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One Gippsland Smart Specialisation Project: Circular Economy

Regional Context Analysis

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Contents

1. Acknowledgments

The *One Gippsland Smart Specialisation Project: Circular Economy* has been developed with input from over 40 business, government, education and community participants. We thank One Gippsland, Latrobe Valley Authority, and all participants for their support, time, and contribution.

In the spirit of reconciliation, RMIT, Melbourne University and Federation University acknowledge the Traditional Custodians of country throughout Australia and their connections to land, sea and community. We pay our respect to their Elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today.

2. Executive Summary

- As efforts to mitigate emissions have intensified, a broad range of stakeholders including the Victorian Government has become increasingly focused on the opportunities of circular economy (CE).

- Local government authorities exercise considerable responsibilities for waste management and hence have increasing views to CE as a framework for developing processes which deliver various types of waste for new purposes.

- One Gippsland, through its Local Government members, has initiated a project using the Gippsland Smart Specialisation (GS3) process to explore innovation opportunities by implementing CE in Gippsland.

- The first step in GS3 is the regional context analysis which draws on demographic, documentary and interview data to understand the current government, business and community activities and perspectives on CE in Gippsland. Interviews with over 40 stakeholders from business, education/research, government and community have been conducted to date, providing information and insights to possible innovation activities.

- Interest in CE has accelerated in Australia in the last several years, particularly in response to international developments in waste management, energy consumption, and overall resource uses. It is widely recognised that implementing CE across Australia offers significant opportunities, in terms of cost reduction, job creation, environmental, social, and governance (ESG) priorities, economic resilience, and well-being.

- Taken together, these reports, policies and investment might represent a significant increase in focus on CE initiatives that offer significant opportunities for regional economies, especially in Victoria. However, ensuring these opportunities are seized, benefit whole communities, and are genuinely transformative, is far from assured.

- Given the importance of identifying the uniqueness of CE assets that can support innovation opportunities, the interviews with stakeholders have been crucial in illuminating the underlying substance and diversity which exists in the Gippsland economic and natural environment.

- The implementation of circular economic principles can help transcend the traditional natural resource and waste intensive take-make-dispose economic model. In a circular economy, natural resources are kept in circulation. This creates new economic opportunities and employment and has significant environmental co-benefits.

- The insights shared by the diverse mix of stakeholders suggest several areas in which innovation opportunities might develop:
    - A more integrated and efficient waste management system that can handle different waste streams from all different industries in the region;
    - Bioenergy (as a form of renewable energy generated from the conversion of solid, liquid and gaseous products derived from biomass);
    - Cellulose to replace Single Use Plastics (SUPs);
    - Solar panels recycling;
    - Textile recycling;
    - Regenerative agriculture and land restoration;
    - Seaweed farming;
    - Insect farming;
    - Aquaculture;
    - Gippsland Circular Economy Precinct;
    - Opportunities for regional specialisation hubs in waste and value-add streams (e.g. forestry in Bairnsdale, dairy in South Gippsland);
    - Education and awareness raising for community, industry and local government alike.
- In this report, we have sought to provide a fair and balanced summary of the major topics that emerged during the interview process. We are not expressing our opinions, but simply mirroring back what interviewees talked about during our conversations. The fact that some topics came out more than others is a consequence of the stakeholder mix we interviewed.

3. Introduction

As efforts to mitigate emissions reductions have intensified, a broad range of stakeholders including the Victorian Government has become increasingly focused on the opportunities of CE. While it has no clear definition CE refers to the development of systems in which business processes are designed so that waste is eliminated, products and materials are circulated at their highest value, and nature is regenerated.

Local government authorities exercise considerable responsibilities for waste management and hence have become actively engaged in CE as a framework for developing processes which supply various types of waste to new purposes. In this context, particular attention should be placed on the importance of reliability of services delivered for community, legislative requirements and the need to consider both efficiency and cost.

Working together as One Gippsland the local government authorities have initiated a project using the GS3 process to explore opportunities for innovation in the implementation of CE in Gippsland. They have been supported in this project by other One Gippsland members, the Department of Jobs, Precincts and Regions (DJPR), the Latrobe Valley Authority (LVA), and a team from the European Union Centre of Excellence at RMIT.

GS3 has been an integral part of the Latrobe Valley Authority's approach to developing the long-term future for Gippsland since 2017. It focuses on identifying the key local assets which offer opportunities for innovation, and on building the collaborative systems around those opportunities in order to foster productive and sustainable innovation. The approach draws on extensive experience, and proven success, in Europe which demonstrates that regions with dynamic, place-based innovation systems are more resilient in the face of economic, social and environmental disruption and transition.

The first step in GS3 is the regional context analysis which draws on demographic, documentary and interview data to understand the current government, business and community activities and perspectives on CE in Gippsland. Interviews with some 40 stakeholders from business, education/research, government and community have been conducted to date, providing information and insights to possible innovation activities in CE. This regional context analysis includes exploring the assets and resources which are available to support innovation, as well as the key policy initiatives that might be relevant.

We acknowledge that policy change and other initiatives are being progressed simultaneously with this work, including:

- Released in 2020, *Recycling Victoria: A new economy* is the state's circular economy policy and 10- year action plan to reduce waste and pollution and improve recycling;[1]
- In November 2021, the *Australian Renewable Energy Agency's (ARENA) Bioenergy Roadmap* was released, setting out opportunities that all levels of government, research institutions and industry can collaborate to grow Australia's bioenergy sector;[2]
- In November 2021, the Victorian *Waste to Energy Framework* was released as part of the Recycling Victoria policy;[3]
- The *Circular Economy (Waste Reduction and Recycling) Act 2021* (the Act) was passed by Parliament in December 2021;[4]
- As part of the Act, a 4-bin waste and recycling system (purple for glass, green for food organics and garden organics [FOGO], yellow for mixed recyclables, red for household rubbish) and a *Container Deposit Scheme* (which uses a cash reward to encourage people to return used drink containers for recycling) will be introduced;
- In May 2022, The Victorian Government has released its nine *Regional Economic Development Strategies (REDS)*, with Gippsland being one of them (*Gippsland Regional Economic Development Strategy*)[5] and circular economy is mentioned as an area to focus on; [6]
- On 1 July 2022, Recycling Victoria (RV) is established as a new regulatory agency for the Victorian waste and resource recovery sector (RV commits to a review of the waste to energy framework in 2023);[7]
- *Gas Substitution Roadmap*, released in July 2022, to help our State navigate the path to net zero emissions while providing greater choice and cutting energy bills;[8]
- On 30 August 2022 the *Environment Legislation Amendment (Circular Economy and Other Matters) Bill 2022* passed in Parliament. It is now expected to receive Royal Assent;
- Under Victoria's Circular Economy Plan, problematic single-use plastics will be banned across Victoria by February 2023;[9]
- *Gippswide Kerbside* collaborative procurement process (on organics processing, glass and mixed recycling, residual waste and household rubbish) being decided upon over coming months;[10]
- The Victorian Government is developing Regional Circular Economy Plans (RCEPs) for regional Victoria, including Gippsland. The **Regional Circular Economy Plan Gippsland** has been drafted in August 2022.

This innovation program is in line with these initiatives and will help to identify opportunities to promote them further. This leads to a report which provides:

- a review of the geographical, demographic and other data related to relevant issues in Gippsland;
- an overview of recent policy documents;
- a summary of data and perspectives on potential innovation opportunities gathered from the interview data.

The report concludes with a summary of possible opportunities for economic and socio-ecological innovation in CE in Gippsland. Development of initiatives to exploit these opportunities will depend on the quality and character of collaboration amongst business, education/research, local and state government, and community (the 'Quadruple Helix'). Effective project management to mobilise resources to realise the opportunities in appropriate economic, environmental and social settings will be critical as the project progresses.

This document is a key resource to underpin the inclusion of Circular Economy initiatives as an integral part of the Gippsland Smart Specialisation Strategy (GS3). As the report of the analysis of regional context, it will be refined on an ongoing basis, as new evidence becomes available. Much of the material set out here will be familiar to those deeply involved with the development of waste, renewable energy and similar initiatives in Gippsland. Nevertheless, it represents a crucial 'fact-finding' function to ensure that the GS3 process is based on a solid descriptive foundation. There is considerable intra-regional variation in some of the key variables explored. However, this document reports generally on the Gippsland Region.

The next step in the Circular Economy GS3 process will be presentation of the report to a stakeholder workshop. At the workshop, the project team will seek verification of the findings; an indication of further areas that warrant consideration (if any); and some indication of the perceived priorities amongst the innovation opportunities.

Following the outcomes of the stakeholder workshop, 2-3 of the innovation opportunities will be examined more closely in an Entrepreneurial Discovery Workshop (EDW). The purpose of each workshop will be for a knowledgeable group of Quadruple Helix representatives to consider whether the opportunity has serious potential. If so, an Innovation Working Group (IWG) will be formed to take the project to the point where there is a clear feasibility outcome.

4. The Place

Gippsland represents almost one fifth of Victoria, extending from Melbourne's eastern outskirts all the way to the state border with New South Wales in Victoria's far east. This includes the diversity of rivers, lush farmland, areas with propensity for drought, the Gippsland Lakes, forestry industry, fishing and snow country.

When the Hazelwood coal fired power station announced it would close in 2016 with only five months' notice, there was little time for preparation. In March 2021, the operator of the Yallourn mine and power station, Energy Australia, announced that it would close in 2028, four years earlier than planned. The longer notice period provides Yallourn workers and the Gippsland community a longer period to prepare for the closure than the five months' notice provided at Hazelwood.

The Inquiry into the closure of the Hazelwood and Yallourn Power Stations highlighted many different opportunities – the opportunity for the region to become a renewable energy hub is one of the most significant. Gippsland has many energy strengths. Natural assets such as geothermal aquifers and stable winds make it suitable for renewable energy generation. Furthermore, the region's history as a coal-fired power producer means there is significant transmission infrastructure across the region unlike any other district in Victoria.

Agriculture and food manufacturing and production are fundamental drivers of Gippsland's economy, with their fishing industry being the largest employer in this sector in country Victoria. Gippsland is a significant contributor to national dairy production, has a $1B horticulture sector,

and quality meat production to reference a few of the food and fibre sub-sectors. The food and fibre sector, complemented by new energy, health and well-being and visitor economy offer the foundation for Gippslanders to achieve decent livelihoods.

5. A worldwide shift towards Circular Economy

Human development has been fuelled largely by rapid and accelerating dependency on natural resources – and the extraction and processing of these resources are responsible for about 50 per cent of greenhouse gas emissions. About 20 per cent of Greenhouse gas emissions (GHG) emissions are caused by the extraction and processing of metals and non-metallic minerals. These emissions, as well as emissions from other materials such as plastics, can only partially be abated by energy technology solutions. Without business and policy model changes, resource use will more than double from current levels to 190 billion tonnes by 2060 and far exceed our planetary boundaries.[11]

We are approaching a decisive moment for international efforts to tackle the climate crisis. The number of countries who have pledged to reach net-zero emissions by mid-century or soon after continues to grow. However, according to a report published by the International Energy Agency (IEA) in 2021, the pledges by governments to date – even if fully achieved – fall well short of what is required to bring global energy-related carbon dioxide emissions to net zero by 2050, leaving around 22 billion tonnes of CO2 emissions worldwide. Most pledges are not yet underpinned by near-term policies and measures.[12] With the global population predicted to approach 9bn people by 2030, and 10bn by 2050, we are using more resources than the planet can provide. As a result, global labour and raw material costs are on the increase.

In this context, the Circular Economy (CE) has emerged as part of the solution to achieving global climate ambitions - one in which products, services and systems are designed to maximise their value and minimise waste. It's an all-encompassing approach where everything has value, and nothing is wasted.[13] Since the volume of waste cannot be eliminated immediately, investments in the recycling industry are an interim response. The move from an economy based on extraction and consumption to one of regeneration and restoration has become an increasing priority not only for policymakers around the world, but also for companies, promising new business opportunities and a decrease in environmental impacts.

6. Defining 'Circular Economy'

A 'circular economy' could improve efficiency, environmental sustainability, and community prosperity and well-being. Beyond this generally positive understanding, however, there is no common or shared understanding of what a CE actually is, exactly how it would function, what the shared benefits would be, or even how it might be achieved.

Its history is deeply connected to the history of the idea of 'Sustainable Development'. This context is critical. Like the idea of 'Sustainable Development', CE is a response to growing understandings of accelerating human impact on the environment, particularly climate change. While some scholarly definitions of CE focus on economic efficiencies and sustainability broadly, both the concept and policies are focused increasingly on the critical and pressing need for both climate action and climate justice. According to Sauvé et al. (2016), for example, "'circular economy' refers to a model of production and consumption that is fundamentally different from the 'linear economy' model that has dominated society".[14]

This fundamental difference is often overlooked in both discussions of, and attempts to implement, a CE. Often, these discussions and policy solutions focus almost entirely on waste management: a 'circular' or 'zero-waste' economy can be understood as an economy that is simply much better at recycling than a current system. While recycling is certainly a key component of a CE, it is far from the full story. Further, an overwhelming focus on recycling can miss innovation and

transformational opportunities offered by a broad understanding of CE. If we look at the 5 R's (Rethink, Refuse/Reduce, Reduce, Reuse/Repurpose, Recycle) of the Waste Hierarchy, in fact, recycling represents the last option.[15]

Recycling occurs at the end of a product's life cycle. A CE, however, aims to fundamentally transform that life cycle, from the beginning rather than the end. A well-designed and fully implemented CE would in fact require very little recycling, as it aims to dramatically reduce waste production. This system is characterised by two inputs: biological and technical. Biological components can be restored into the biosphere without waste, while technical components can be continuously re-used and re-purposed. This, then, is a question of design: in a CE, waste is designed out of the system. Circular economy is a design challenge. Design for long life ensures products remain in the system longer. Design for disassembly ensures that different components of a product can be upcycled.

Implementing such a fundamental transformation is far from straightforward. In the interim, significant investment in recycling capacity and infrastructure is required. Designing such infrastructure is especially complex, given that it should be understood as a step in the process, rather than inadvertently locking in waste streams or doubling down on linear systems and products. For the purposes of this investigation, a shared understanding of CE might be:

> An economy that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles.[16]

This model of production and consumption would mark a fundamental departure for the regional economies, because, as Sauvé et al. (2016) argue:

> The circular economy aims to decouple prosperity from resource consumption, i.e., how can we consume goods and services and yet not depend on extraction of virgin resources and thus ensure closed loops that will prevent the eventual disposal of consumed goods in landfill sites.[17]

The circular economy is based on three principles, driven by design:

- Eliminate waste and pollution
- Circulate products and materials (at their highest value)
- Regenerate nature

It is underpinned by a transition to renewable energy and materials. A circular economy decouples economic activity from the consumption of finite resources. It is a resilient system that is good for business, people and the environment.[18]

7. Moving from paper to action

At the global level, the Sustainable Development Goals, adopted by the United Nations Member States in 2015, include many related ambitions. The CE holds promise for achieving multiple SDGs, including SDGs 6 on energy, 8 on economic growth, 11 on sustainable cities, 12 on sustainable consumption and production, 13 on climate change, 14 on oceans, and 15 on life on land.[19] There are efficiency gains that can come with the transition to a CE. United Nations Industrial Development Organization (UNIDO) estimates that by 2025, around $1 trillion could be saved in materials under circular business models. New businesses and jobs will be created in resource recovery, repair and remanufacturing to the benefits of national economies, entrepreneurs and workers.[20]

According to research published in 2021 by García-Sánchez et al., the success of CE initiatives depends on the availability of financial resources and the efficacy of the institutional environment.

Firms located in European Union countries, for instance, show a heterogeneous and greater commitment to the CE due to operating in institutional environments in which there is a common strategy. The European Green Deal,[21] which has been reinforced with a post-covid Next Generation EU recovery plan, targeting circular transformation through a package of measures (structural funds, research and innovation financing programmes and so on), helped European businesses and consumers in the transition to a more sustainable economy.[22] However, while Europe's policies on CE have continued to grow and gain importance throughout the continent, its implementation still seems to be complicated for many Member States.[23]

Rather, an impartial assessment conducted by the European Environmental Agency (EEA) indicates that Europe is still very waste oriented.[24] The EEA has examined CE and resource efficiency policies across 34 countries. Noting that approaches to the CE and resource efficiency vary greatly from country to country, they also identified some trends. For instance, economic interests, such as competitiveness, jobs, growth, security of supply and reduced import dependency, continue to be the predominant driving forces of material resource efficiency and CE policies, followed by environmental concerns and regulatory requirements. In addition to that, good practice in the transition to a more circular economy still tends to have a non-mandatory character, with hardly any targets to assess and evaluate its progress being set.

When looking at a company/business level, evidence points to CE not readily being included within corporate sustainability reports. Opferkuch et al. (2022) reviewed 138 reports that were published in 2020 by 94 European companies, not restricted by sector. Results showed that nearly all companies are referencing CE explicitly, however, only 7 per cent of them integrate CE within all five sustainability reporting elements. Less than one third of companies were found to include both targets and indicators for CE suggesting that overall, CE content within sustainability reports is largely superficial and inconsistent.[25]

8. Which countries are leading the way?

This is not easy to assess. [26] According to Burdett, 'If we look at policies, metrics, design, reuse and recycling rates, EPR [extended producer responsibility] schemes, business models, and innovation, they each present a complex picture—and there isn't one easy answer about which nation is "leading the way". Every actor committed to working on the CE is probably leading the way somewhere, and all are contributing to the conversation'. This demonstrates that a systemic change is needed, at local scale, as well as at national or international level.

Within the international context, some countries and regions have higher circular economy scores. In Europe, a 'two-speed' advancement towards CE was identified in a study published by Mazur-Wierzbicka in 2021.[27] Leading countries, those most advanced in pursuing operation according to CE principles, include Germany, Belgium, Spain, France, Italy, the Netherlands and the United Kingdom. The second pole accommodates EU countries in which transformation towards CE is happening at the slowest pace. This group includes mainly countries of the Central and Eastern Europe and the countries of the south of Europe. Mazur-Wierzbicka argues that the countries that are most advanced in their transformation towards the CE (highly industrialized countries) began to feel problems of excessive waste generation, exhaustion of resources, environmental pollution, increasing consumerism or unbalanced consumption much earlier than the economies of European countries which are developing more slowly (e.g. East European countries that have their economies been operating according to the principles of free market and competitive economy since late 1980s).

While ranking nations in such a dynamic and complex area is problematic, researchers have highlighted encouraging progress in several diverse countries. Some countries and regions are "leading the way", such as the Netherlands, Scotland, Slovenia, France, Belgium and Finland. Some examples of good practice of CE policies are given by the Netherlands with a *Green Deal Circular Procurement* invoking over € 100 million in procurement done circular, France with 20 extended producer responsibility (EPR) schemes in 14 sectors, and Sweden with a low VAT rate

and income tax reduction for certain repairs. Others are making impressive strides, such as Italy which increased their municipal waste recycling rate from 17 to 45 per cent since 2001 and Portugal with a broad CE policy mix including many EPR schemes.[28]

The Netherlands is a first mover, having set firm targets to reduce natural resource consumption in its economy by 50 per cent by 2030, while the country's target for 2050 is a fully circular economy. In order to achieve this goal, the PBL Netherlands Environmental Assessment Agency developed a framework and baseline assessment for monitoring the progress of the CE in the Netherlands. This document lays the foundation for a system to monitor whether the transition process and its effects on resource use, environmental pressure and the economy are progressing as planned, placing the country at the international forefront of such developments.[29] While Germany, being a very heavy industrial economy, has looked at CE through material flows and material availability, avoiding any processes that would jeopardise the availability of materials, the approach in the Netherlands has been more from an entrepreneurial angle, innovation in materials, business models, because that is the type of economy they have.[30]

CE is not only being implemented in Europe, but in Asia. China has had CE in its policy since the early 2000s. It was part of the eleventh five-year plan and we're currently on the 13th. To begin it was primarily an industrial ecology agenda, looking at how the waste of one company can become resources for another. It was very much end of pipe, the three R's: reduce, reuse, recycle. But the latest *Circular Economy Policy Portfolio*, which came out in 2017, looks at eco-design (both as a concept and as a policy) and extended producer responsibility. A lot of cities are also looking at CE so it seems that the Chinese perception of the concept has evolved massively. Rather than a focus on 'how do we manage the flows' perspective, it has become an innovation agenda.[31]

Japan is another early CE innovator, with several policies introduced since the early 2000s to reduce, reuse and recycle. A densely populated, highly industrial and resource-constrained country, Japan adopted ambitious waste-management policies early. Today, it boasts impressive recycling rates, empowered by a culture of collaboration and continuous industrial innovation. While its policies have not always been explicitly linked to the CE, they are a source of inspiration for many practitioners. Its latest *Circular Economy Vision 2020* policy roadmap encourages industries to shift to new business models with higher circularity and to improve resource efficiency. It has also introduced a *Resource Circulation Strategy for Plastics*, to tackle the waste problem from single-use plastics.[32]

The CE remains a developing concept, exemplified through the amount of discourse surrounding the definition of the phrase. The EU has identified 3 main areas that contribute to the closing of material loops and increasing resource efficiency that have been effective. The three policy areas are:

1. policies for reuse, repair and remanufacturing;
2. green public procurement and innovation procurement; and
3. policies for improving secondary materials markets.

Finally, a potential policy mix, including instruments from the three policy areas, could outline a possible pathway for transitioning to CE policy making. Policy interventions are required in different levels, from local and regional to national and international, to tackle the challenges of CE in the most effective way. For example, innovators that already embrace CE principles in their business models would need sufficient assistance from the policy environment they operate, to scale up and be able to compete at a national/international context. This "bottom-up" approach is expected to highlight important issues for future policy research.[33] However, in emerging economies, a top-bottom approach seems to be more needed, particularly for small and medium enterprises (SMEs).

9. Circular Economy in Australia

Interest in CE has accelerated in Australia in the last several years, particularly in response to international developments in waste management. It is widely recognised that implementing a CE across Australia offers significant opportunities, in terms of cost reduction, job creation, economic resilience, and well-being. There is also significant potential for increasing sustainability and embedding efficiency, given that in Australia, 27 per cent of waste is still sent to landfill (compared, for example, to 2-3 per cent in the Netherlands).[34]

In 2021, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) published a report focused on how we can catalyse the transition to a CE in Australia.[35] KPMG recently quantified the potential economic benefits of circularity across the sectors of food, transport and the built environment.[36] A significant amount of research has also been conducted across the university sector, with Deakin University launching its own *Circular Economy Initiative*[37] and RMIT launching a *Circular Economy Hub*.[38]

In Australia, even focusing on recycling and improving product life cycles alone offers significant opportunities. For example, in a 2017-18 Senate inquiry into Waste and the Recycling Industry in Australia, the Waste Management Association of Australia claimed that 'for every 10,000 tonnes of waste recycled, 9.2 jobs are created'.[39] Similarly, a 2020 New South Wales report, *The Circular Economy Opportunity in NSW*, argued that a state-based CE could generate in the built environment, transport, manufacturing and recycling industries alone up to 150,000 jobs over the next five years.[40] A growing community awareness is also emerging thanks to TV shows such as ABC 'War on Waste'.[41]

In Victoria, there is also considerable interest and policy action in CE. Established under the Sustainability Victoria Act 2005 as a statutory authority, Sustainability Victoria (SV) plays a pivotal role in accelerating Victoria's transition to a circular and climate-resilient economy by delivering education and behaviour change programs, grant funding, industry development and investment facilitation.

In 2017, in response to the Chinese government's waste import restrictions, the state government released its $37 million *Recycling Industry Strategic Plan*.[42]

The four goals of the plan are to:

- stabilise the recycling sector
- increase the quality of recycled materials
- improve the diversity and productivity of the recycling sector
- develop markets for recycled materials

In 2020, the state government built on this plan through the introduction of a 10-year circular economy plan, *Recycling Victoria: A new economy.*[43] The plan aims to fundamentally transform the state's recycling sector, reduce waste, create thousands of jobs and set Victoria up for a more sustainable future. The plan will invest more than $300 million in a suite of landmark reforms dedicated to shifting Victoria to a circular economy.

The plan outlines five key areas for action:

- a new four-stream waste and recycling system for all households across the state for better and more recycling and less waste
- a cash for cans scheme that rewards return of used drink cans, cartons and bottles for recycling, and reduces litter
- a stronger waste and recycling industry with new infrastructure and innovative waste management solutions for better and more recycling and reuse, and less waste
- new recycling laws and governance to support best practice waste management, resource use and recycling
- a state-wide ban of single-use plastics and promotion of reusable items that reduce waste and pollution for a cleaner and healthier environment.[44]

As part of this plan, RV recognises that Victorian businesses are central in the transition to a circular economy and details a commitment to improving business productivity, reducing waste and accelerating innovation. From this commitment, *Circular Economy Business Innovation Centre (CEBIC)* was born, a virtual hub that, through event series, networking opportunities and workshops, works to develop partnerships with organisations at the leading edge of circular economy innovation. Launched in November 2020, CEBIC is delivered by Sustainability Victoria and DELWP.

Following the introduction of Recycling Victoria in July 2022, many of Sustainability Victoria's program names will change to remove 'Recycling Victoria' from their title and instead highlight our role in transitioning to a circular economy.[45] SV has a role in the State Government's recycling policy. They continue to work in the same capacity with local governments, councils, and alpine resort boards to increase recycling and processing capacity, roll out best practices in waste management and education, and support communities to investigate and implement circular solutions.[46] SV is involved in quite a lot of product stewardship schemes.[47]

Here follows some relevant reports and work that SV has collaborated on and/or funded:

- Victorian Circular Activator (VCA) is a CE innovation hub, funded partially by SV. They provide activation in the form of applied research, activation programs and a physical innovation hub: https://www.circularactivator.com/
- VCA ecosystem mapping, an ongoing piece of research that is mapping the circular economy ecosystem in Victoria: https://assets.sustainability.vic.gov.au/cebic-microsite/Report-CEBIC-Research-Victorian-Circular-Activator-ecosystem-mapping.pdf
- Research on circular opportunities for stone fruit waste: https://assets.sustainability.vic.gov.au/susvic/Report-Waste-Valorisation-options-for-stone-fruit-waste-Monash-University_2022-07-18-051339_ehur.pdf
- Research on designing out on-farm food waste: https://www.cebic.vic.gov.au/research-and-insights/how-can-we-design-out-on-farm-food-waste
- Dairy Sector Food Waste Action Plan: https://www.dairyaustralia.com.au/manufacturing-resources-and-support/dairy-sector-food-waste-action-plan#.Yww5NHZBwuV (should be published soon)

On 30 August 2022, *the Environment Legislation Amendment (Circular Economy and Other Matters) Bill 2022* passed in Parliament. This Bill aims to support the state's transition to a circular economy and establishes a waste to energy (WTE) scheme. According to the Energy, Environment and Climate Change Minister Lily D'Ambrosio, the thermal WTE plan 'will ensure appropriate waste to energy investment and help Victoria transition to a circular economy, support new jobs and reduce the waste sent to landfill'. Victoria is predicted to generate 20.8 million tonnes of waste annually by 2040, according to Sustainability Victoria. A big jump on the 15.86 million tonnes created between 2019-2020.[48]

After waste avoidance, reuse, and recycling, waste to energy is the final opportunity to get value from material that would go to landfill. The Victorian waste to energy framework places a one million tonne cap on the amount of waste that can be heat treated to make energy and outlines how the cap is to work. The Victorian Government will support waste to energy technologies where they:

- meet best-practice environment protection
- reduce the amount of waste sent to landfill
- reduce greenhouse gas emissions
- meet best-practice energy efficiency
- create jobs and economic development.[49]

This is an important milestone in delivering the Victorian Government's circular economy reforms. In particular, the Bill establishes Victoria's thermal waste to energy scheme in legislation. The legislation enables the processing of certain types of waste (permitted waste) at thermal waste to

energy facilities to be capped. It provides for the Head, Recycling Victoria to licence thermal waste to energy facilities in Victoria. It also ensures the Head, Recycling Victoria will not be able to issue licences that exceed the annual cap on permitted waste. DELWP is developing regulations to support this legislation in two stages:

- Stage 1: regulations will be developed to allow existing waste to energy operators to apply for licences before the end of the year;
- Stage 2: regulations will be developed to allow for applications for a cap licence in 2023. DELWP will consult on these draft regulations in late 2022 – early 2023.

Taken together, these reports, policies and investment might represent an increase in focus on CE initiatives that offer significant opportunities for regional economies, especially in Victoria. However, ensuring these opportunities are seized, that they benefit communities as a whole, and are genuinely transformative, is far from assured. In 2022, Iyer-Raniga, Gajanayake, and Ho, in *Mapping the Circular Economy Ecosystem of Victoria*,[50] found that although Victoria has a level of engagement with CE, this is sporadic, and set in a largely linear economic system. There remains no consistent understanding of CE among stakeholders, and the focus of CE policy and implementation continued to be end of the line waste management. Collectively embracing a systemic approach and transition to a CE, with attention to re-design, re-purposing and embedded sustainability, remains a significant challenge.

10. Findings from Gippsland

Participants' definitions of Circular Economy

As previously mentioned, the concept of CE has a wide range of meanings, adopted by various stakeholders, and often applied from different perspectives. Hence, it can be misinterpreted and misunderstood. Although some research points out that "there are various possibilities for defining circular economy", others claim that "there is no commonly accepted definition of circular economy".[51] There is a consensus among social scientists on the attractiveness of the concept. However, evidence suggests that a commonly accepted definition of CE does not exist, mainly due to the diverse disciplinary background of authors and their focus areas.[52]

This emerged from interviews with participants as well. Here follows a selection of some of the definitions they have provided:

> Whatever waste is produced this gets reshaped or repurposed into something else. It's about supporting innovations, particularly in the use of renewable energies.
>
> It's about reusing products more than once, for a lesser purpose, but ideally would be good to use it for its highest reuse multiple times rather than single time single purpose.
>
> Using a material at its highest use for as long as possible
>
> Trying to understand what the shape of CE may be in the future is about understanding the reliability of the services, low risk, and cost effective. It is also about engaging with the community and ensuring that these services are applicable to the community.
>
> Maximising resources value. Reducing the use of virgin resources. Adopting sustainable strategies. Waste management action plan is the corner stone of what is waste minimisation. Minimisation gets overlooked when discussing CE. CE stems beyond waste.
>
> It is a system where, whether it is a region or a town or district, you need to think "what's coming in? How much of it is coming in? What's it made of? Can we make it better, more sustainable? What are the leftovers of what's coming in as well? Because every manufacturing activity has leftovers. What can we do with the leftovers? How can we cut

down the leftovers?" It's about looking at every step of that way to say, “is that really sustainable? Can we do something better?” CE is about looking at any waste that we've got in the process that we can draw back in and make sure that we're using in this circular fashion.

Circular economy is simply about reducing the inputs needed to create a product. So, for example, if you have an aluminium can, you can actually melt and recycle that and then restamp the aluminium, you would then maintain a circular economy on that particular product. It can be many forms of different material that can be repurposed or reused into another product. Another part of the circular economy is also about making something achieve its full lifespan.

My understanding would be that that the main thing is to get rid of the concept of waste and turn anything that at the moment is treated as waste, into a resource for some other use.

My mind goes back to idea of cradle to cradle and the work by Michael Braungart and William McDonough. Circular economy is one that only produces products that are made from materials that we know can be recaptured, recycled, repurposed, reused. Circular economy is where systems are in place to ensure materials are constantly recycled and where that cycling is powered by renewable energy sources. Then we're mimicking nature, right?

My idea of circularity is that a product, like a tin can be reused, recycled, repurposed and goes all the way around. And it has different lives after its original one. Circular economy is also about the industry opportunities associated with it. So, thinking about in our regional context we have quite a strong industry footprint with a good flow of industries associated with achieving circular economy outcomes.

My perception of circular economy is first, to design waste out, not to have waste. Second, is purity of resources. What you cannot extract, then recycle, repurpose, redesign. It is fundamentally tied to the purity of resources, designing waste out and keeping any element within the cycle of use for as long as possible. When the purity of resources really comes to its own end, when it cannot continue to be reused, what can be done with it? Is it easily biodegradable? Is it easily recycled? There's an element of cultural shift needed to move people thinking from a linear mentality to a circular mentality and that means people understanding more how to move from a linear economy to a sharing economy.

Circular economy is about the use and reuse of waste as a resource. Virgin natural resources have been used to create the product and then the circular economy is designed in a way that as the product is used and reused or repurposed, becomes feedstock for a different product. So, preventing it from going into landfill.

The biggest barrier is probably in people's minds, in that lack of appreciation for the truly systemic nature of the change that we're talking about. Real circular economy requires that we think about the entire cycle. Real circular economy is how can we make a product out of materials that can come back to us to make new products in two years’ time or 10 years’ time. And that requires engagement way outside the local government, involving the whole business sector as well government, other tiers of government who set those regulations and standards and expectations with consumers who might need to be prepared to pay a little more for the product.

It is about creating a closed loop and minimal impact production systems, it is about taking nutrients and energy from one system and applying them in other systems, so that there is limited waste of nutrients and energy and materials in the economy.

From the data collected we can tell that, despite the multitude of definitions, there are some common threads which can be traced back to the definition provided by Kirchherr et al. (2017), which is the result of a coding approach of 114 previous definitions. They defined CE as:

> *an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers.*

This means that participants had a general understanding of some of the principles of CE, but most people considered CE in the sense of what to do with the problem of waste, rather than the opportunities that come with implementing this approach holistically. These are the key elements that emerged from the definitions provided by this project's participants:

- Reduce, reuse, recycle materials (3R framework)
- Use of renewable energy
- Elimination of waste
- Adoption of sustainable strategies
- Community education

However, as pointed out by a few respondents, CE must be understood as a fundamental systemic change, recognising the importance of the economy needing to work effectively at all scales – for big and small businesses, for organisations and individuals, globally and locally.[53] CE definitions provided somehow lack or do not stress this systems perspective enough. As someone mentioned "You've got to bring everybody with you, because otherwise what you do is in isolation". But it is also about understanding the entire process and its impacts at various stages through a comprehensive full cycle assessment.

CE's link to sustainable development and social considerations is weak also, with no mention on its impact on the development of the society, social equity, human well-being, and future generations. In these definitions, there is little focus on the role played by the consumer as a second enabler of CE (although the participants did emphasise this in answers to other questions) or on their preferences (there is rather a prescriptive approach where people need to be educated to do something). In short, people's (community but also policy makers) understanding of CE is still forming and knowledge is a big barrier that will need to be addressed through consistent education and awareness raising.

Key opportunities, challenges and enablers to an effective implementation of CE

During the interviews conducted between July-August 2022, participants identified several dimensions of CE as the concept is developing in Gippsland. The major topics discussed by participants were (in decreasing order of the total number of times the topic was mentioned):

1. Waste management/recycling
2. Renewable energy
3. Coordination, collaboration and policy framework
4. Community education and engagement
5. Public and private investments
6. Research and development

Consistent with the earlier sections of this report, the two main areas of growth (in circular terms) for Gippsland are seen to be waste management/recycling and renewable energy.

1. Waste[54] management and recycling

Most of the participants (mainly municipal and industrial) interviewed strongly focused their views on issues related to dealing with waste management. In this context, it appeared evident the barriers to circular economy were very much depending on the type of material/waste and its value on the market.

Waste has become quite a high value commodity, particularly because there are many challenges for local governments to work out what to do with it (not only to remove it but to do something with it). Up until recently, Australia and Victoria had sent low-grade waste to landfill or to China. Since China began enforcing restrictions on the importation of recycled materials under its 2018 'National Sword' operation[55], new strategies have had to be developed. However, participants highlighted the fact that high-quality material recovery facilities and factories that can use recovered waste product are not in place. At the same time, different rules apply in different LGAs.

Logistical issues, such as big distances between different parts of the region, the quantity/quality of materials, and the need for better sorting and recovery are also major obstacles. As one participant said, "it's hard to set-up a business in a regional area in an innovative space when you know that you're not the epicentre of where all those materials flow. The availability of feedstock in regional areas is dispersed with travel distances often across long distances. You can see a completely different situation in places like Dandenong or Sunshine, where you know that all roads already lead to those industrial precincts". A potential solution would be more investment in the creation of a broader and more efficient infrastructure (i.e., better rail and port connections) to improve the network performance within the region and to meet its freight challenges. For some, for instance, the nearest recycling glass plant is in Albury (NSW); hence, there is an emerging interest in the region in setting up glass processing plants. Industry response to collaborative tenders are competitive and aim to support the consolidation of material in the region.

As another participant noticed, "the Gippsland region needs the volume and quality right to bring the necessary change to attract remanufacturing or reuse. Without a product to sell or make available to an industry, things will remain the same". A collaborative procurement process could be the key. It was observed that the six Council Shires in Gippsland are currently doing a *Region-wide Kerbside Collaborative Procurement* project delivered by Resource Recovery Gippsland, which focuses on their FOGO collection, for residual, mixed glass recycling and residual waste.[56] Organic waste in landfills is the main contributor of greenhouse gas emissions. The hope is to attract an organisation who will set up a processing facility, which will be able to get that organic material out of landfill. In turn, this will significantly lower our greenhouse emissions that come from landfill.

Currently there are 15 Material Recovery Facilities (MRFs) used by Victorian councils - nine in Melbourne, five in regional Victoria and one in New South Wales at Albury. Together these MRFs process approximately 570,000 tonnes of kerbside recycling each year. Underpinning a Gippswide kerbside collaborative waste and resource recovery is the establishment a 50,000-tonne capacity MRF, producing recyclable product at the quality and quantity necessary to supply new markets and attract new industry, jobs and investment. The Morwell Heavy Industry Precinct in Latrobe City has been earmarked as an ideal location for such a facility. To secure a long-term, large-scale resource recovery hub in eastern Victoria, Government and industry partnerships will be essential. The $30 million facility could be funded jointly by the Victorian and Commonwealth Governments, alongside with private investment.[57]

In this regard, Food & Fibre Gippsland has applied GS3 to the $7 billion Gippsland sector[37] to undertake feasibility and technical studies for an Advanced Vegetable Processing facility to valorise non-consumed fractions from the horticulture sector. This process has involved government, industry, and researchers. Growers have been involved in the whole journey, and it has involved people like CSIRO throughout that development. That project has now had complete feasibility and investment logic mapping done on it. It is now ready, and they are starting to seek discussions about potential investment for this project in the region. It promotes circular economy thinking and will address up to 40 per cent of waste that is left on growers' farms.[58]

Wet waste residues can become a great opportunity for the region. Through use of anaerobic digesters, it is possible to extract gas for local use from manures, food processing wastes, and similar wet materials. This process also involves the production of fertiliser products, which will be put back into the agricultural industry from which they were extracted. This is what a participant had to say in relation to a potential way to create a more systemic approach:

> Once you have a big anaerobic digester plant or a series of them linked by common plumbing, you can commercially connect around 400 different dairy farms so that it can do to this industry what an ordinary reticulated system would in a human suburb. The next thing though is to get them from wet sloppy digestate (which look like thick oil when you get them out of the plant) to a dry state, into the product that people want. The technology to do this was used at the demonstration plant in Bacchus Marsh.[59] Building this in connection to forest processing/dry pyrolysis plants means that you have surplus heat to dry the organic wastes and turn them into the finished products that the local agronomists are going to need.

Gippsland Regional Organics, which is located in Dutson Downs (in Wellington Shire), is one of the largest facilities treating waste from their own wastewater treatment facilities as well as waste from commercial customers, including industrial, car, truck and machinery wash water, poultry manure and animal effluent, green waste, and food organic and garden organic waste.[60] While reducing the amount of waste going to landfill, they use green waste to manufacture multiple compost products that can be reused, for example, in agriculture safely to improve crop yields. As a participant stated "this is probably the most obvious and basic example of a true circular economy. We're taking organic and food waste and getting it back into the soils that grow our food". Food waste can also be used as a sustainable feed for animals (to grow insects, to feed aquaculture systems, or to feed chickens).

Quite interestingly, although they are based in the Wellington Shire, they take the bulk of Melbourne green waste, but they don't take Gippsland's waste. According to a participant, "this is due to the fact they do not offer sorting arrangements. They have been invited to. Material they do receive has been pre-sorted. In the case of Bass Coast, for instance, FOGO goes to Dandenong for sorting and is then trucked back to Dutson Downs". As some might argue, this is not the most effective solution for preserving and renewing water, energy and material resources at local level. Many experts agree that achieving circularity at the local level is a key first step to moving toward a circular economy worldwide.

Another aspect that Gippsland Regional Organics is trying to address (a 'missing link' as they call it), which could make their activities truly circular, is the potential opportunity of using their resources to generate renewable energy. This could come from their massive waste and water streams, as well as from installing wind turbines on their land.
Another challenge connected to the reuse and supply of waste materials is the standardisation of the recycling process, certification of new potential products, and Environment Protection Authority Victoria (EPA) requirements. As someone observed "because you have a variability in a feedstock, you have a variability in the product that you produce. And by not having the consistent data to be able to form a standard, it makes it very difficult then to create a market around that product and to sustain a circular economy around it". To substantiate this statement, the participant provided a few examples that clearly show the impact of lack of standards on businesses:

> Manny's Market was unable to sell a compost product or anything similar because it didn't meet certain criteria. Instead, they have utilised it with a couple of local market gardeners to regrow vegetables, which they could bring back into the shop. With solar panels, your issue is going to come down to the legal body for the installers. Clean Energy Council's regulations are heavily designed around the use of new panels, but they do not have a specific system to allow you to utilise old panels. A similar thing occurs with the dehydration of food. There is a lack of standard which would allow that to be commercially viable.

Currently, there are also serious issues around waste contamination. Many complained about the fact that "people don't put the right rubbish in the right bins. And once they contaminate it, it goes to landfill. And companies contracted don't have the resources to be picking everything out and cleaning that". Others mentioned that "some people don't want to go out of their way too much" particularly when it is about travelling long distances to give back their rubbish. Increasing garbage charges also creates pushbacks. People need to be better informed about the potential benefits of moving from a linear to a circular economy, but the transition should be made easier for them to be part of (including the technical side of the process).

Participants believe that educating people is important. Building their capacity would help to improve the involvement of the community while contemporaneously fighting back some anti-government attitudes (which are framed by a deep-rooted sense of being disadvantaged felt by many people). However, the materials need to be recycled easily which depends on having the technology and equipment that will be able to separate different elements of waste. A participant suggested that "we need to move away from the high-performance composite materials that are extremely difficult to break apart and recycle. So, we need to be looking for more elegant simple solutions, more easily reusable materials than the ones that we have now, materials not contaminated by other materials. We must keep it simple".

Another participant seemed to echo this point and provided a more holistic approach to waste management which distinguishes between an "industrial cycle" and a "biological cycle":

> We should not let ourselves get caught in conversations that are exclusively about "how can councils better intercept waste and make sure it doesn't go to landfill?" To me that's like standing at the bottom of the cliff with an ambulance. We should be engaged throughout the entire product lifecycle, ensuring that products are only made from materials that we know we can recycle and there's stewardship in place. We should have an "industrial cycle" and a "biological cycle" in our economy, so that when we are using materials like heavy metals or plastics or things like concrete, they are not biological materials, we should be using them in a way that makes sure they go back into the industrial cycle and can get reused or recycled. The biological materials should go back through a biological cycle where they can either be broken down and reused again and ultimately composted. When we blend, we create these monstrous hybrids like these materials that are so intertwined that both cycles end up contaminated and, ultimately, we cannot recycle them. We need to keep those two cycles separate.

All forms of plastics that go to landfill are a big issue as well for which there is still no solution. The disposal of plastic-based materials raised several questions: "do we look at taking a piece of plastic purely as a fuel (because basically it's an oil)? For instance, do we take it through to being a high-grade aviation fuel? or do we take it back to its precursor to make it back into a plastic?". All these options are possible, but they rely on electricity and on access to new infrastructure. In agriculture silage is wrapped in plastic, a low-grade plastic that is not recyclable and, as one participant commented, farmers still need a recycle centre where they can dispose of it.

Rubber and plastic, for instance, can be reused in road construction or make road signs or bollards, which in many cases are made of aluminium or other metals. A Department of Transport spokesperson says the recycled roads are demonstrably better. For instance, performance testing of a Victorian-made asphalt mix containing the equivalent of approximately one million recycled glass bottles, 746,000 plastic bags, 420 tonne of reclaimed asphalt and 21,800 printer cartridges at a site on the Hume Highway near Euroa has shown a significant improvement in the longevity of asphalt.[61] Other materials, such as recycled crushed concrete, crushed brick, crushed glass, recycled steel, Reclaimed Asphalt Pavement (RAP) are commonly used in construction to supplement traditional aggregate and sand products extracted from quarries.[62] As a participant argued, "the opportunity for a regional Materials Recovery Facility (MRF) function will address many of these issues – providing the quality and quantity of material required for re-processing to be viable".

Textile waste was also a reported issue that could turn in a potential resource not only for Gippsland, but the country as a whole. Annually Australian's acquire an average of 27 kilograms of new clothing per person, and discard around 23 kilograms of clothing to landfill each year.[63] According to a participant, "charitable recyclers—like Salvos and local op shops—are struggling to manage the flow of used clothing. Four in ten of them closed during the pandemic and many of them have workforce shortages". On top of that, Melbourne's materials recovery facilities have seen a significant increase in textiles and clothing contamination in the recycling stream: up to 28 per cent of contaminants by weight. There are very limited options for recycling textiles in Australia, so this might be an area to focus on.[64] Supporting upcycle enterprises where garments and fabric are given new life and Government regulations (e.g. banning certain substances, standardised labelling and licenses for developing products) can support the transition to a circular economy.[65]

With regards to some of the four most common waste streams in our economy (plastics, tyres in automotive and mining, glass and paper), CSIRO was tasked to lead the development of a *Circular Economy Roadmap* to explore circular economy opportunities for Australia. In 2020, CSIRO consulted with 83 industry, research and government representatives to determine what solutions are available and published a report which identified the challenges that will need to be overcome moving towards a circular economy:

- Loss of source material through sub-optimal product design, consumption, and collection;
- Lack of reprocessing capacity;
- Lack of end markets for secondary materials;
- Lack of consistency across jurisdictions in consumer education, industry standards, and waste governance;
- Lack of system-wide capability to support a circular economy.[66]

CSIRO's 2021 Circular Economy Roadmap found innovation could triple job creation from resource recovery by designing new products and materials, advanced manufacturing, and in embracing new business models that will create domestic and export markets for waste streams. Increasing Australia's recovery rate by just 5 per cent would add an estimated $1 billion to GDP.[67]

Discussion

In 2019-20, Victoria generated 15.86 million tonnes of waste from all sectors (municipal, commercial, industrial and construction sectors). Of this amount, 2.37 million tonnes were collected from households (with 13.3 per cent being contaminated). 11.05 million tonnes of waste was diverted from landfill. The remaining 4.81 million tonnes went to landfill, which means that 69.7 per cent of waste generated across all sectors from landfill was diverted.[68] Business waste is much larger than town waste. The 79 Victorian local governments spent $556 million on the provision of kerbside collection services for garbage (2.71 million properties), recyclables (2.65 million properties) and organics (1.63 million properties) and collected 2.37 Mt with these services. The waste management is a big business, still with gaps and opportunities, and it is not surprising that most of the interviews touched on this topic.

The conversations with participants generated many ideas, some of which are undergoing feasibility and technical studies already. Apart from individual project ideas, participants believed that the region needs a more integrated and efficient system that can handle different waste streams from all different industries in the region. According to one, for instance, "whether it's manure from the dairy industry, whether it's residues from forest industry, whether it's abattoir waste, whatever it is coming out of the primary sectors, we need a commercial system that operates just like a residential reticulated sewerage system would through a neighbourhood. This would aggregate all this material into one place, so it can be processed very efficiently to produce the best range of products". *GIppswide Kerbside* is a leading response from the region, which is coming to fruition in the coming months.

At the moment, there are still challenges in providing an equitable access to waste management and recycling services in regional and remote areas. For consumers who live in regional areas, for

instance, repair services can be limited (or non-existent), making repair more expensive (or impossible).[69] What is required to drive improvement is very different in large cities compared to remote, regional and rural areas. Different economies of scale require different technical and financial solutions. As someone stated, “we need high-quality material recovery facilities and factories in the region that can actually use that recovered product once we get the volume and quality right”.

A CE system will put together the efforts of Gippsland's 6 LGAs to create consolidated waste streams of a scale/volume that would allow to attract the recovery or reprocessing of existing industries. We should be able to say “yes, we have X amount of waste, it is reliable, and it is going to be sorted to a standard that you can use, for instance, in a plastic manufacturing industry in the region”. *Gippswide Kerbside* will provide a response to waste services that are currently dispersed on the territory and not joined up, with little quality or content control, and with all waste material going everywhere, rather in more centralised locations. This public tender process, to which reputable industries have responded, is not a hypothesis – it will deliver the framework of waste, recycling services for the majority of Gippsland LGA’s, putting a lot of weight on finding regional solutions. At the same time, a small, but important, contribution that councils can make is to constantly review their service offering, make sure that it stays up to date and as progressive as possible, while offering more community education programs.

Another aspect that LGAs could consider is how policy levers can support the industry and community challenge to transition towards a circular economy. Are policy incentives successful in encouraging industry action, or is policy regulation more successful? Should community members receive incentives or higher fees for the disposal of certain types of waste at landfill? Different stakeholders are driven by different needs. Whatever direction is taken, environmental quality, economic prosperity and social equity implications all need to be considered while adopting a systemic perspective.

2. Renewable Energy

Renewable energy was the second most widely discussed topic to emerge from the data collection phase. However, what became immediately clear during the conversations with stakeholders from the quadruple helix was that any opportunity in this space (with their relative challenges and enablers) was somehow dependent on the geographical location and regional specificity. As someone pointed out “the focus of Latrobe Valley is different to Wellington, which is different to East Gippsland.” Understanding what the priorities of different LGAs are, while offering a package of collaboration and multi-level governance, is key to a process that will lead to finding common interests and opportunities.

As coal-fired energy production is phased out, there is a real challenge not only for the region but also Victoria to support a just transition process. According to an LGA’s representative “this change comes in all different guises, but the main focus is on energy, mainly bioenergy and geothermal, wind (on and offshore) and solar.” In this context, the challenge is to review all the waste streams out of organic processes and find innovative ways to move these streams up the chain into biomanufacturing (i.e., from leftover pine you can make turpentine). This work encompasses the food and fibre industry, with CE as a potential pillar.

There are already several significant investments in renewable energy in the region. For example, the Ellinbank SmartFarm in Baw Baw Gippsland is Australia’s leading dairy innovation facility, fast-tracking innovative technology solutions in a research environment and showcasing them to the dairy industry. This SmartFarm has an ambitious target of being the world’s first carbon-neutral dairy farm by:

- reducing methane emissions
- generating electricity through a range of alternate options including solar, wind and bio-digestion

- improved fertiliser and manure management practices.

There seems to be a growing request from stakeholders for government to invest in pilots or demonstration sites like the Ellinbank SmartFarm, so that the community/industry could learn and de-risk some of these opportunities. This initiative has been funded through the Labor Government's $5 million Smarter, Safer Farms initiative.[70]

Marinus Link is a proposed 1500-megawatt capacity undersea and underground electricity connection to further link Tasmania and Victoria as part of Australia's future electricity grid. Hydroelectric generators and storage resources, such as pumped hydro energy storage, can support solar and wind generation by storing excess energy and then make it available to customers as required. Marinus Link and the supporting transmission developments in Northwest Tasmania will provide access to Tasmania's cost-competitive renewable energy and storage resources.

Star of the South is Australia's first offshore wind project. Proposed to be located off the south coast of Gippsland, it has the potential to supply up to 20 per cent of Victoria's electricity needs, generating up to 2.2 GW of new capacity. They are in the early feasibility phase with site investigations and environmental studies underway.

BlueFloat Energy and Energy Estate are also investing in another offshore wind development venture. Greater Gippsland Offshore Wind Project is a 1.3GW project to be located off the coast of the Gippsland that will use bottom-fixed technology. Located in the Bass Strait, this project will build on the momentum for the accelerated retirement of brown coal-fired power stations and complement the existing and planned transmission infrastructure investments in Gippsland.
The Renewable Energy Zone (G-REZ) is another important project in Gippsland, which will unlock 3-4GW of renewable energy by 2027 – enough to power two million homes. G-REZ will be connecting multiple renewable energy projects to the grid via shared infrastructure. A REZ acts like a new type of power station, which coordinates the delivery of renewable energy from multiple large-scale generators to the electricity grid.

The Gippsland region has a long history of industrial development and is home to well-established onshore and offshore energy industries. Utilising the strong skills base in the region, these and other similar projects will help facilitate the diversification and transition of Victoria's energy supply. Gippsland already has the skills and expertise in energy generation, as well as abundant natural energy resources including solar and wind. The region is best placed to play an important role supporting Victoria sustaining a reliable energy supply. According to some participants, Gippsland is also a 'perfect spot' to be a biomass powerhouse because of the amount of land, the amount of soil, the perfect climate, and the local expertise.

Bioenergy was, in fact, another opportunity that came out strongly during the interview process, about using biomass waste, rather than growing fuel crops, having multiple food and fibre uses, and using by-product for energy or use the energy crop on rotation to improve soil health.[71] This is a form of energy produced from renewable, biological sources such as biomass. Biomass is organic material that can be turned into fuel (also known as biofuel when it is made from biological material) to supply heat and electricity. Sources of biomass include agricultural crops, animal and plant wastes, algae, wood and organic residential/ industrial waste. The type of biomass will determine the type and amount of bioenergy that can be produced and the technology that can be used to produce it (conventional combustion, gasification, pyrolysis, anaerobic digestion, transesterification, and fermentation).[72]

A study published in 2021 by Popp et al. provides a comprehensive review of global biomass and biomass-based energy supplies and demand. To date, over 50 countries have developed bioeconomy[73] strategies. The global economy is mainly based on fossil fuels to produce electricity, heat, chemicals, fuels and energy. In the total primary energy supply, fossil fuels account for 81 per cent, nuclear energy represents 5 per cent and renewable energy sources 14 per cent (of which the contribution of biomass is about 70 per cent). Biomass thus is already important in the renewable energy space.[74]

According to a representative of Sustainability Victoria, “there are in the order of 30+ bioenergy facilities across Victoria today (ranging from +50 MW capacity at Opal to under 200 kW at Beaufort Hospital and everything in between), with the bulk of these being thermal biomass units and a growing pipeline of anaerobic digestion prospects emerging”. An example comes from the Stanhope Bioenergy Plant, which is 90% Delorean Corporation owned. In Stage 1, the project will process up to 40,000 tonne per annum of organic and agricultural waste streams for the generation of 1.2MW baseload renewable electricity exported to the grid. In Stage 2 (future expansion), there is the potential for extension to 71,000 tonne per annum.[75]

Latrobe City Council has installed a Biogas Generator (a gas engine) at Hyland Highway Landfill to use harvested methane to generate electricity. Methane is produced as a natural product of decomposition at the landfill and is 25 times more damaging to the environment than carbon dioxide. The project means Latrobe City is at the forefront of Victorian councils adopting innovative waste management and renewable energy technologies. The Biogas Generator project has the capacity to offset 70% of Council’s electricity demand, saving millions of dollars to Council over the life of the landfill. This is an example of applying a circular economy design to an otherwise wasted resource.[76] According to a participant, though, “landfill gas is good practice for existing landfills but landfilling of organics needs to stop. Organics need to become part of a more circular economy”.

Within this space, the region will need a broad systemic approach in which all key stakeholders can be involved and play their part to create a circular economy. Not an easy task, considering that, as a participant suggested, “you need to understand first what this system will look like, then trial opportunities where you can pull X out of a waste stream without bringing down the system. A type of approach where there are people not fighting over different materials, which is probably what is going to happen soon in the bioenergy space. Because there's some big players in the region, that own most of this stuff. Ideally, rather than bringing those empires down, they can advance while growing that pie for other players to join”. According to another participant, “in Gippsland the waste space is very crowded with many players that want all the feedstocks’.

Although this sounds good in theory, in practice there is an emerging criticism. According to a participant, “we are going to do everything with consultations, and we are going to talk to everybody. And whilst that’s happening, we have now this waste-to-energy plant coming on, which is a terrible waste of resources. They went way too far. They have received something like $50 million in government grants to make this project happen, which is a scandal in itself. That is just too much public money into a private sector operation. But such is their desire to hang on to jobs and to keep the forest and paper industry in town that obviously politically that sort of amount of money felt justified. It isn't justified in circular economy terms. So, a lot of the other municipal waste recovery is probably just going to be burnt”.

The energy-from-waste plant would be built at Opal Australian Paper's Maryvale Mill near Morwell in the Latrobe Valley to provide its power.[77] Environmental advocacy group, Environment Victoria, has previously raised concerns about the plant's emissions, but OPAL has stated that modern energy from waste facilities have very sophisticated scrubbing systems to prevent that. While emitting greenhouse gases, it would prevent methane emissions from landfill. There would also be ash residue as part of the combustion process, but they are already developing a project that will turn that into recycled aggregates that go into road construction. The Federal Government has recently given the green light for a $48.2 million grant.[78]

Another criticism from one of the participants was that there are some great residues coming out of the paper mill industry, which “could be turned into very high value products. But somehow by building a waste-to-energy plant they are just going to blow the whole up in smoke, which will produce ‘a’ result. but it won't produce ‘the’ result. Everything will get locked up under contract for 20 years with the waste to energy plant and it won't be available for its highest and best use. Australian Paper Mill is looking for waste to energy (transition out of the landfill), but the unfortunate thing is waste to energy goes against the whole reduce/reuse/recycle approach. They need to lock in quantities of waste. So, where is the incentive to reduce waste?”

Biomass has other advantages. To make steel, for instance, carbon is necessary: “it won't be steel unless you put carbon molecules in. But you cannot make anything that comes out of the petrochemical industry unless you've got a source of carbon that isn't fossil. And biomass is a very good source of it, which can be used to make ‘green steel’. What we need is a wet and dry biomass processing industry in the valley so that all the primary producers can get the most from their by-products and wastes”. In other words, what is needed is a shift towards enhancing the capacity to process and get the most value from wastes and other industry residues.

Biochar is another substance that is made from biomass. It is the lightweight black residue, made of carbon and ashes, remaining after the pyrolysis of biomass.[79] It can be used in various applications to numerous beneficial ends. One of its well-known benefits is its ability to sequester carbon, thus lowering carbon emissions. Biochar can be made through a process called pyrolysis. Recent research shows that the current biochar market in Australia is small, fragmented and still in its early stage. This is also because there are a number of other valuable products created during pyrolysis, not all producers may process biomass with the intent of making biochar.[80] Worth noting that the Gippsland Climate Change Network (GCCN) has engaged Eco Waste Pty Ltd to undertake a scoping study with the aim of creating BioHub in Gippsland. This might be a future opportunity for Gippsland.

Soil remediation is another benefit that comes from biomass production. As a soil amendment, biochar is assumed to induce long-lasting effects on chemical, physical, and thus biological properties of the soil, including moisture holding capacity, as well as fertility. According to a participant, “by planting biomass, that is going to be immediately harvested to make biocarbon products for the industries that need them, we are also restoring the land. Eventually, after a few rotations of planting biomass, you will have remediated the soils and they will have become reactivated, they'll become more stable, and they'll start to be able to be used for more valuable processes than just making carbon. But in a place like Gippsland, that's years down the track because of the huge damage done by the brown coal industry for a long time”.

The scale of opportunity is more visible within the context of the new forestry arrangements. At the end of 2019, the Victorian Government announced the Native Forest Transition Package, part of the Victorian Forestry Plan. It supports Victoria’s forest industry to transition away from native forestry. As part of the plan, harvesting native forests in Victoria will cease by 2030 and the whole industry is to convert to plantation management.[81] The *Gippsland Plantations Investment Program* and the *Gippsland Centre of the National Institute for Forest Products Innovation* (NIFPI)[82] are all part of the Victorian Government’s commitment to support the sustainable growth of Victoria’s plantation estate. In addition, the *National Forest Industries Plan* includes an action to establish Regional Forestry Hubs across Australia. The *Gippsland Forestry Hub (GFHub)* is one of them.[83]

All these initiatives will complement the transformation of the industry, aiming to improve plantation management, timber processing, wood fibre recovery, advanced manufacturing and the creation of a bioeconomy. However, as a participant observed, this is the time to make the right decision regarding the best way to use to create a “biomass economy”:[84]

> The biomass is so rare that it should be used for the best it can, down in Gippsland (rather than being exported to China or Japan to make paper). We are going through a transition now. The forest industry got a huge budget to transition from native forest to plantation. The LVA should be doing the detailed work and think about what to do with all the residues from that forest industry, the routes, the tops, the branches, the adequate restoration of land after it's been cropped once and before it's cropped again. Now is the time when a serious discussion about instilling circular economy principles into that process right the way through, right from creating the products to using them for re-fertilizing after each crop, to developing new harvesting techniques.

The bioenergy and biomanufacturing sectors represent potential growth sectors for Gippsland. Within this context, the Wellington Shire Council, in partnership with the Latrobe Valley Authority, has developed a framework (*Gippsland Bioenergy Development Framework*)[85] to support industry

to build capability in initiating, developing or investing in biomass to energy projects in Gippsland. The guide provides tools and resources to assist Gippsland based communities and industries to methodically step through four discreet phases of a successful bioenergy project. Bioenergy projects require careful research, preparation and adherence to a number of planning and environmental regulations.[86] It is a great opportunity for Gippsland to use locally the by-products of agricultural, food and forestry industries, and domestic and industrial waste management systems, for the creation of material products such as fertilisers, and the provision of bioenergy, which not only has the potential to be highly significant in a circular economy, but it will also shift our focus more on regenerating the soil rather than depleting it.

Discussion

Over the 2020/21 financial year, renewable energy sources accounted for approximately 29.4 per cent of Victoria's electricity generation, up from 24.3 per cent in 2019/20.[87] The Second Victorian Renewable Energy Target Auction (VRET2) aims to bring online at least 600 megawatts (MW) of new renewable energy capacity in Victoria. VRET2 will help meet Victoria's legislated renewable energy targets of 40 per cent by 2025 and 50 per cent by 2030.[88] Modelling by the market operator (AEMO) shows that Victoria needs to build 45 gigawatts more wind and solar generation, plus 15GW of storage by the end of the decade.[89] Investment in new renewable energy projects over recent years has been broadly evenly split between wind and solar farms.[90]

According to a participant, we should not be surprised if "we are going to see the majority of solar farms and the offshore wind being based more along the coastal region and further to the east. In other words, the centre of electricity production is going to move from the Latrobe Valley into both Wellington and into East Gippsland. Once you understand that, then you start to realise that we are going to lose this major industry from that particular LGA (being Latrobe in this case)". Such plants will also be built in South Gippsland, based on the new zones. Large-scale renewable generators tend to be located in more remote areas. Together with other initiatives that are involving solar and wind farms in Gippsland, there is a huge variety of opportunities emerging across the region. It is important to be mindful that, while many job opportunities will be created in setting up infrastructures, a focus should be also in developing more ongoing positions for local residents. Not Life cycle cost (LCC) will continue to be central due to legacy grid infrastructure.

The existence of some well-established industries will certainly help in the transition. The energy companies want to move off coal, they are well aware of the climate change impacts from burning coal, "but you know you cannot just switch the power stations off overnight", as someone argued. By investing in those industries, you can still count on a skilled workforce, capital, and local knowledge. On top of that, there are advantages is reusing these factories' sites: "the big thing with the power stations is that they were massive infrastructure, with a huge potential of getting power into the place, you had water, you had saline disposals, you had all sorts of aspects around that, which then makes building another factory so much easier". At the same time, it will be equally important to support smaller businesses or new start-up initiatives.

One thing that has been strongly suggested by some of the participants was investing in enhancing the manufacturing potential of Gippsland (and Australia more broadly), as a way to build long term opportunities and jobs. According to a participant, in fact, "the only thing that is going to replace a major industry long term is not these construction jobs, these project-based ones, they boom and bust. The thing that makes it work is production". However, circular thinking involves looking at how things are manufactured and their inputs so that there is a clear endpoint in sight when that product reaches its end-of-life cycle. Without a holistic approach to CE in manufacturing, end-of-life strategies for products will continue to have problems with implementation, cost competitiveness, rebound effect, and effectiveness.[91] Improving the capacity to manufacture goods is a key issue, considering that Australia has the lowest level of manufacturing self-sufficiency of any OECD country. The pandemic revealed that Australia's industrial base is limited in its capacity to supply essential products.[92]

Examples of Circular Economy in Gippsland

The implementation of circular economic principles can help to transcend the traditional natural resource and waste intensive take-make-dispose economic model. In a circular economy, natural resources are kept in circulation. This creates new economic opportunities and employment and has significant environmental co-benefits. It helps conserve natural resources and reduces emissions and waste.[93] In the previous sections, there is reference to CE initiatives taking place in Gippsland that clearly show the region's intention to play a leading role in this space for years to come. Circular economy has been a 'buzzword' that for some time, and LGAs are now investing resources to work with businesses helping them to adopt CE principles and increase their understanding of what CE means. Nevertheless, there is still uncertainty about what this approach looks like in practice.

As highlighted by Kirchherr et al. (2017), describing good CE implementation examples can help sharpen the understanding of the CE concept both among scholars and practitioners. Although some participants could not provide any specific examples, the data collected suggests that there are several contemporary CE practices in Gippsland. Unfortunately, these are still isolated cases, not part of a broader systemic approach. The example provided by a participant can help to make this point clearer:

> There is a sawmill that wants to experiment with building a pyrolysis plant to turn its sawdust into energy for itself and provide some biochar for the local farmers. One sawmill on its own is doing that. This could be useful and could be incorporated into a fully-fledged integrated bioeconomy for the region. But on its own, it's not a circular economy. It's not.

Nevertheless, as one participant suggested, it is crucial to start talking about these experiences, so that the broader debate about climate action is informed about what happens on the ground:

> I think that is some kind of reward for them or something which would motivate people. I think incentives sometimes might not be always in monetary terms, giving them recognition, showcasing their work, would be useful, not only within the country, but overseas as well. And the same people who are actually implementing circular ideas should speak, rather than somebody else speaking on their behalf.

In turn, this will help to connect to the community, supporting them in better understanding the benefits of a CE.

Here follows a selection of other CE examples that were not previously discussed, subdivided into existing projects and projects that could become future opportunities for Gippsland. These projects could form the basis of industrial districts and local innovation systems creating new competitive advantages for the Australian industry. One participant suggested that there could be "… a permanent supporting group/body for the Gippsland region with a specific focus on finding and connecting businesses that may complement one another (circular economy). This group could then assist in connecting businesses to experts in the appropriate areas to drive an outcome for the region. This would also require funding for research, innovation and development in order to bring these projects to completion".

Existing Projects

Insect farming industry

Insects are enjoyed by over 80 per cent of the world's population as a tasty, nutritious, and sustainable source of protein. Black Soldier Fly farming is presently the most widespread form of insect farming in the world. Black soldier fly larvae can consume and grow off organic waste like horticultural or dairy waste. There are currently 14 active commercial insect farming businesses in Australia, and this number is growing rapidly as interest in the industry builds. The discovery work on the opportunity for a potential insect farming industry in Gippsland is conducted by Food & Fibre

Gippsland and is an initiative of the Gippsland Smart Specialisation Strategy (GS3). Food & Fibre Gippsland is investigating into the potential of native edible insect species.[94]

Sailors Grave Brewing

Gippsland does not malt any grain. Most of the grain goes to feed. However, there are more than a dozen brewers and distillers within the region who wish to use locally malted product. One such brewery in East Gippsland, Sailors Grave Brewing, is taking quite a circular approach to their work. To avoid any waste from their process, they have partnered with organizations like mushroom growers in Wellington, where they redirect their spent grain[95] which would normally go into a lower value animal feed. Mushroom growers use that substrate to grow mushrooms for human consumption. After all the spent grain and all its nutrients have been utilised, it becomes a compost product to grow other vegetables and grain to be malted.[96]

Manny's Market

Based in Morwell, it is a locally owned Fruit and Vegetables store which is a member of Food and Fibre. All the cafes and businesses to which they provide their fresh vegetables and produce, return any organic refuse to Manny's who then put it through a machine that breaks it down and turns it into really high value compost. They use things like coffee grounds as well, and then apply this compost to grow new produce.

Recycled tyres to make roads

Tyres that once drove over roads will be used to make roads in a trial by Latrobe City Council. Council will use crumb rubber made from recycled tyres to construct road surfaces. The crumb rubber will be melted into the bitumen binder, and along with coarse and fine stones, is part of the asphalt mix. The rubber comprises approximately 1.5 per cent of the overall mix. So, a roadwork project using 200 tonnes of asphalt would use three tonnes of tyres. [97] This is something that the South Gippsland Shire Council is exploring as well. According to a participant, "we have 1,200 kilometres of unsealed roads (gravel roads). To reconstruct them, you need water, moisture, to compact materials properly. But we don't have access to water. So, we are relying on rain. We are working with the South Gippsland Water Board to address the issue and understand the investment in infrastructure needed to get the recycling process up to a class that is acceptable to be able to spray that recycled water on pavements. We also reuse storm water in agriculture making sure it is clean for the purpose".

Latrobe Magnesium

Latrobe Magnesium is building a 1,000 tpa demonstration plant to convert fly ash resource into magnesium metal, Supplementary Cementitious Material (SCM), amorphous silica, char and iron oxide using their proprietary process. Once operating successfully, a commercial production facility of 10,000 tpa will be built.[98] As a participant stated "particularly at Hazelwood, the ash itself holds around about 12 per cent magnesium. Largely, it is a toxic waste material. So, to have it repurposed and have it turned into other products makes a lot of sense. It gives you a chance to neutralise it. The opportunity to create a green economy, and produce green metals, would be far more desirable into the international market".

Used lead acid batteries (ULAB) project

Chunxing Corporation Pty Ltd will soon commence to build a state-of-the-art Used Lead Acid Battery (ULAB) Recycling Facility in Hazelwood North, Victoria. This facility will process 50,000 tonnes of ULAB into 27,000 tonnes of refined lead and other by-product streams.[99] This project was approved on 5 January 2021.[100]

Gippsland Circular Economy Precinct (GCEP)

The Gippsland Circular Economy Precinct (GCEP) has signed an agreement with H2X Global to establish Gippsland as a centre of excellence for the development of hydrogen-based industries. The agreement sets in motion an ambitious plan to manufacture hydrogen fuel cells, electrolysers, hydrogen fuel cell-powered vehicles, and a range of hydrogen power units including generators and emergency power supplies. GCEP is a consortium of Gippsland-based businesses that have

recognised the need to transition the local economy toward renewables. H2X is an automotive and power unit company focused on sustainability and harnessing the most efficient and effective technologies, with the onus on capturing free and renewable energy sources.[101]

Hydrogen heavy vehicle and airplane manufacturing

The Latrobe Valley could become a hydrogen heavy vehicle and airplane manufacturing and fuel-hub, according to a consortium of Gippsland businesses investing in new technology in the region. Gippsland Circular Economy precinct has claimed that it could lead to 5000 new Gippsland jobs in the next five years. The hydrogen would be created from a range of resources such as electrolysis, agricultural or industrial waste, or from diverting non-recyclables from landfill. It would use the existing skills base to support a more diverse economy once brown coal power generation is phased out.[102]

Bairnsdale Repair Café

The Bairnsdale Repair Cafe is an exciting initiative delivered by the Bairnsdale Recycling Enterprise Inc. and a dedicated group of volunteers with funding from the Foundation for Rural and Regional Renewal in partnership with the Australian Government.

Amber Creek piggery and sawmill

They generate their income from pig farming, tree farming and saw milling, which they have designed to operate together to recycle waste and improve soil quality and the landscape. They use pruned timber grown on site for the mill thus minimising their environmental footprint. Off cuts from the mill are used to construct ‘home pads’ for their pigs which they rotate every three to four days. This level of mobility enables them to constantly regenerate the soil by using naturally produced pig manure supplemented with saw dust from the mill to compost the land.[103]

Prom Coast Food Collective

The Prom Coast Food Collective is a collaboration between small family farms, ethical producers and makers, and conscientious consumers who are passionate about good, local food. All farms and producers are based in the South Gippsland and Bass Coast Shires, where they are farming organically and regeneratively. Food produced by farming families reduces food miles, food waste, encourages organic and regenerative land stewardship, invigorates communities and strengthens relationships in families, consumers and the relationship one has to what nourishes people. the Collective is a volunteer-run and wholly producer-led initiative, set up with the aim of helping the producers receive a fairer slice of the return for their produce than is usually available through supermarkets.[104]

BioPathways Partnerships Project

New training courses in bio-manufacturing have been designed in Gippsland to provide vocational training and skills in this emerging technology for the local workforce. Backed by a strategic partnership known as the *BioPathways Partnerships Project*, the training is the outcome of an industry-led collaboration between Opal Australian Paper, TAFE Gippsland and Federation University to assess and support Gippsland’s future bio-manufacturing training needs. Funded with $3.8 million from Victoria’s Workforce Training Innovation Fund (WTIF), and another $500,000 from Opal Australian Paper, the project is delivering a purpose built, innovative bio-manufacturing training facility, including the latest bio-manufacturing equipment, and it is also investing in a new curriculum to support the training course.[105]

Gippsland Regional Organics expansion

Gippsland Regional Organics is preparing to expand its major processing facility located at Dutson Downs, near Sale. The site is currently licenced to receive 250 kiloton of organic waste per annum and is taking between 170 to 190 kiloton. It is experiencing high unmet demand but is constrained by technological and infrastructure limitations. This project will enable organic processing capacity at the site to ramp up to as high as 350 kiloton per annum and introduce waste to energy generation capabilities. The feasibility and design will be delivered by late 2022. Gippsland

Regional Organics is seeking co-contributions from the Victorian and Australian governments to the total of $7.6m.

Potential Projects Under Investigation

Cellulose to replace Single Use Plastics (SUPs)

A number of Single-Use Plastics (SUPs) are to be withdrawn progressively in Victoria from February 2023. An opportunity exists for companies to partner with an intention to produce cellulose-based biodegradable alternatives in Australia to replace SUPs. Cellulose-based film alternatives to food wrappings are already in existence and are being used worldwide. Utilising cellulose extracted from wood pulp, waste paper and cardboard can already replace single use plastics. Sustainability Victoria indicated there is both market pull and technology push to solve the major problems of ocean and food pollution and overflowing landfills. Robin Cranston (CSIRO) and Warwick Raverty (Monash University) started consultation with OPAL (a paper pulp producer owned by Nippon), Futamura (a well-established manufacturer of environmentally friendly cellulose products) and Wesfarmers (who have a wide range of retail markets).

Spent chicken litter as a feedstock for bioenergy production

Some broiler farms are looking at utilising chuck litter as a source for bioenergy. Traditionally, spent chicken litter has been applied to land as a fertiliser and soil conditioner and this is currently the largest and most important end use for poultry litter. However, opportunities may exist in the future to utilise the energy value of litter with a number of different bioenergy production techniques, producing bioenergy and valuable fertiliser products. These technologies range from mature to prototype, and very few have been applied in the Australian chicken meat industry.[106]

Solar Panels Recycling

A solar panels recycling company's proposal to establish a facility beside the existing Kilmany Resource Recovery Centre and Landfill facility would bring much-needed economic investment and job opportunities to the area. Wellington Shire Council has been approached by the Ojas Group (Elecsome), which is seeking land for a facility to recycle solar panels and other "renewal energy-related operations". It is understood the facility will be one of six state-wide hubs created to accept household and solar farm panels. At the moment, most components associated with renewable energy generation are imported (e.g. solar panels and wind turbines).[107]

According to one of the people interviewed for this project:

> A facility which is being built at Kilmany, just outside of Sale, they currently have 8,000 solar panels sitting there which are marked for destruction. If you have a solar panel with a value of probably more than 200 to 250 watts, it is still an economic value to be able to put into a community owned solar farm. We were able to demonstrate that economically there was no sense in destroying these things. Pre-COVID was believed that there was a desperate need for production of a solar cell in Australia. At the moment, the only production of solar cells is in either China or Taiwan. You cannot buy solar cells outside of those two countries. This could bring long term jobs. You look at how many proposals there are for solar panel jobs inside Australia, it's phenomenal.

Australia's first dedicated solar panel recycling company will develop its first processing facility in the industrial Adelaide suburb of Lonsdale, in South Australia.[108]

Seaweed Farming

Seaweed growing initiatives in Europe have successfully utilised wind farms and other offshore structures to support seaweed growth, which may then be harvested for food, alternative energy as a biomass, or to sequester (remove) carbon from the atmosphere. Gippsland, with over 600km of coastline and a vast network of lakes and waterways, in addition to an established aqua-cultural industry, could potentially be a prime location for the development of a commercial seaweed

industry in Victoria. A Food & Fibre Smart Specialisation team are currently meeting with potential partners to work out the next steps in this process (investigating what species of seaweed are present and where they may be grown, together with farming methods).[109]

Barramundi recirculating aquaculture system

In partnership with Mainstream Aquaculture and the Victorian Government, Opal Australian Paper embarked on a feasibility study to farm Barramundi in the Latrobe Valley. The $1.24 million feasibility study, funded by the three parties, investigated the technical, commercial, social and environmental aspects of a state-of-the-art Recirculating Aquaculture System (RAS) facility.[110] This project would be the beginning of a cluster of businesses sharing infrastructure and resources to produce competitive, sustainable, organic products in the Latrobe Valley. The feasibility study was completed in early 2021. They were successful in a $30 million grant application under the Modern Manufacturing Initiative – Manufacturing Collaboration Stream. This $30 million would leverage $95 million worth of private investment. They received a positive announcement in May, just before the federal election. The Labor government is currently reviewing all the grants that were given out that do not have signed contracts.

Cogen Plant

Waste to energy biogas cogeneration plant, that will both reduce direct emissions from wastewater and provide renewable energy.[111] Westernport Water (WPW) intends to invest in renewable energy for methane cogeneration at Cowes Wastewater Treatment Plant.[112] The Cowes Wastewater Treatment Plant (CWWTP) is the major plant in WPW's wastewater treatment system, servicing Phillip Island and the township of San Remo. Servicing an area of 300km2 and 19,240 permanent customers, Westernport Water provides services to more than 100,000 people during major events and peak holiday periods. At many wastewater treatment facilities, methane is typically wasted by burning or flaring, which releases greenhouse gas emissions like carbon dioxide and methane into the atmosphere. Cogeneration engines, instead, convert methane into renewable energy, thus reducing emissions.[113]

Hydrovation project: Wetland restoration

The project, which was put forward by Westernport Water aims to see if it is feasible to restore a wetland filled with recycled water at a site currently in poor condition. The project will assess if a restored wetland can store carbon providing offset opportunities and an overall net sink for carbon. There will be multiple benefits such as improved biodiversity, habitat, water quality, social benefits (if the site is made accessible to the public) and improved scientific understanding of the capacity to store carbon in water, which is an emerging area of research. If it is possible to provide a net sink for carbon in the wetland and limit leakage of methane, the wetland could also potentially offset the fugitive emissions generated from the wastewater treatment plant providing a real avenue to assist in the site becoming carbon neutral.[114]

BioHub Gippsland

In 2017, the Gippsland Climate Change Network (GCCN) has engaged Eco Waste Pty Ltd to undertake the following Gippsland BioHub Project (GBP) scoping study. The study identified potential to add value to agricultural waste. A preliminary financial assessment identified a promising project for future development.[115] Gippsland has the potential to be a world leading region for the manufacture of the "bio carbon" products that will be essential to support and maintain all branches of industry (including the entire petro/chem sector that is entirely based on organic chemistry), manufacturing, agriculture and horticulture that must have carbon molecules for the essential chemistry of their existence.

Textile Recycling

For Textile recovery systems to work, education is the first step. As textiles touch everyone, if done properly education raises general circularity in the economy and not just in textiles. The 5Rs' approach (Rethink, Refuse/Reduce, Reduce, Reuse/Repurpose, Recycle) is key to this process. Life Line Clothing Malaysia (LLCM) and Australian Textiles Manufacturing Malaysia (ATMM) work

in all areas of the 5Rs. They collect, sort, grade and sell used second-hand clothing worldwide by working closely with the communities, corporations and local governments. the unwearable items are manufactured into wiper material, then sold to industries as cleaning cloths, thus massively reducing the number of textiles being thrown into landfills sites. also involved in fibre reclamation which is when the textile is pulled or shredded into the fibre. Then it is combed and manufactured into usable items. Most textiles recycling systems methodology is not based on the 5Rs, but are trading systems where textiles are moved around for a period and eventually end up in landfill.

11. Final Observations

Establishing circular economies at scale across Gippsland must address complexities surrounding this goal, such as transport and logistics, infrastructural limitations, and different priorities. Some participants commented on the importance of a standard practice in place across the LGAs, which is currently missing. For instance, when it comes to waste management there are different standards across the LGAs within the region such that getting waste materials from one end of the region to the other can be prohibitive. LGAs are already working on some common projects, and there are possibilities for the development of more micro facilities or regional facilities and aggregators. More efficient infrastructures across the region, which can create larger opportunities that could be shared, would also be valuable.

The introduction of incentives could potentially accelerate the implementation of circular economy principles, but they might differ from stakeholder to stakeholder. Some businesses pay a lot to get rid of some forms of waste. So, an incentive for them is any potential opportunity that reduces that burden. There needs to be more investment into developing new opportunities, particularly for small businesses. Some of the options that might be available to them are not well or widely advertised. LGAs could provide incentives to businesses adopting CE principles, particularly businesses that focus on recycling and repair. Information on the available options on how to better engage with CE and implement this approach could be clearer and simpler to understand.

According to some participants, there are still many businesses that don't have an appetite to engage with CE, which might be a consequence of the cost and time implications required to develop innovative solutions around it. The use of Public Private Partnerships (PPPs), which has increased quite dramatically across the world over the past two decades, could support the transition towards a new economic approach. PPPs, with more resources invested in developing economic and social infrastructure projects, many claim have inherent benefits, such as lower project costs, faster delivery, development of innovative solutions by the private sector, and higher quality of the delivered end product.[116]

Our consultations with representatives from business and government sectors alike show their enthusiasm regarding the implementation of CE (more concerns exist among community organisations, afraid to be left out). However, as emerged from research conducted by Ramanathan in 2016 titled *Public–Private Partnerships and Implications for a Circular Economy in Australia*, unless circular economy principles are specified at the request-for-bid stage and included explicitly in the KPIs, it may be difficult to get the private sector partners to engage in circular thinking and propose innovative solutions.[117] Government agencies are thus called to play a key role that may accelerate the CE transition. In turn, this may help solving many problems at once: solving emerging resource issues (e.g. conservation and efficient usage), lowering carbon emissions, and helping to address waste management problems.

At the moment, however, there still seems to be a certain disconnect between LGAs and businesses. In some cases, this could be about differences in objectives and the different planning horizons of the public and private sectors. According to a participant, a “low and slow approach”, building on an evidence-based approach which requires more time to introduce innovations in design and manufacture, may not be acceptable to the public sector partner who may be under pressure to ensure quick delivery due to political compulsions. This brings LGAs to be more reactive rather than proactive in embracing CE principles within their strategies. A proactive

approach might align their organisational values with the ambitions of users, being the community members and industry.

In other cases, a mismatch in the objectives of the public sector client and private sector partners might be a consequence of an over-layered political system which limits the decisional power and autonomy offered to local councils. This mismatch works both ways. Some LGA representatives felt that "large businesses once they are big enough, they don't connect back". On the other hand, for large businesses, what they call "a local government's lack of strong vision for the future", leads them to have conversations more with State government and with Commonwealth government. Because the decisions that are made at that level tend to have more impact on them and their operations, rather than the local government, they feel like not depending on local government for support.

There were different views also on how to encourage innovation. Participants felt that having the right policy frameworks in place is important to drive investment. Representatives from larger companies mentioned that they have substantial capital that they could use to invest, but some of the policy settings are not allowing this. In their view, the often-negative narrative used to speak about industry ignores the history and the role that these major industries have had in the development and the prosperity of the state. Changing some of the policy settings to provide better direction could be the key to creating more effective collaboration. In this way, government can play a role in making sure that the policies, the legislation, the regulations that are in place encourage innovation. More policy direction from a federal level is required also. Apart from shifting the policy settings to encourage circular thinking, further work is required to simplify an overall policy framework which, according to many stakeholders, is becoming more complex.

The education sector can also play an important role in creating synergies with local businesses. Some industry representatives operating in Gippsland mentioned the lack of certain specific skills within the region, which leads them to look for the candidates elsewhere, in many cases outside Australia. One participant from the education sector mentioned a cooperative design course model which involves industry guest speakers coming to talk to the students in different courses. They suggested that a more 'co-designed' approach, in collaboration with business practitioners, might be even more useful.[118] A focus on positive and more sustainable practices could increase the employability of students in more specific and needed fields. Some also suggested bringing experts from overseas to train or work with TAFE institutes and Universities, to develop new training courses by adopting a "train the trainer" approach. In other cases, the skills already exist, and tertiary institutions can help industries coming into the region to employ their workforce locally. And when new courses need to be developed (which can be slow, due to a very structured and rigorous process, like in the case of hydrogen), they can also help to speed up the accreditation process. More importantly, research and education sectors can take the lead in developing a shared understanding of CE and its implications for practice. More funds will surely support the shift.

A circular economy approach also requires a certain critical mass to support more comprehensive initiatives. To achieve this, only a co-designed solution, with everyone involved, will enable an effective implementation in a sustainable way that would enhance the prosperity and well-being of all Gippslanders. According to a participant "a local community is more likely to adopt that solution if co-designed, rather than someone coming in and saying, 'hey, this is what we should do'". With this regard, NIMBY pushbacks need to be considered as rate payers do not generally want these industries in their towns.[119] One possibility is the opportunity for creating 'green industrial' zoning, where industry needs to meet certain criteria to operate. As someone else argued, "while certain things make sense on a regional level, like the creation of a big infrastructure, there are other things that need to be addressed on a smaller scale, like a small township or farm scale level". Partnering with smaller businesses (particularly those operating on a community level), monetary enablers, federal government grants are all tools that can be used to create more inclusiveness and address unequal bargaining power.

The impact of CE on social equity and future generations is also an important aspect that should be considered. There are a few questions that should be taken into consideration when developing

initiatives that aim to embrace new economic principles. For instance, how can CE-related projects be combined and boosted for optimal benefit to the local area and its residents? How could communities be involved in choosing technologies and partners? What ownership and governance can ensure customers are protected, while benefits are equitably shared within the community? CE certainly aims to bring great social benefits. However, there is also an emerging scholarship which indicates that it may also increase inequalities.[120] As someone mentioned, “we need to pay proper wages, making sure a future horticulture worker is not going to be a slave labourer or a backpacker. There are also underlying issues around skills, affordability of housing that we need to flag, key enablers that if you don't get them right, how do you get a circular economy going where people can't even afford their gas bill?”.

A genuine community involvement at an early stage of projects is certainly an issue that was raised by several participants during the consultation process. More involvement of local communities should also come with more attention to the health of the people that will be impacted by the innovation opportunities being developed on their territory. At the same time, local communities should also be able to share some of the benefits. As some participants noted, more community owned renewables, smaller scale projects, could be one way to address this issue. Representatives of community organisations were concerned that renewables will end up being just another version of profit-oriented ventures: “Big companies using our resources, building things in our spaces, and the local community still will not see the benefits”.

The current linear economic system of “take-make-throw away” is known to be the cause of environmental degradation, resource depletion, waste and pollution. The environmental justice side of the transition, the impact of coal mines and the legacy of pollution is something that communities in Gippsland are dealing with. Some respondents would like to see a comprehensive remediation and clean-up in the region (lands but also waterways) being factored in as part of the transition to renewable energies, adopting approaches that are restorative and regenerative by design. This means that when the Governments is planning to support particular technologies, a thorough due diligence is necessary to properly assess the systemic impact. As a participant suggested, “this is to avoid the risk that a technology might solve a certain problem in a certain part of the system, but then it creates problems elsewhere”.

Many also fear that this is going to be industry led, and communities should also be provided with more information about what lies ahead. There should be enough community education, support for workers and their families, providing them with enough time to be ready for those changes. As someone said, “not like Hazelwood, where it was just dropped like a bomb on folks. And then they had to kind of figure out their life plans from there”. There needs to be a transition plan in place that can help people to be more engaged. This is particularly important considering that “many people are disengaged with politics and disempowered to think that they can actually make a difference”, as someone argued.

Another issue with the current linear economic system is that it has created extreme forms of inequality. The United Nations Industrial Development Organisation (UNIDO) recently pointed out that current circular economy approaches focusing solely on environmental and economic performances risk leaving out an essential third pillar: inclusiveness.[121] In 2018, a comprehensive review of the academic literature on the circular economy has pointed out an important research gap: current academic discourses focus primarily on business models, cleaner production approaches and optimising performance and efficiency, but only marginally consider social and institutional implications.[122] This emerged from another research conducted in 2021 by Vanhuyse et al., which also pointed out that CE will only be transformative if social impacts are considered, including culture, health and fears and aspirations.[123] More research is needed to understand these future implications.

APPENDIX

International Case Studies

Sugar Beets – the Netherlands

Biomass "is at the heart of the circular economy"[124] as it is a supplier of renewable resources with a wide range of applications. The best example is sugar beets farming in the Netherlands. About 85,000 sugar beets per year are used to produce sugar. The largest waste stream that results from this, beet pulp, is used in the animal feed industry. Waste streams that do not have any other useful application are fermented to generate energy. The beet leaves remain on the land to provide the soil with organic matter and to recycle the nutrients. In order to acquire more valorisation from the residual streams of the sugar production, biorefinery is used to separate part of the beet pulp into high-grade fibres, special sugars, saccharin acids, and oligosaccharins. These semi-finished products can be used, among other things, for food, polymers, cosmetics, coatings, and composites, replacing non-renewable resources in turn. The beet pulp provided to the animal feed market ensures that nutrients are kept in the cycle, because they return to the land through manure. This way sugar beets can be used in multiple ways in a circular, bio-based economy.

Tesco – the United Kingdom

Tesco is the largest supermarket in the UK with almost 28% of the market share. Since the start of 2018, Tesco has been on a mission to change their approach to plastic packaging. Following on from this in mid-2019, Tesco launched its 4R strategy – remove, reduce, reuse and recycle – which now informs all their packaging design. By applying two small design and process rethinks - the elimination of secondary lids on cream pots or multi-pack films (see below), scales across Tesco's huge retail network has led to over 100 million pieces of plastic being eliminated from its stores. In combination with other 4R measures, Tesco successfully eliminated 1 billion pieces of plastic from its stores by the end of 2021.[125]

Residual construction waste – Denmark

With over 30% of Denmark's waste coming from construction, upcycling of used building materials has become an area of increased focus. As a result, traditional disposal methods that send waste insulation to landfill sites and crush porcelain and sanitaryware to make road fill are being replaced by a new, greener alternative jointly developed by three Danish companies. Construction waste from Danish recycling centres is delivered to RGS90, a company which specialises in the processing, sorting, removing and recycling of waste products. Here, all unwanted materials are removed. Recyclable ROCKWOOL insulation and ROCKFON acoustic panels are then separated from the unrecyclable insulation before being granulated. Porcelain and sanitaryware are crushed before being sent to the ROCKWOOL production facility, where they are used to manufacture new, recyclable insulation.[126]

Regenerative Agriculture – Brazil

Connect the Dots aims to create a food system network that tackles social inequality and supports regenerative farming. Set up for the São Paulo peri-urban zone and the surrounding region, the programme supports and purchases produce from local farmers, to provide healthy food for vulnerable people. São Paulo municipality buys produce from these local farmers at 30% more than the market value to incentivise the transition to regenerative practices. Today, 160 farmers are involved in the project and around 40% have fully converted from conventional to organic or regenerative practices, with a goal of 50% having done so by June 2021.[127]

Matchmaking companies to turn waste into profit – South Africa

Africa's first Industrial Symbiosis Programme supports the transition to a circular economy by enabling manufacturing companies to exchange under-used resources that usually become waste. It's a free facilitation service that helps companies identify mutually beneficial opportunities to exchange resources. By matching companies' supply and demand for secondary raw materials (materials recycled from waste), it helps businesses identify new opportunities. For example, a marine fishing company's broken fishing nets have been repurposed to make sports nets for schools and sporting facilities.[128] A similar experience exist in Australia as well. ASPIRE (Advisory System for Process Innovation and Resource Exchange) was developed by CSIRO and Data61 in response to a need from Australian businesses and their local councils who were seeking a solution to their ever-growing waste disposal costs.[129]

12. Endnotes

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