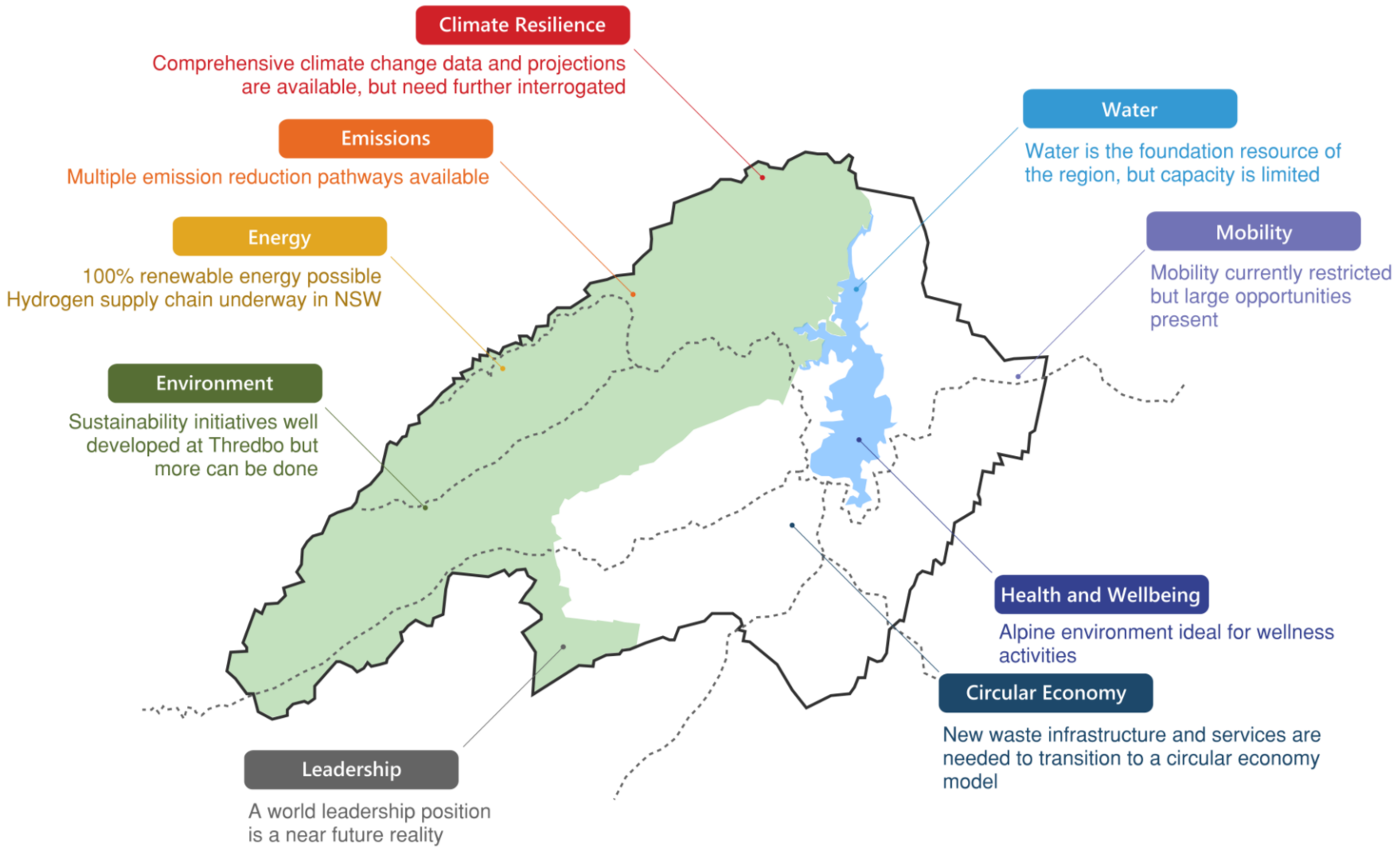

CLIMATE RESILIENCE
An adaptable community resilient to climate change
EMISSIONS
Reducing emissions beyond zero
CO_2
ENERGY
Powered by renewables
ENVIRONMENT
Touch the ground lightly
SNOWY MOUNTAINS SPECIAL ACTIVATION PRECINCT
TOURISM
LEADERSHIP
An internationally recognised sustainable tourism destination
HEALTH AND WELLBEING
Mind, body and soul rejuvenated
MOBILITY
Experience the future of efficient mobility
CIRCULAR ECONOMY
Collaborating to share resources and knowledge
WATER
Celebrate Snowy's founding natural resource

UN World Tourism Organisation (WTO)

dsquared

Strengths and opportunities

dsquared



ESD Destinations

dsquared

Adventure tourism opportunities

Immersive eco and wellbeing activities

Eco-cabins and glamping offerings

Zero carbon scenic flight 'bucket list'

Jindabyne mini hydro education centre

Zero emission transport hub for eco-tourists

Jindabyne township as a sustainable design centre

Zero emission adrenaline sports

CLIMATE RESILIENCE

An adaptable community resilient to climate change

Context

_Climate data and projections well developed

_Adaptation and transition already identified in the AdaptNSW reports

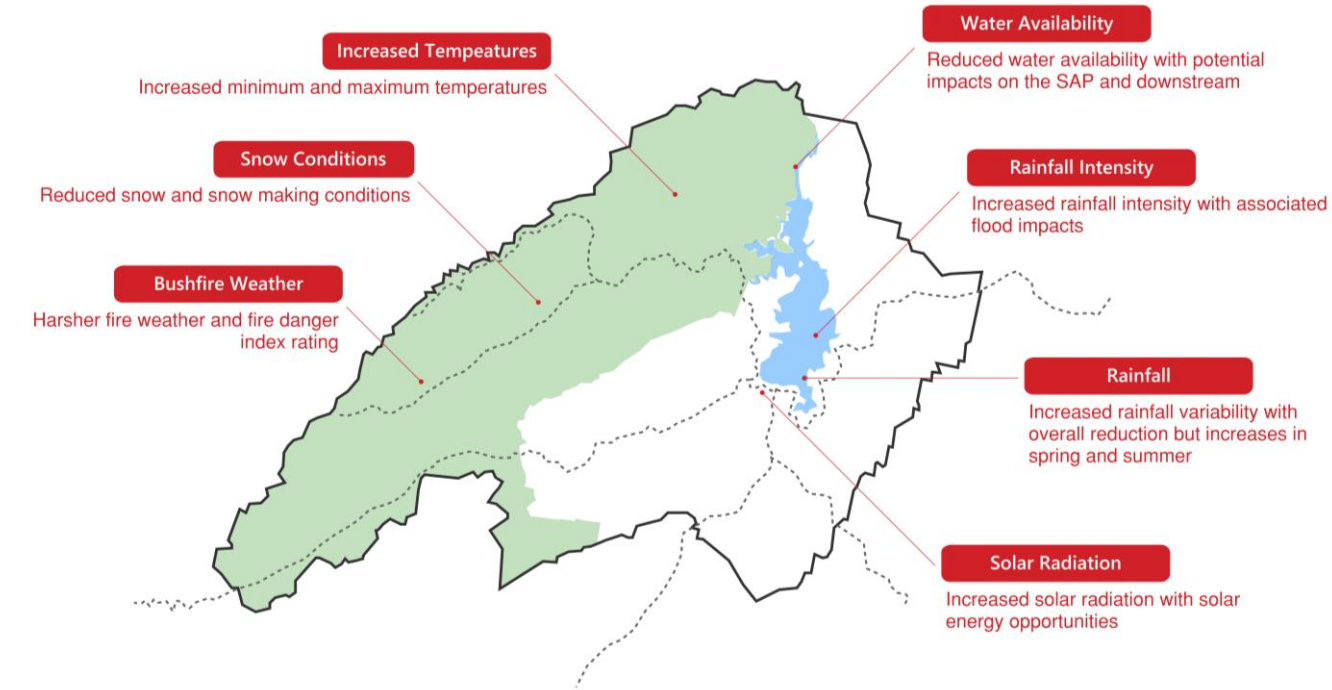
_Water availability and snow making conditions are key, along with bushfire and biodiversity

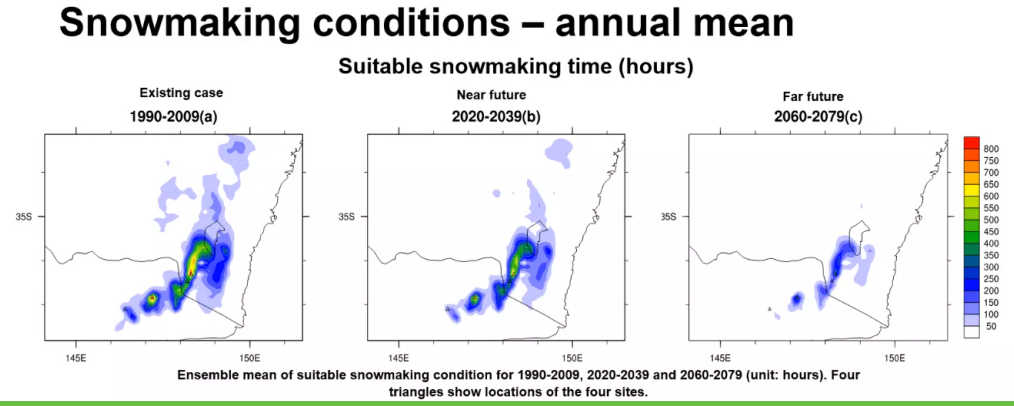
Key moves

_Interrogate climate data projections

_Transition resorts most vulnerable to alternatives to snow based tourism

_Implement improved urban design, infrastructure and building standards to increase resilience





Ensemble mean of suitable snowmaking condition for 1990-2009, 2020-2039 and 2060-2079 (unit: hours). Four triangles show locations of the four sites.

ENERGY

Powered by renewables

Context

_160% of the SAP's net energy demand is met by existing renewable energy (hydro + solar PV)

_However hydro/solar is not always generating resulting in imported fossil fuel energy from the grid

_Snowy Hydro also sell the renewable energy on the wholesale market and as part of energy contracts

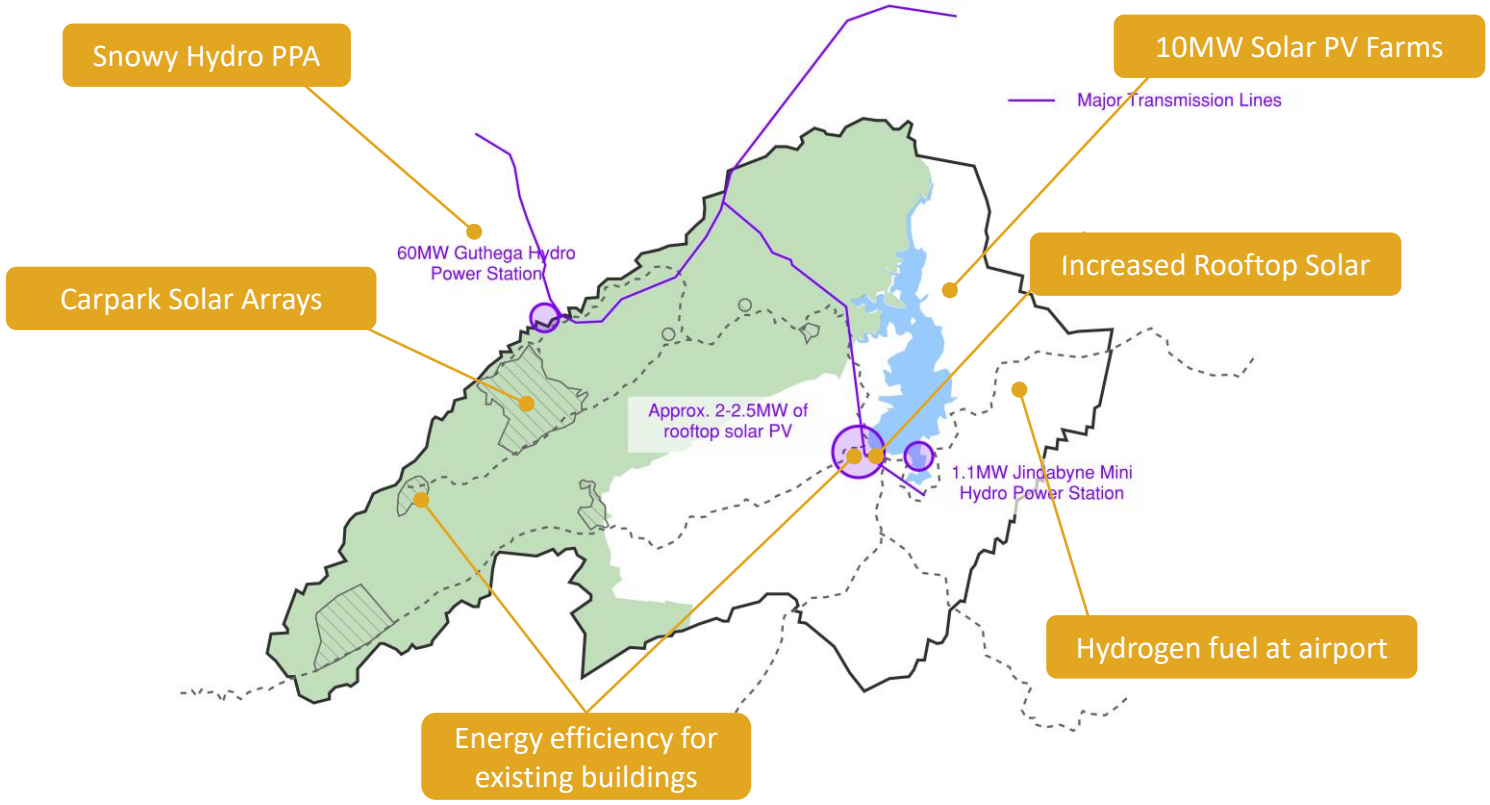
_Existing solar power is small scale with lots of opportunities

Strategy

_Develop a PPA with Snowy Hydro

_Build new renewable energy systems

_ Build new energy storage systems



MOBILITY

Experience the future of efficient mobility

Context

_Transport to and within the SAP is constrained to passenger vehicles

_Transport is estimated to be the largest source of carbon emissions for the SAP, however will transition to lower emission options over time

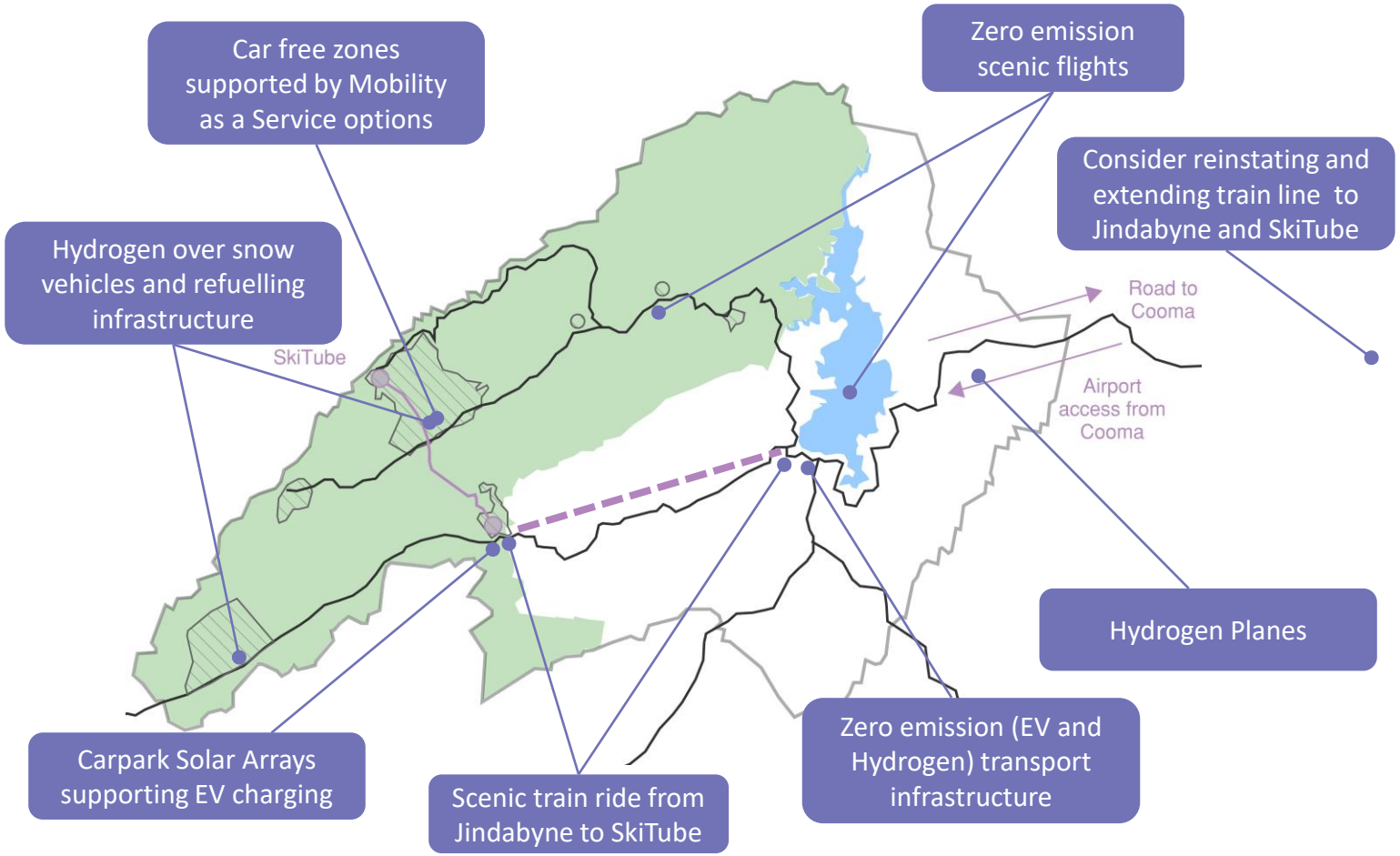
_Touching the ground lightly is problematic based on current transport systems with high emission, impacts on air quality and congestion.

Strategy

_Develop zero emission transport and infrastructure

_Develop hydrogen supply chain

_Maximise mobility as a Service (MaaS) provisions



WATER

Celebrating Snowy's Founding Natural Resource

Context

_Water is the SAP's founding natural resource

_Water availability is reducing due to climate change with existing supply constraints, as well as increased demand expected from the SAP

_Wastewater and stormwater pollution an ongoing concern

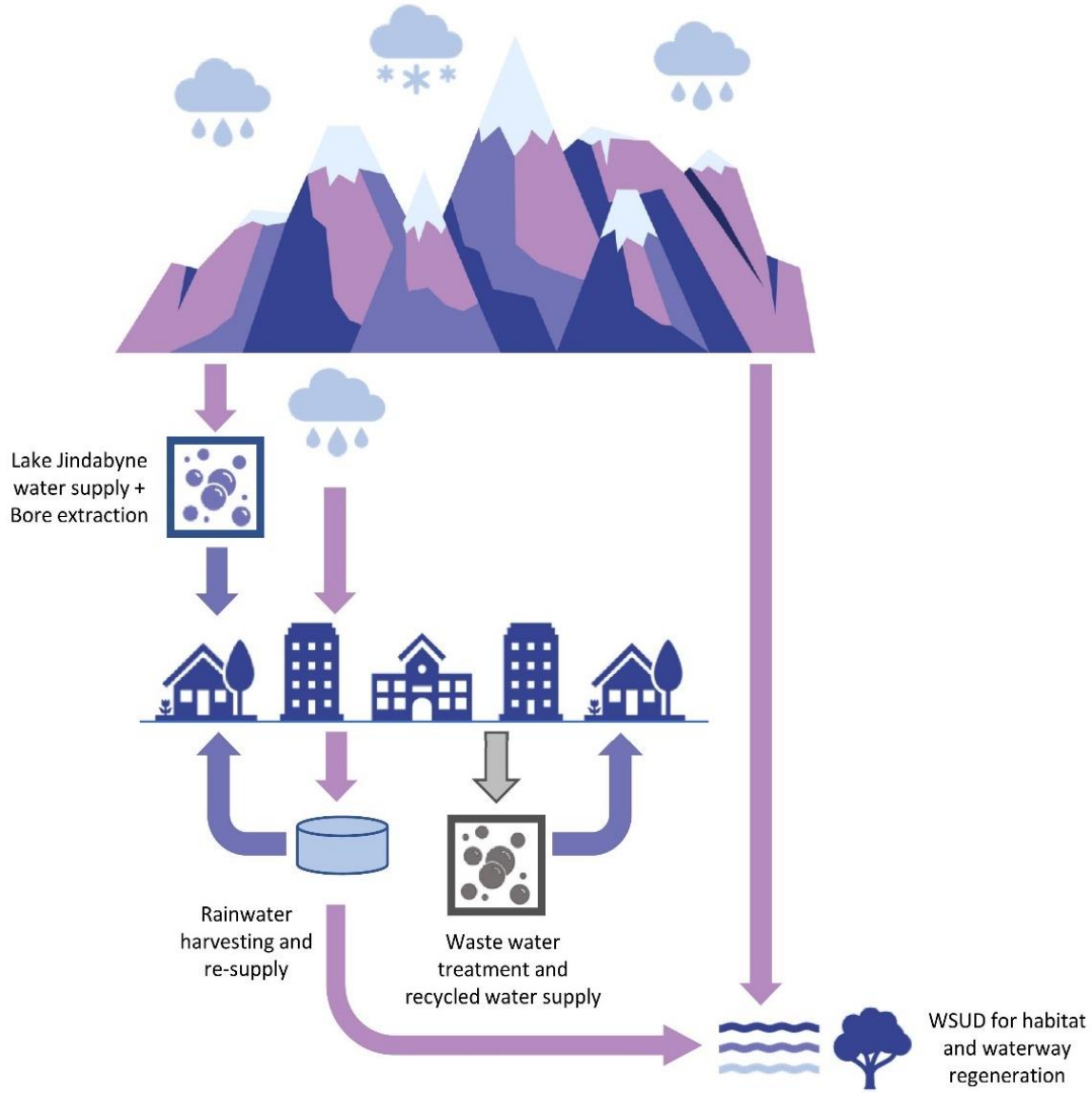
_Snowy Hydro operates a Cloud Seeding Program to increase precipitation by an average of 14%.

Key moves

_Incorporate water sensitive urban design

_Build water capture and reuse infrastructure

_Upgrade wastewater treatment systems to closed loop



ENVIRONMENT

Touch the ground lightly

Context

_The natural environment is the key attraction for the Snowy Mountains region and plays a huge part in the region's economy

_Incorporates a large number of threatened flora and fauna

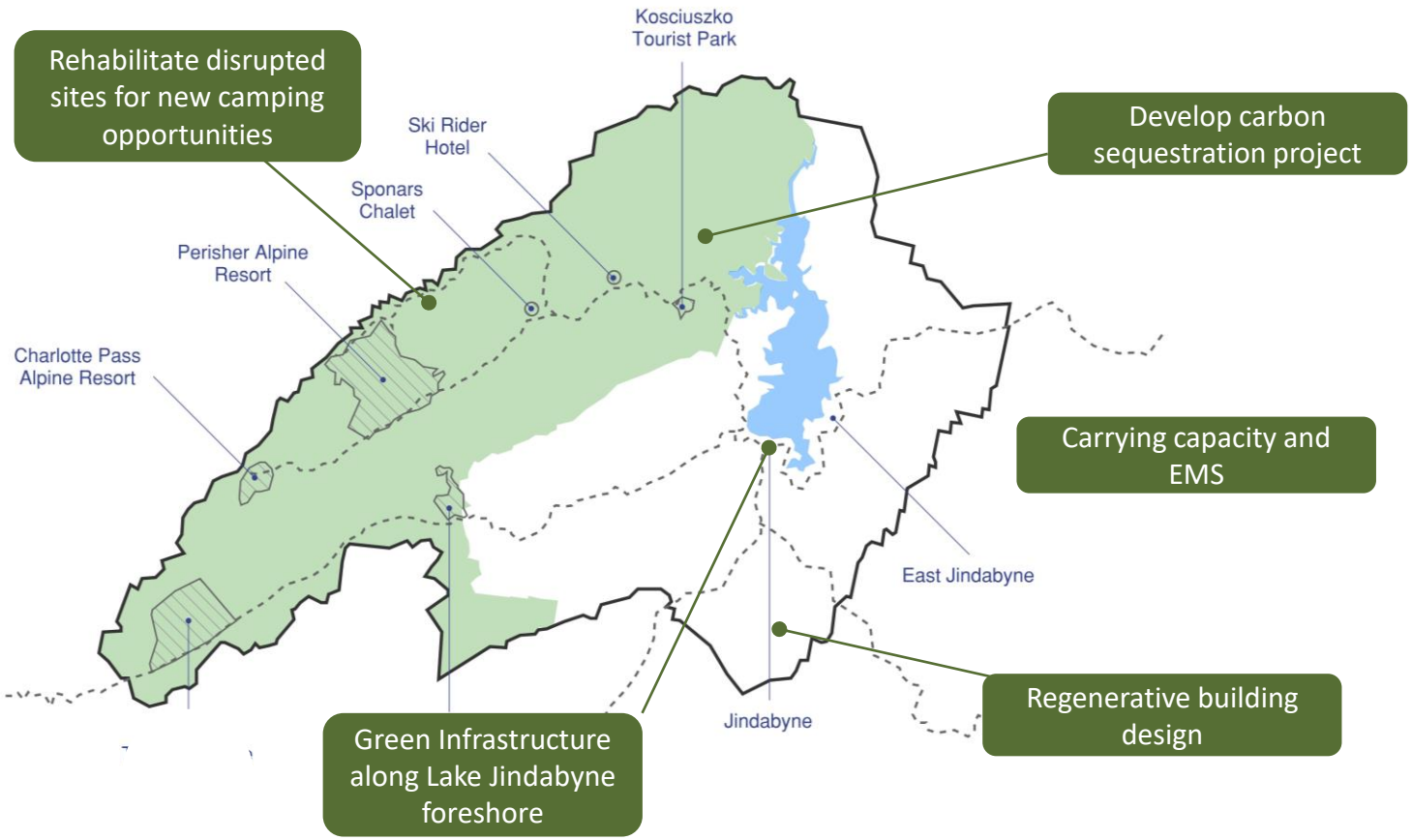
_Famous for winter snow sports but also supports nature-based activities including walking, hiking, fishing, mountain biking, and water-based sports on Lake Jindabyne

Strategy

_Identify and prioritise previously developed sites e.g. old Snowy village

_Green infrastructure is embedded in urban design

_Offset 100% of development footprint



EMISSIONS

Reducing emissions beyond zero

Context

_Transport and energy and estimated to be the largest emission sources

_SAP study area includes agricultural land which will need to be considered

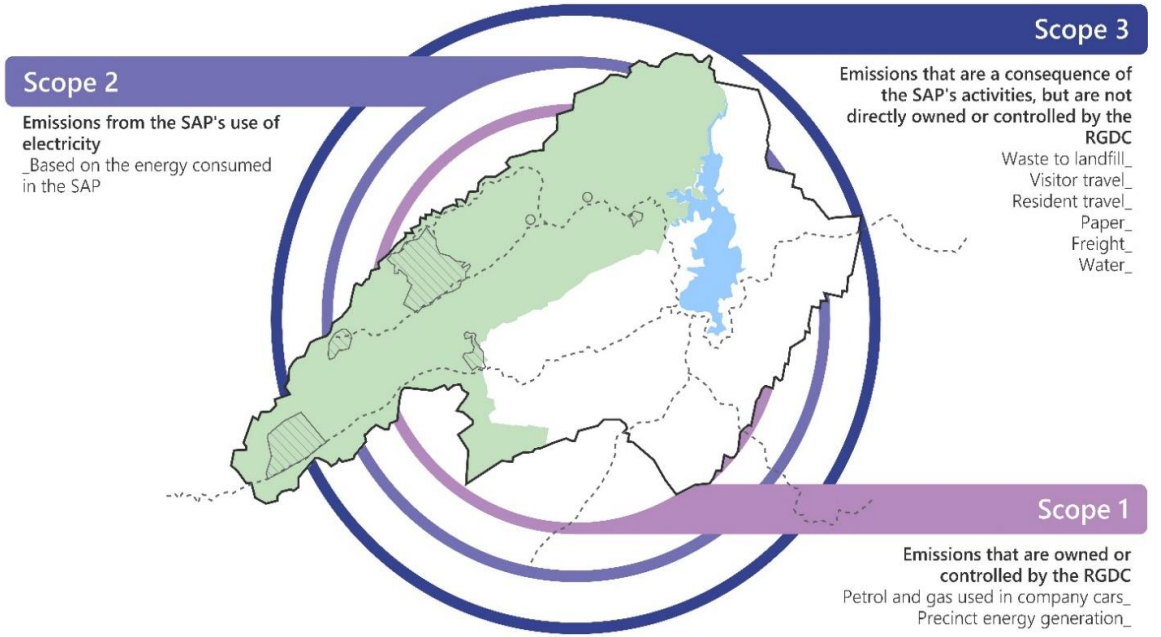
_Clear emissions boundary needs to be developed

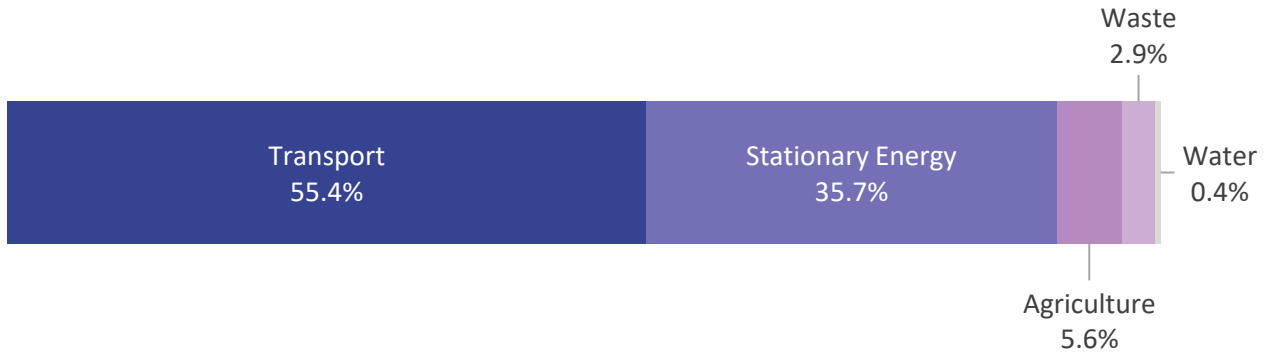
Key moves

_Develop an emissions boundary and inventory

_Implement emission reduction initiatives

_Develop a carbon neutral certification plan





HEALTH AND WELLBEING

Mind, body and soul rejuvenated

Context

_The Alpine environment of the Snowy Mountains naturally draws people to a lifestyle based on connection to the outdoors.

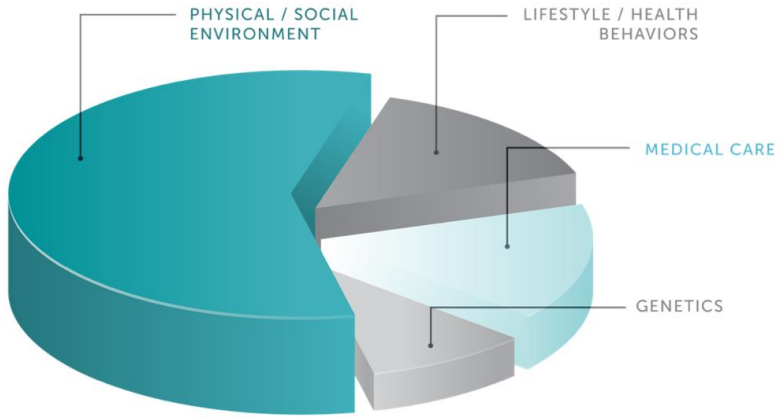
_Major drawcards for living in the area was the relaxed pace of life, healthy and balanced lifestyle, friendly and inclusive atmosphere, and connections to nature.

Key moves

_Design buildings and community spaces for wellbeing

_Create sports & recreation infrastructure focussed on wellness

_Create social infrastructure focussed on wellness



CIRCULAR ECONOMY

Collaborating to share resources and knowledge

Context

_Jindabyne landfill expected to reach capacity in 3 years

_Waste and resource management varied with community and commercial services offered by the council and the resorts arranging their own waste services

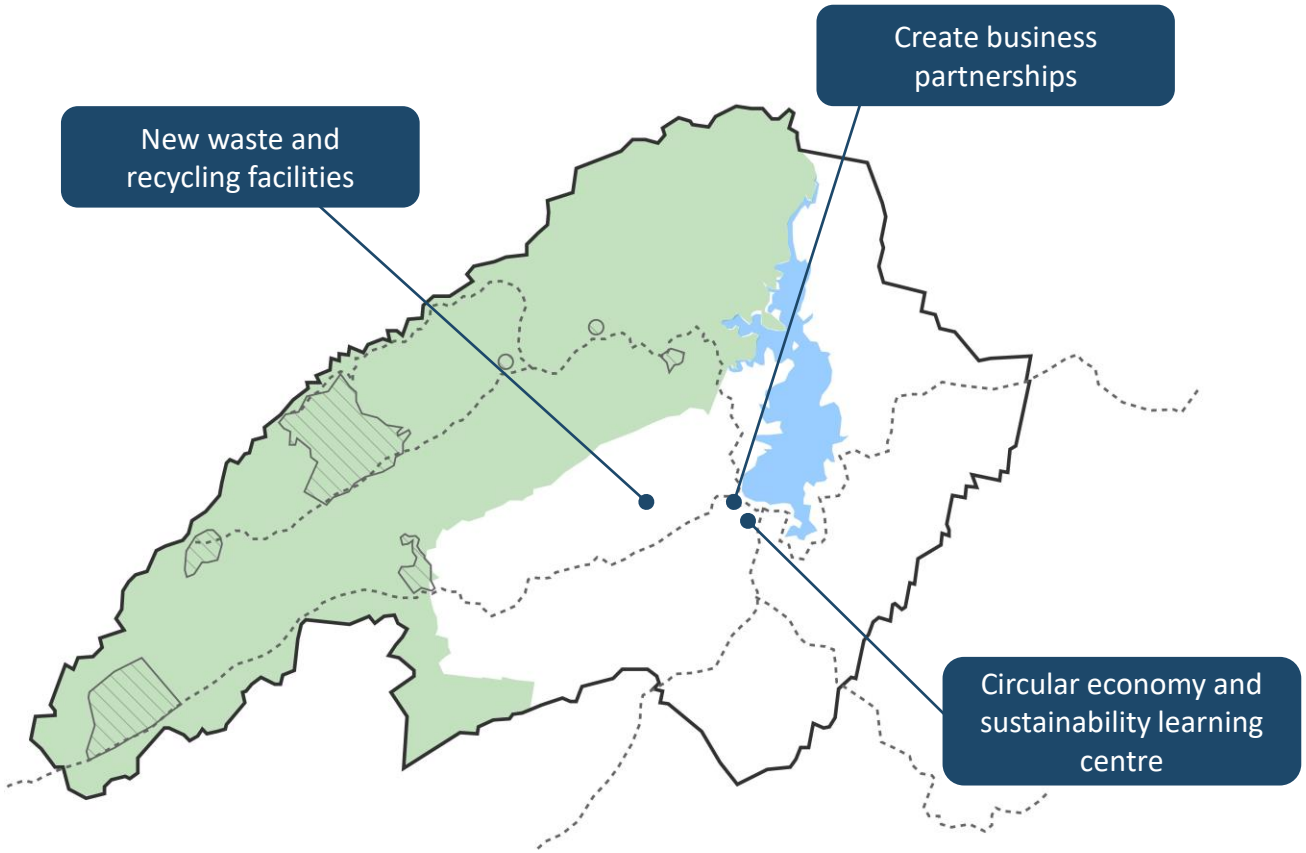
_Waste to landfill increases due to peak tourism, however recycling rates unchanged

Key moves

_Build waste management and recycling infrastructure

_Develop circular economy education and skills programs

_Develop local partnerships



Leadership


BUSINESS RATINGS INCENTIVISED BY DELIVERY PLAN
_Earth Check
_Ecotourism Australia
_Climate Action Business
_Respect Our Culture
POTENTIAL PRECINCT RATING CERTIFICATIONS
_Earth Check Destination
_Living Building Challenge
_One Planet Living
_Green Star Communities
_WELL Community
ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEM
SUSTAINABLE DEVELOPMENT GOALS
TOURISM
EARTHCHECK
eco CERTIFIED Tourism
Climate Action BUSINESS
Respecting Our Culture ROC Certified
ISCA
Climate Active Carbon Neutral PRECINCT
EARTHCHECK
LIVING BUILDING CHALLENGE
ONE PLANET LIVING
Green Building Council Australia
INTERNATIONAL WELL BUILDING INSTITUTE
ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEM

ESD Vision


CLIMATE RESILIENCE
An adaptable community resilient to climate change
EMISSIONS
Reducing emissions beyond zero
CO_2
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Powered by renewables
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Touch the ground lightly
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Collaborating to share resources and knowledge
WATER
Celebrate Snowy's founding natural resource

Appendix E Precinct Rating Tool Assessment

Rating Tools and Certification Options

Rating / Certification	Focus	Verification	Indicative Cost	Rating Timeframe				Topics Incorporated												
				Design / Master Plan	As-built	Operational	Re-Certification Timeframe	Climate Change / Resilience	Emissions	Energy	Water	Transport	Waste / Circular Economy	Land Use / Environment	Air Quality / Noise / Light Pollution	Health and Wellbeing	Sustainable / Healthy Food	Cultural / Social / Community	Materials	Economic Benefit
ISO 14001 Environmental Management System	Environmental Management	ISO 14001 Accredited Auditor Independent third-party audit	**TBC**	**Masterplan**			**Annual surveillance audit + 3 yearly re-certification**	ISO 14001 is a management system, therefore does not specify topics but requires the managing organisation to identify, assess and reduce all environmental impacts and continually improve environmental performance. Can be used to gain accreditation at masterplan stage and then requires annual monitoring and reporting with an independent surveillance audit undertaken by an ISO 14001 accredited auditor.											
Climate Active Carbon Neutral	Emissions	Third party audit by Climate Active Registered Consultant	**TBC**			**12 Months Operating**	**Annual**	1												
One Plant Living	Sustainable Development	Peer Review by Bioregional Suitably Qualified Professional	**~$35K+**	**Action Plan / Masterplan**		**Annual Peer Review**	**Annual**	2	3											
EarthCheck	Sustainable Travel & Tourism	EarthCheck Auditor	**~$19K+**			**12 months operating**	**Annual**												4	
Green Star Communities	Community	Green Star Accredited Assessor	**~$50K+**	**Masterplan**		**Re-certification**	**Every 5 years**													
The Mohonk Agreement	Sustainable Travel & Tourism	**N/A - Framework and principles**																		
UN WTO	Sustainable Travel & Tourism	**N/A – Framework and guidelines including Mohonk Agreement principles**																		
Eco-Tourism Australia, Climate Action, Respecting Our Culture	Sustainable Travel & Tourism	Eco-Tourism Auditor	**Project Specific**				**3 yearly on-site audit**													

Rating / Certification	Focus	Verification	Indicative Cost	Rating Timeframe				Topics Incorporated											
				Design / Master Plan	As-built	Operational	Re-Certification Timeframe	Climate Change / Resilience	Emissions	Energy	Water	Transport	Waste / Circular Economy	Land Use / Environment	Air Quality / Noise / Light Pollution	Health and Wellbeing	Sustainable / Healthy Food	Cultural / Social / Community	Materials	Economic Benefit
Living Community Challenge	Sustainable Development	Independent Living Community Challenge Auditor	**~$52K+ (TBC)**	**Masterplan Compliance Only**		**12 Months Operating**	**Every 5 Years**								5					
WELL Community	Community	Green Business Certification Inc. (GBCI) Assessor Independent third-party audit	**~$99K+**	**Pre-certified**		**6-12 months operating**	**Every 5 Years**													6
ISCA	Infrastructure	Independent Infrastructure Sustainability (IS) Verifier	**Project Specific**																	

1 Climate Active's aim is to reduce emissions to mitigate the impacts of climate change, however is not intended to improve resilience or assist in adapting to a changing climate.

2 Although climate change is listed as an issue to address, One Planet Living does not directly target climate resilience and adaptation.

3 One Planet Living indirectly targets emissions through efficiencies and renewable energy supplies.

4 The Earth Check Destinations standard only incorporates environmentally harmful substances and the storage of hazardous chemicals. Does not address VOCs, sustainable materials, recycled content etc.

5 Living Community Challenge indirectly addresses air quality as part of the other topics.

6 The economic benefit of WELL communities relates to the health and wellbeing improvements, increased productivity and reduced health care needs but is not a direct target or point.

Appendix F Energy and water calculator summary and guide

Snowy Mountains Special Activation Precinct (SAP)

Energy and water calculator guide

15th March 2021.

1.1 Introduction

An energy and water calculator has been developed for the Snowy Mountains Special Activation Precinct (SAP).

The calculator enables various scenarios to be tested and includes options to either take a holistic whole of SAP view, or to take a micro-view and deploy specific building types of known size at a sub-precinct level.

The output from the calculator includes:

a. Annual electricity consumption (kWhr)

b. Peak electricity demand (kVA)

c. Annual gas consumption (MJ)

d. Annual potable water consumption (kL)

e. Annual non-potable water consumption (kL)

Electricity, gas and water metrics have been developed for the ESD calculators to enable concept scenario testing to be undertaken. The reference data used is based on previous dsquared projects, including detailed modelling and verification against operational data provided by industry.

1.2 How the calculator works

By selecting 'Building Type/Description' from the drop-down menu, the calculator looks up the corresponding electricity, gas and water consumption metrics which are stored in the 'Reference Data' tab. These metrics have been developed based on previous dsquared projects and aligned with WSP's infrastructure figures for consistency.

The corresponding metrics associated with the 'Building Type/Description' are multiplied by the 'Gross Land Area' and the 'Land Utilisation Factor' to determine the actual annual consumption values for that particular land use. This is repeated for each land use type within each 'Sub-Precinct'.

In the overall 'Summary' tab, the results for each 'Sub-Precinct' are replicated. Where 'Yes' is selected for either or both 'Standalone Solar PV' or 'Roof Mounted Solar PV', the estimated solar PV generation is calculated for the corresponding arrays utilising the data entered in the 'Standalone Solar PV' tab, or the relevant 'Sub-Precinct' data.

For 'Standalone Solar PV' arrays, the calculator simply determines the generation based on the defined solar PV array size for each sub-precinct, based on a nominal kWh/installed kW rate for the Snowy SAP location.

For 'Roof Mounted Solar PV' arrays associated with a sub-precinct, the calculator determines the likely available roof area for the installation of solar PV panels within that sub-precinct, how much solar PV capacity can be installed on the roof and then calculates the generation associated with that array size. The generation is based on a nominal kWh/installed kW rate for the Snowy SAP location.

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 nett export.

There are two (2) main steps to using the calculator as follows:

- Step 1: Complete the 'Sub-Precinct' tabs of the calculator for all sub-precincts being analysed;
- Step 2: Go to the 'Summary' tab.

These steps are described in more detail in the sub-sections below.

1.3 Sub-Precinct Tabs

The calculator incorporates twenty (20) 'Sub-Precinct' tabs which provides the calculator with the capability of analysing up to this number of sub-precincts. The tabs are prepopulated with the main precincts under investigation in the SAP and has an additional 10 spare tabs if required.

Within each 'Sub-Precinct' tab, the sub-precinct may be given a name (located in cell C1), otherwise it remains with the default name, i.e. 'Sub-Precinct 1', 'Sub-Precinct 2' etc.

All cells with a grey background are locked out and should not be altered by the users.

The cells with a white background are for user selection.

To enter data into a sub-precinct, the following steps should be taken:

- Select a 'Building Type/Description' from the drop-down menu (column C);

Name	Thredbo Alpine Resort		
Building Reference	**Building Type/Description**	**Building Floor Area (m^2)**	**New or Existing Building**
1			New
2	Commercial: Alpine Resort		New
3	Commercial: Eco-Tourist Accommodation		New
4	Commercial: Hotel/Motel		New
5	Commercial: Office and Admin		New
6	Commercial: Emergency Services		New
7	Retail: Shopping Centre/Light Commercial		New
8	Retail: Cafes/Speciality Shops		New
9	Residential: Detached Dwellings		New
10			New
11			New
12			New
13			New
14			New
15			New
16			New
17			New
18			New
19			New
	Total	**0**	**-**

- Enter the land area associated with that usage type, in hectares (column D);

Name	Thredbo Alpine Resort		
Building Reference	**Building Type/Description**	**Building Floor Area (m^2)**	**New or Existing Building**
1	Commercial: Alpine Resort	10,000	New
2	Commercial: Hotel/Motel	5,000	New
3	Commercial: Emergency Services	2,000	New
4			New
5			New
6			New
7			New
8			New
9			New
10			New
11			New
12			New
13			New
14			New
15			New
16			New
17			New
18			New
19			New
	Total	**17,000**	**-**

- Repeat as necessary for all the different building types located proposed within each sub-precinct.

Once all building entries have been made for each Sub-Precinct, return to the 'Summary Tab' for overall results and to apply diversity factors and assess solar PV arrays, as required.

1.4 Summary Tab

The calculator incorporates an initial overall 'Summary' tab which summarises the results from each 'Sub-Precinct' as well as the overall results for the precinct as a whole.

All cells with a grey background are locked out and should not be altered by the users.

All cells with a white background are for user selection.

Within the initial 'Summary' tab, users have the option to select a 'Diversity Factor', from the drop-down menu (column C) associated with each sub-precinct. When a value below 100% is selected, a percentage reduction to the calculated electricity, gas and water consumption figures, as well as the electrical maximum demand figures is applied. This may be used where the user believes there to be diversity in usage within each 'sub-precinct' or for the precinct as a whole.

SUMMARY

Precinct Name	Diversity Factor	Standalone Solar PV (Y/N)	Roof Mounted Solar PV (Y/N)	Electricity Consumption (MWh/Yr)		Peak Electricity Demand (kVA)	
				Without Solar PV	With Solar PV	Without Solar PV	With Solar PV
Thredbo Alpine Resort	100%	Yes	Yes	1,050	759	224	0
Charlotte Pass Alpine Resort	100%	No	No	0	0	0	0
Perisher Alpine Resort	100%	No	No	0	0	0	0
Sponars Chalet	100%	No	No	0	0	0	0
Ski Rider Hotel	100%	No	No	0	0	0	0
Kosciuszko Tourist Park	100%	No	No	0	0	0	0
Bullocks Flat Terminal	100%	No	No	0	0	0	0
East Jindabyne	100%	No	No	0	0	0	0
Jindabyne	100%	No	No	0	0	0	0
Proposed New Airport Site	100%	No	No	0	0	0	0
Sub-Precinct 1	100%	No	No	0	0	0	0
Sub-Precinct 2	100%	No	No	0	0	0	0
Sub-Precinct 3	100%	No	No	0	0	0	0
Sub-Precinct 4	100%	No	No	0	0	0	0
Sub-Precinct 5	100%	No	No	0	0	0	0
Sub-Precinct 6	100%	No	No	0	0	0	0
Sub-Precinct 7	100%	No	No	0	0	0	0
Sub-Precinct 8	100%	No	No	0	0	0	0
Sub-Precinct 9	100%	No	No	0	0	0	0
Sub-Precinct 10	100%	No	No	0	0	0	0

The initial 'Summary' tab also provides the users with the option to select 'Standalone Solar PV', from the drop-down menu (column D) associated with each sub-precinct. When 'Yes' is selected, the calculator utilises data entered on the 'Standalone Solar PV' tab for the relevant sub-precinct and incorporates the annual solar PV generation associated with the installation of standalone solar PV arrays (i.e., not building/roof mounted arrays) and determines how much this contributes to the overall sub-precinct electricity consumption.

SUMMARY

Precinct Name	Diversity Factor	Standalone Solar PV (Y/N)	Roof Mounted Solar PV (Y/N)	Electricity Consumption (MWh/Yr)		Peak Electricity Demand (kVA)	
				Without Solar PV	With Solar PV	Without Solar PV	With Solar PV
Thredbo Alpine Resort	100%	No	No	1,050	1,050	224	224
Charlotte Pass Alpine Resort	100%	Yes / No	No	0	0	0	0
Perisher Alpine Resort	100%		No	0	0	0	0
Sponars Chalet	100%	No	No	0	0	0	0
Ski Rider Hotel	100%	No	No	0	0	0	0
Kosciuszko Tourist Park	100%	No	No	0	0	0	0
Bullocks Flat Terminal	100%	No	No	0	0	0	0
East Jindabyne	100%	No	No	0	0	0	0
Jindabyne	100%	No	No	0	0	0	0
Proposed New Airport Site	100%	No	No	0	0	0	0
Sub-Precinct 1	100%	No	No	0	0	0	0
Sub-Precinct 2	100%	No	No	0	0	0	0
Sub-Precinct 3	100%	No	No	0	0	0	0
Sub-Precinct 4	100%	No	No	0	0	0	0
Sub-Precinct 5	100%	No	No	0	0	0	0
Sub-Precinct 6	100%	No	No	0	0	0	0
Sub-Precinct 7	100%	No	No	0	0	0	0
Sub-Precinct 8	100%	No	No	0	0	0	0
Sub-Precinct 9	100%	No	No	0	0	0	0
Sub-Precinct 10	100%	No	No	0	0	0	0

Similarly, the initial 'Summary' tab also provides the users with the option to select 'Roof Mounted Solar PV', from the drop-down menu (column E) associated with each sub-precinct. When 'Yes' is selected, the calculator utilises data entered on the relevant sub-precinct tabs to estimate the annual solar PV generation associated with the installation of roof mounted solar PV arrays, and determines how much this contributes to the overall sub-precinct electricity consumption.

SUMMARY

Precinct Name	Diversity Factor	Standalone Solar PV (Y/N)	Roof Mounted Solar PV (Y/N)	Electricity Consumption (MWh/Yr)		Peak Electricity Demand (kVA)	
				Without Solar PV	With Solar PV	Without Solar PV	With Solar PV
Thredbo Alpine Resort	100%	No	No	1,050	1,050	224	224
Charlotte Pass Alpine Resort	100%	No	Yes / No	0	0	0	0
Perisher Alpine Resort	100%	No		0	0	0	0
Sponars Chalet	100%	No	No	0	0	0	0
Ski Rider Hotel	100%	No	No	0	0	0	0
Kosciuszko Tourist Park	100%	No	No	0	0	0	0
Bullocks Flat Terminal	100%	No	No	0	0	0	0
East Jindabyne	100%	No	No	0	0	0	0
Jindabyne	100%	No	No	0	0	0	0
Proposed New Airport Site	100%	No	No	0	0	0	0
Sub-Precinct 1	100%	No	No	0	0	0	0
Sub-Precinct 2	100%	No	No	0	0	0	0
Sub-Precinct 3	100%	No	No	0	0	0	0
Sub-Precinct 4	100%	No	No	0	0	0	0
Sub-Precinct 5	100%	No	No	0	0	0	0
Sub-Precinct 6	100%	No	No	0	0	0	0
Sub-Precinct 7	100%	No	No	0	0	0	0
Sub-Precinct 8	100%	No	No	0	0	0	0
Sub-Precinct 9	100%	No	No	0	0	0	0
Sub-Precinct 10	100%	No	No	0	0	0	0

The calculator also identifies the impact of both standalone and building/roof mounted solar PV arrays on electrical maximum demand.

References and metrics

Identifier	Building type	Description	Electricity (kWhr/ m^2/Yr)	Electricity Demand (kVA/m^2)	Gas (GJ/m^2/Yr)	Non-Potable Water Consumption (kL/m^2/Yr)	Potable Water Consumption (kL/m^2Yr)
Commercial: Alpine Resort	Commercial A	Alpine Resort Accommodation	150	0.030	0.06	0.53	0.30
Commercial: Eco-Tourist Accommodation	Commercial B	Low Impact, Low Intensity Eco-Tourist Accommodation	50	0.010	0.02	0.18	0.20
Commercial: Hotel/Motel	Commercial C	Hotel, Motel	200	0.040	0.08	0.70	0.40
Commercial: Office and Admin	Commercial D	Office Buildings, Administration	150	0.032	0.08	0.30	0.10
Commercial: Emergency Services	Commercial E	Emergency Services Facility	150	0.032	0.08	0.30	0.10
Retail: Shopping Centre/Light Commercial	Retail A	Retail, Shopping, Shopping Centre, Light Commercial Buildings	190	0.040	0.08	0.50	0.30
Retail: Cafes/Speciality Shops	Retail B	Speciality Retail, Independent Shop, Cafes	150	0.032	0.08	0.30	0.10
Residential: Detached Dwellings	Residential A	Residential Single Detatched Dwellings (quantity required)	6,200	6.250	11.5	0	348
Residential: Apartment Dwellings	Residential B	Residential Apartment Dwellings (quantity required)	4,400	4.440	9.4	0	209
Education: Primary/Secondary School	Education A	Primary or Secondary school / education and training building	120	0.026	0.08	0.56	0.30
Education: TAFE/University Education & Training	Education B	TAFE or University education and training building	150	0.032	0.08	0.70	0.30

Identifier	Building type	Description	Electricity (kWhr/m^2/Yr)	Electricity Demand (kVA/m^2)	Gas (GJ/m^2/Yr)	Non-Potable Water Consumption (kL/m^2/Yr)	Potable Water Consumption (kL/m^2Yr)
Education: TAFE/University Laboratory	Education C	TAFE or University research and laboratory facility	180	0.045	0.08	0.90	0.20
Sports Centre	Recreation A	Sports Hall, Community Gym, Mixed-use sporting facilities, Swimming Pool	215	0.28	0.86	4.70	0.20
Airport	Transport A	Airport, terminal building, hangar and aviation services	150	0.19	0.08	0.70	0.40
Low Impact Industry: General Industry	Low Impact Industry A	General Industry, light manufacturing	250	0.130	3.00	0.30	0.10
Warehouse & Distribution	Freight Logistics A	Warehousing and distribution, storage and logistics, non-refrigerated	16	0.053	0	0.04	0.06
None	None	None	0	0.000	0.000	0.00	0.00
Spare	Spare	Spare	0	0.000	0.000	0.00	0.00

Appendix G Emissions calculator summary and guide

Snowy Mountains Special Activation Precinct (SAP)

Emissions calculator summary and guide

15th March 2021

1.1 Introduction

The following provides a summary of the emissions calculator developed for the Snowy Mountains Special Activation Precinct (SAP) as well as a guide on using the calculator.

1.2 Data sources

The emissions calculator sources data from a range of sources including:

- **Population:** Australia Bureau of Statistics (ABS) – Census 2016 – SA2 Jindabyne Bomaderry
- **Visitor and population projections:** CIE SAP forecast – January 2021
- **Electricity and natural gas emissions:** National Greenhouse Accounts Factors 2020
- **Passenger vehicle emissions:** Australian Government - Green Vehicle Guide
- **Bus/Coach emissions:** United Kingdom – Department for Business, Energy & Industrial Strategy - Greenhouse gas reporting: conversion factors 2020
- **ABS Survey of Motor Vehicle Use** (21/12/20)
- SAP technical consultant reports
- Snowy Monaro Regional Council – Reports and publicly available information
- Community emissions: Snapshot municipal emissions report

1.3 Calculator summary

The emissions calculator incorporates the main emission sources for the Snowy Mountains SAP and allows projections to be made based on a business-as-usual approach and to test various emission reduction measures. The calculator is interconnected with the energy outputs from the energy and water calculator which is used to estimate energy demand and renewable energy integration.

1.4 How to use the calculator

The only tab that requires inputs is the main “Precinct Emissions” tab and all others are locked. The below provides a step-by-step guide to using the calculator.

1.4.1 Energy reduction target

In line with the ESD Technical Report, a number of energy efficiency programs and initiatives have been recommended to reduce existing energy consumption and therefore emissions. The emissions calculator includes an “Energy reduction target” scroll bar (refer Figure 1) which will allow for energy targets to be set depending on the programs implemented. A 1% annual energy reduction target has been included which can be tracked over time as part of the Environmental Management System (EMS) Key Performance Indicators (KPIs). Higher targets should only be set following dedicated programs being implemented.

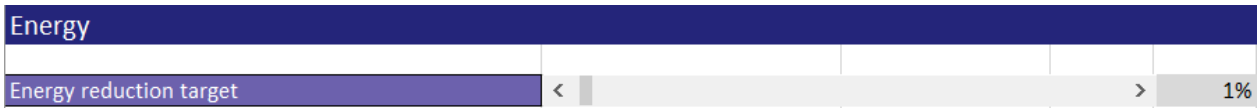

Figure 1: Energy reduction target scroll bar

1.4.2 Energy and water calculator

The Energy and Water Calculator will need to be populated first to calculate the additional demand and renewable energy being incorporated into the SAP (refer to the Energy and Water Calculator Guide). Once complete the energy outputs from the energy and water summary tab can then be added to the "Energy Demand" and "Renewable Energy Integration" tabs.

Energy demand		
New Developments	Energy Impact (MWh)	Timing
Thredbo Alpine Resort		
Charlotte Pass Alpine Resort		
Perisher Alpine Resort		
Sponars Chalet		
Ski Rider Hotel		
Kosciuszko Tourist Park		
Bullocks Flat Terminal		
East Jindabyne		
Jindabyne		
Proposed New Airport Site		
Sub-Precinct 1		
Sub-Precinct 2		
Sub-Precinct 3		
Sub-Precinct 4		
Sub-Precinct 5		
Sub-Precinct 6		
Sub-Precinct 7		
Sub-Precinct 8		
Sub-Precinct 9		
Sub-Precinct 10		
Total	-	

Renewable energy integration		
New Developments	Energy Impact (MWh)	Timing
Thredbo Alpine Resort		
Charlotte Pass Alpine Resort		
Perisher Alpine Resort		
Sponars Chalet		
Ski Rider Hotel		
Kosciuszko Tourist Park		

Figure 2: Energy and Water Calculator inputs

1.4.3 100% Renewable energy

100% renewable energy can be added to the emissions profile with a year for implementation which will automatically cancel out emissions for electricity in SAP.

100% Renewable energy PPA		
Initiative	Emissions factor	Year
100% renewable energy	-	2030

Figure 3: 100% renewable energy integration

Transport initiatives

The transport section includes a number of pre-populated initiatives that have been identified in the Structure Plan and technical studies. The scroll bars can be altered to increase the uptakes of technologies and solutions as the SAP is developed.

Transport		
Transport initiative	Per annum transport transition target	
Zero emission buses/coaches	< >	10%
Zero emission flights (hydrogen planes)	< >	5%
Zero emission walking / cycling transition / MaaS	< >	1%

Figure 4: Transport initiatives

It should be noted that increasing the zero-emission walking / cycling / Mobility as a Service (MaaS) option is directly linked to transitioning from private vehicles use. It is not recommended to increase the target beyond 2% as this has a significant impact on transport emissions which is unlikely to be achieved.

1.4.4 Waste and water

The waste and water sections have a simple target scroll bar for transitioning to alternative water sources (rainwater and recycled water) and reducing waste to landfill. Due to the relatively low emissions associated with waste and water, increasing the targets will have smaller impacts on overall emissions.

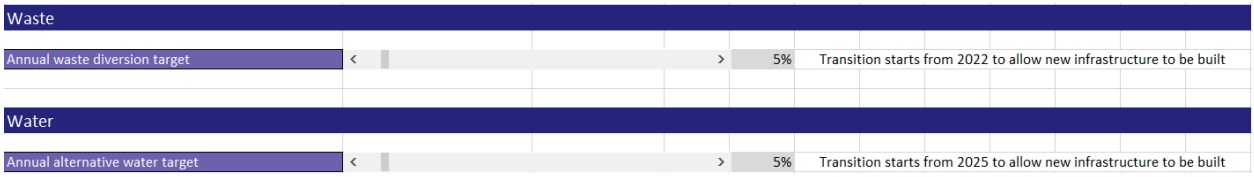

Figure 5: Waste and water scroll bar targets

1.4.5 Agricultural emissions

As there is agricultural land in the SAP boundary, emissions based on the Snowy Mountains SA3 statistical area have been incorporated. These can be excluded following confirmation of the emissions boundary.

1.5 Emissions projection graph

The emissions calculator automatically generates an emissions projection graph which includes a baseline "business-as-usual" trend line and the emissions reduction pathway being implemented by the SAP. The baseline includes existing emission reduction trends and projections including renewable energy uptake (based on the NSW Government Electricity Strategy and Renewable Energy Zones), electric vehicle projections and the introduction of flights which have lower emissions compared to combustion vehicles.

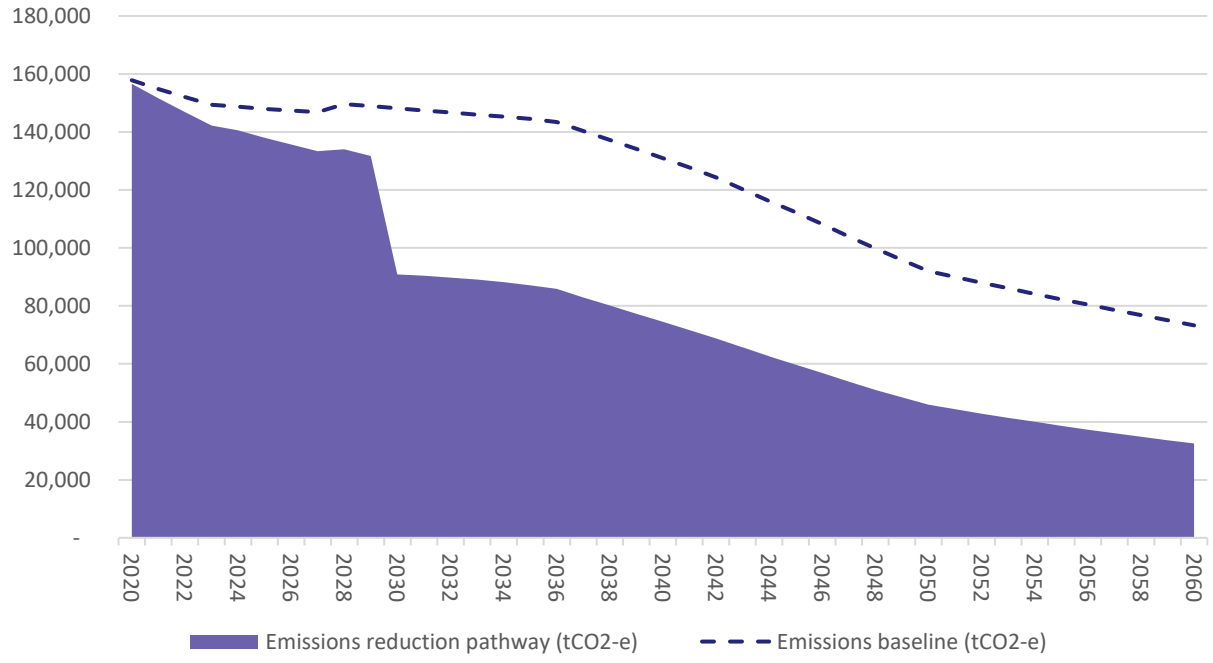

Figure 6: Emissions projection graph