MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

BRIEFING

Completion of Circular Economy and Bioeconomy work programme

Date:	17 July 2024	**Priority:**	Medium
Security classification:	In Confidence	**Tracking number:**	2324-3887

Action sought		
	Action sought	**Deadline**
Hon Melissa Lee **Minister for Economic Development**	**Note** that MBIE will disseminate research findings to support current and any future work programmes. **Agree** to forward this briefing to the Ministers of Climate Change, Environment, and Trade.	22 July 2024

Contact for telephone discussion (if required)				
Name	**Position**	**Telephone**		**1st contact**
Nora Burghart	General Manager, Economic Strategy Branch		s 9(2)(a)	
Claire Mortimer	Policy Director, Economic Strategy Branch		s 9(2)(a)	✓

The following departments/agencies have been consulted
MPI, MfE, NZTE, MFAT

Minister's office to complete:

- ☐ Approved
- ☐ Noted
- ☐ Seen
- ☐ See Minister's Notes
- ☐ Declined
- ☐ Needs change
- ☐ Overtaken by
- ☐ Withdrawn

Comments

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

BRIEFING

Date:	17 July 2024	**Priority:**	Medium
Security classification:	In Confidence	**Tracking number:**	2324-3887

Purpose

This briefing provides a summary of findings from the Circular Economy and Bioeconomy (CEBE) research programme and recommends next steps. This briefing completes the CEBE action in the first Emissions Reduction Plan that you are responsible for.

Recommended action

The Ministry of Business, Innovation and Employment recommends that you:

a. **Note** the completed research (summarised in Annex One) which MBIE is making available to support current government work programmes and business.

Noted

b. **Note** that our research on the bioeconomy found significant opportunities to expand the development of high-value, low-emission bio-based products.

Noted

c. **Note** that our research found potential for significant emission savings over time through shifts to resource circularity, but this would require substantive changes in business and consumer behaviour supported by comprehensive policies by government.

Noted

d. **Note** that no new CEBE actions are recommended at this time, but we are disseminating the research findings to support current and any future work programmes.

Noted

e. **Note** that New Zealand's trading partners are investing in circular policies which are leading to new requirements for New Zealand exporters.

Noted

f. **Note** that MBIE is working with MFAT, MPI, MfE and NZTE to coordinate information flows to officials and businesses about changing circularity requirements that affect trade.

Noted

g. **Agree** to forward this briefing to the Ministers of Climate Change, Environment, and Trade for their information.

Agree / Disagree

Nora Burghart
General Manager
Economic Strategy Branch
Te Waka Pūtahitanga, MBIE

….. / ..... / .....

Hon Melissa Lee
Minister for Economic Development

..... / ..... / .....

Background

1. You are responsible for developing and commencing an evidence-based Circular Economy and Bioeconomy (CEBE) strategy, which are two actions in the first Emissions Reduction Plan (ERP1).

2. The Circular Economy was included in ERP1 as a medium-term approach to reduce emissions, supplementing action on direct and easier-to-abate emissions. It does this by designing out waste, keeping resources in use for as long as possible, then recovering and regenerating products and materials at the end of their lifecycle.

3. The Bioeconomy was included to coordinate efforts to extract greater value from our biological resources and to avoid negative impacts from transitioning to bio-based energy and materials.

4. In February you directed us to discontinue the strategy, and instead complete the research and use the evidence to identify potential actions for future ERPs [ref 2324-1498].

Research insights

5. The CEBE has a broad, whole-of-economy scope and as a consequence the research assesses opportunities and challenges at a strategic level. It does not include detailed analysis of emissions savings and costs of specific policies. Research insights are summarised here and in more detail in Annex One.

There are opportunities to increase export value from our biological resources.

6. In the last twenty years, the New Zealand food and beverage industry has begun to diversify, exporting a growing range of added-value consumer products valued at $8.3 billion in 2023. These include nutraceuticals, infant formula, premium petfood, alcoholic and non-alcoholic beverages, as well as non-food bio-products such as biocosmetics.

7. The research identified 30 commercial opportunities using New Zealand's biological resources that are high-value and low-emissions which, with support, could be accelerated to contribute to the Government's goal to double the value of exports (see Annex One Section A).

8. New Zealand has strong capabilities in our core (primarily commodity) industries, but the capabilities needed to compete internationally in these added-value product markets are still under-developed. These include capabilities to manage more complex value chains, access to pilot facilities and new technologies, and skills in brand development.

9. While progress has been made in developing these capabilities by the private sector, together with some Government support, such as the New Zealand Food Innovation Network, public investment in developing this industry in New Zealand significantly lags that in competitor countries such as Australia, Singapore, and Canada, all of which are investing more in driving bioeconomy growth and innovation.

Circularity could reduce New Zealand's emissions…

10. The research analysed the areas of the economy known to have high potential for emissions reductions through circular approaches - building, agriculture/food, and manufacturing.

11. In these areas, emission savings were quantified for eight opportunities which together could provide estimated savings of 1.5-1.9 Mt CO_2e on the annual emission level. For reference, the potential savings quantified would be equivalent to about three per cent reduction on New Zealand's 2021 net emissions. They would represent savings from both domestic emissions and those embodied in imports.

12. Opportunities related to more resource-efficient building accounted for most of these quantified savings, and included interventions such as switching to more recycled, reused and renewable materials, and using less carbon-intensive building materials.

13. A similar amount of additional savings was estimated for the coming decades if resources (especially buildings) are kept in use for longer (see Annex One Section C). A range of other opportunities for emissions savings through circularity approaches were identified but were not able to be quantified due to limited data.

…but comprehensive Government support would be needed.

14. The findings indicate the potential for significant emission savings through circular approaches over time. The experience from other countries shows that achieving meaningful emissions reductions is challenging as it involves significant change in production and consumption systems. In Europe, comprehensive approaches are being used to overcome these challenges, including support for redesigning products, increasing resource efficiency and promoting sustainable practices across sectors.

15. For New Zealand, research insights show that Government action in support of emissions reduction would need to involve multiple interventions over a sustained period, implemented through circular approaches by industry and consumers.

No new actions are being recommended at this time, but we have identified shifts that could be considered in the future if there is appetite.

16. The wide scope of the CEBE means that responses fall under several ministerial portfolios, such as Environment, Agriculture, and Trade, most of which are outside of Economic Development. Due to fiscal savings requirements and the shift in government priorities, officials in those portfolios have not been able to consider new CEBE-related actions.

17. In addition, the ERP2 consultation document (released 17 July) does not include a specific CEBE chapter (ERP1 did). ERP2 is proposed to focus more strongly on the Emissions Trading Scheme with a reduced focus on complementary measures. New CEBE actions have not been considered part of this focused, drivers-based approach, though related concepts are implicit in some chapters, like waste and forestry.

18. We have summarised the types of shifts that could be considered if New Zealand wanted to materially accelerate the transition to a circular economy and a high-value low-emission bioeconomy in the future.

19. These shifts are illustrated in Annex Two with examples of the types of policies which could be analysed for their emissions reduction potential and costs at a future date.

20. The shifts and actions identified for Annex Two were informed by international experience and our own research within the New Zealand context on what is needed to support change in systems. They represent actions which have the best potential to leverage change and impact multiple outcomes, and therefore cover a mix of incremental and transformative shifts/actions enabled by levers across different policy areas.

21. As set out in Annex Two, the research identified multiple benefits from shifting to a circular economy including reduced emissions and lower negative environmental impacts, increased economic productivity and growth, greater export value, and supply chain resilience.

Circular policies of trading partners have implications for New Zealand exporters.

22. Our research found many of New Zealand's trading partners have well-advanced circular policies (see Annex One Section D). Circular economy objectives (explicitly or implicitly) occur in the trade and economic policies of New Zealand's top four trade partners: China, Australia, US and Japan, as well as in the UK, EU, and indications towards this in India.

23. Circular Economy cooperation provisions are included in our recent Free Trade Agreements with the UK and the EU, and in New Zealand's joint statement on Climate Change with the State of California, USA, signed in July 2024.

24. This has implications for New Zealand trade and exports, including potential market access requirements. This will require ongoing awareness of international circular economy developments to ensure timely responses to opportunities and risks. It may also increase business demand for circular policy in future.

25. Our key exporters are reporting that aspects of circularity including packaging and scope 3 emissions (emissions across a product's supply chain) are now regularly raised with them by international customers. For example, exports will soon have to meet Australia's new 2025 National Packaging Targets and standards.

26. We are working with MFAT, NZTE, MPI and MfE to better coordinate information flows to officials and businesses about changing circularity requirements that affect trade. This aligns with the Government's export growth goals.

The Circular Economy and Bioeconomy research can also support other current policy work.

27. Several policy areas have already used the research findings to embed CEBE considerations into existing policy programmes eg the draft Minerals Strategy, which is currently out for consultation. We will actively ensure relevant policy areas are aware of and can access the research. These areas include trade, biotechnology, manufacturing, waste, energy, building and construction, and economic strategy (including Māori economy).

28. The research can also inform a range of priorities signalled by the Minister for the Environment on waste and resource efficiency, including waste infrastructure investment, priority waste streams (organic, plastic, construction and demolition waste) and industry-led product stewardship.

29. Most of the research is published on the MBIE website. Business organisations have used the bioeconomy opportunities research reports, and stakeholders have expressed appreciation for access to the research.

Risks and mitigation

Discontinuing the CEBE strategy and having no explicit CEBE elements in ERP2

30. The Climate Change Commission (CCC) recommended product stewardship circular policies to reduce emissions and 'overarching guidance and an enabling regulatory framework to advance a circular bioeconomy' in its December 2023 advice to the Government on ERP2.

31. Under the Climate Change Response Act of 2022, the Government is required to only consider the CCC's advice on ERPs. There is no requirement to select a specific set of approaches, such as circularity. The Minister of Climate Change is responsible for leading the Government's response to the CCC advice later this year, with support from other Ministers.

32. Stakeholders, including business networks, iwi partners and NGOs have expressed disappointment that the Government is not pursuing a CEBE strategy (discontinued ERP 1 action) and may also voice concerns through the consultation that CEBE actions are not explicitly included in ERP2.

33. We have provided your office with ERP2 Q&A material in advance of the consultation document period.

Summary report on the research programme

34. We will also publish a paper that brings together MBIE's insights from the key findings of all the research. It is a longer version of the summary provided in Annex One, and references the research reports. It will not include the actions outlined in Annex Two. We do not consider there are risks to publishing this paper.

35. MBIE is also preparing the final Bioeconomy situational analysis research report for release. We will update you in a weekly report when we are ready to publish this research.

Next steps

36. This briefing completes the CEBE research action that you have responsibility for in ERP1.

37. MBIE's Small Business and Manufacturing team will use the research insights to support their work. A research report commissioned by this team on 'Mapping Waste and Emissions within the Manufacturing Sector' (delivered with links to our research programme) will be released by the Minister for Small Business and Manufacturing at a Manufacturing sector event in Auckland on 29 July. This report will be published on the same MBIE webpage as our suite of research reports.

38. We recommend you forward this briefing and/or discuss the findings of the research with the Minister of Climate Change. We also support MFAT and MfE's recommendations to forward the briefing to the Ministers for Trade and Environment for their information.

Annex One - Summary of research

As part of the first Emissions Reduction Plan, MBIE undertook a programme of research to determine:

1. New Zealand's potential to reduce emissions through resource efficiency and recovery (circular economy).
2. How to get greater value from New Zealand's biological resources.

The research was focused on developing evidence and insights relevant to New Zealand's distinctive economy, and related challenges and opportunities. For the purposes of this research:

a) a circular economy involves designing out waste and pollution, keeping resources in use for as long as possible, then recovering and regenerating products and materials at the end of their lifecycle

b) the bioeconomy encompasses the sustainable use of natural biomass resource and a reduction in waste and pollutants coupled with transitioning away from dependence on fossil fuel resources.

Both have objectives to achieve economic, environmental, cultural and social outcomes.

A summary of key insights from the research is set out here. The full reports are available on MBIE's website: www.mbie.govt.nz/business-and-employment/economic-development/circular-economy-and-bioeconomy

A. Bioeconomy opportunities, near-term and future, are key for New Zealand's shift from volume to value

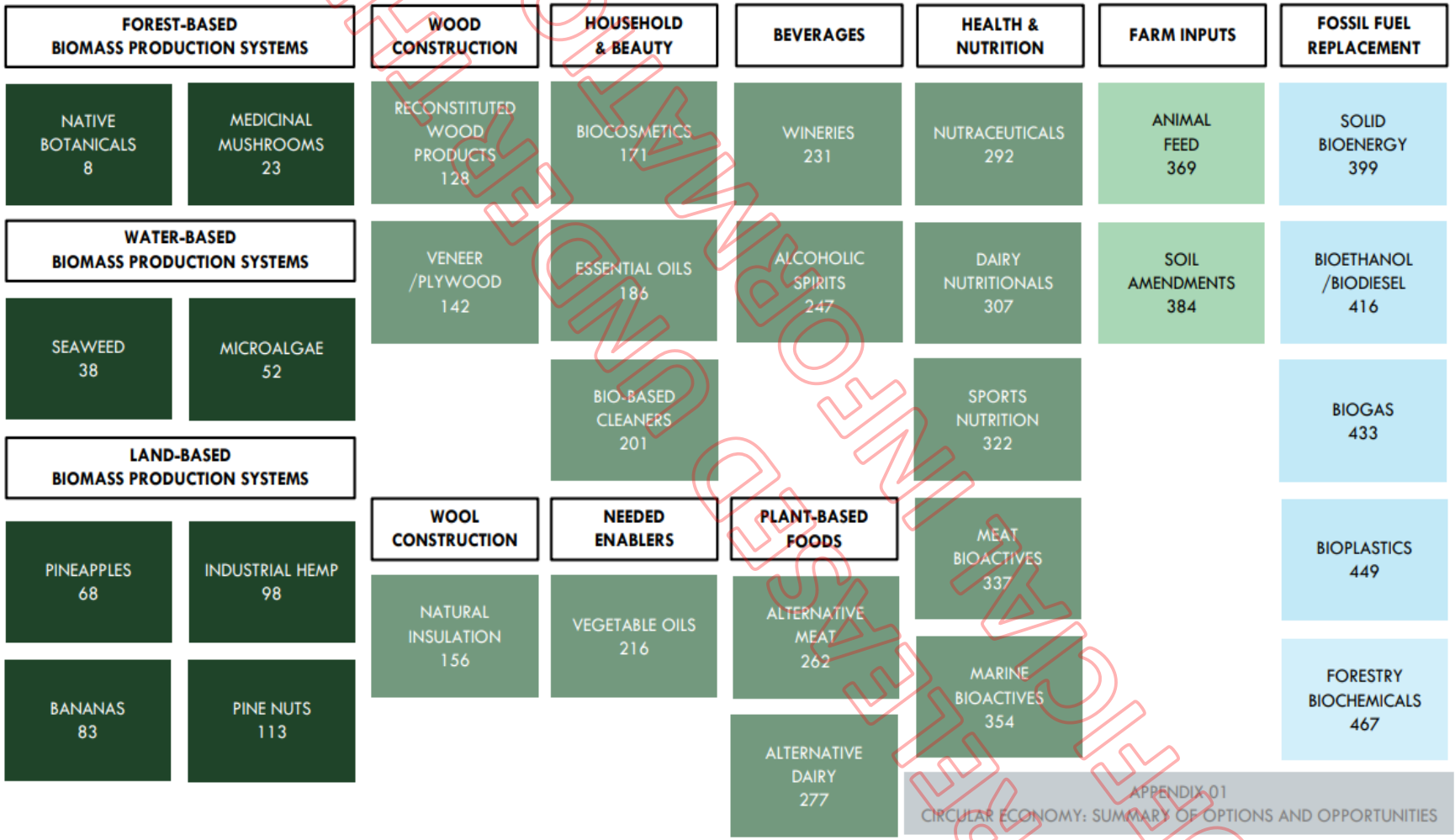
Our research identified emerging or future bioeconomy products/industries that could support the shift to lower emissions and a more productive economy.

One of our research projects identified commercial opportunities for high-value, sustainable and low-emission use of bioresources with a focus on utilising bio-waste streams, increasing circularity in production, and/or reducing emissions and dependency on fossil fuels. Thirty bioeconomy opportunities were identified, listed in Chart 1.

In the short-term, the most attractive are complex products aimed at consumer markets in the categories of household and beauty (eg essential oils), and health and nutrition (eg nutraceuticals). In aggregate, added-value bioeconomy exports spanning processed foods, infant formula, nutraceuticals, alcoholic and non-alcoholic beverages, manuka honey, and petfood were valued at $8.3 billion in 2023, up from $1.5 billion in 2003, a 20-year compound annual growth (CAGR) rate of 9 per cent, above the CAGR required to double in ten years.

Opportunities in biocosmetics, sports nutrition, and marine bio-actives were explored in depth. These are light weight, high-value, knowledge-intensive products aimed at high-growth international markets, and their development may include applications of biotechnology. Importantly, the more value that is created from existing resources through these kinds of products, the more scope there is to achieve greater economic value while limiting or reducing resource depletion and environmental impacts.

Chart 1: Thirty high potential emerging bioeconomy platforms for New Zealand. Index page from Coriolis report, 2023



The research finds that our strength in post-farmgate bioprocessing systems (manufacturing) is highly flexible and not directly tied to the land. This means it is easily adaptable to the manufacture of high-value products (as distinct from commodities),driving diversification and growth in our export economy. Thus, utilising our existing bioresources – including waste streams – into their highest value applications is found to be easier than developing all new crops and sources of biomaterials.

In the longer-term, New Zealand might look to develop new production systems, examples being seaweed, microalgae, industrial hemp, canola, and eucalyptus, most of which are currently being trialled by market players. The key issue with new production systems is whether they can scale quickly and become competitive. Some, like seaweed, will require significant R&D around growing and harvesting systems, to develop efficiency and scale economies. The success of others, like canola, is dependent on whether New Zealand can be internationally competitive with major offshore producers.

Ideally, in the future, New Zealand can utilise its significant forestry resources and potentially new high-rotation crops such as eucalyptus to manufacture biochemicals, bioplastics and bioenergy at a scale to substantially replace similar fossil fuel-derived products. Currently the economics of doing this is challenging. In addition, New Zealand would have to develop a whole value chain around these bio-industries to make them work. This includes funding of innovation infrastructures, such as an open-access pilot-scale biorefinery to enable proof of concept, technical information acquisition and pilot scale production. Work to date on costs of establishing such a facility, including potential revenue streams, indicates that reasonably substantial Government capital investment and ongoing part-funding of operations would be required. This is consistent with the experience of similar facilities in other countries.

Māori business are well placed to pioneer and benefit from emerging ‘new’ bioeconomy products and industries, given existing investment, knowledge, and skills in land-based industries, particularly forestry. Māori enterprises have higher rates of innovation and R&D compared to other New Zealand firms, indicating a strong preference to create long-term and enduring value. For Māori, innovation will be key for: minimising the use of fossil fuels through the development of alternative products; increasing value added by exporting finished and consumer-ready goods rather than raw inputs; and increasing the production of biomass by shifting land-use to higher yielding crops.

Transitioning to the value-added/branded export business requires different skill sets and capabilities – in firms and institutions – that are new to New Zealand

New Zealand has highly developed capabilities along the whole value chain as a low-cost commodity food exporter, based on 120 years of public and private investment. Over the last twenty years there has been growing industry investment in developing more complex added-value products, often consumer products, with exports now valued at $8.3b as indicated above.

This growth has often been led by start-ups and new entrants (eg Chinese investment in infant formula and petfood) rather than by the large incumbents. A key reason for this is that the commodity business requires skills and capabilities based around scale,

efficiency, and quality, while the added-value business requires a whole additional set of skills and capabilities that the commodity players (and New Zealand generally) lack. The additional capabilities include the ability to manage more complex value chains, the need for constant product and packaging innovation, access to pilot facilities, new technologies and machinery, market insights, access to capital, and skills in sales and brand development. Some of the capabilities required have been put in place, such as the New Zealand Food Innovation Network (NZFIN), the Bioresource Processing Alliance (focusing on waste streams), and the Food and Beverage Information Project that ran from 2011 to 2021 (focusing on tracking industry developments and identifying opportunities). Achieving the Government's export target through value rather than volume will likely require scaling and expanding these programmes, in line with the significant investment in food being made by competitor countries like Australia, Singapore, Denmark, and Ireland. Upgrading of capital equipment to enable the production of added value more complex products is also an important opportunity to embed practices of reducing waste and producing more circular products.

B. Circular practices in buildings and infrastructure, agriculture and food and manufacturing will provide significant emissions savings, over time, and have impacts for productivity, jobs and supply chain resilience

Circular economy practices can reduce resource extraction, loss of resources and waste generation, and through this, lower emissions. Emission savings were identified for buildings and infrastructure, agriculture and food, and manufacturing, areas known to have high potential for emissions reductions through circular approaches. Approaches include switching to recycled, reused or renewable materials for buildings, less use of carbon-intensive materials, the use of more local and organic alternatives to imported fertiliser, and greater product durability of manufactured goods.

In these areas, emission savings were able to be quantified for eight interventions with a total savings of 1.5-1.9 Mt CO2e on the annual emission level. (For reference, the savings quantified are equivalent to about three per cent reduction on New Zealand's 2021 net emissions.) Opportunities related to more resource-efficient building accounted for most of these quantified savings.

Further savings are possible over time, for example, a saving of 1.5 Mt CO_2e per annum was estimated to be achievable in 50 years' time if residential buildings are designed to last 100 years, rather than 50 years.

Other opportunities for emissions savings through circular approaches were identified but not able to be quantified in this research due to data limitations. These include those from emerging or long-term change such as designing buildings for reuse, reducing consumption of resources, and agricultural and manufacturing practices that enable storage or sequestration of carbon. These savings would be in New Zealand domestic emissions production, as well as global emissions in products that we import and consume.

Other impacts of circular approaches identified in the research though not quantified were:

- greater productivity through more efficient use of physical resource inputs for manufacturing
- maintaining trade and export competitiveness
- opportunities to mitigate supply chain risk and increase economic resilience, for example through enabling durability, reuse, repair, recovery and local sourcing of critical materials
- new and changed jobs, for example job gains in repair and remanufacturing and job losses in packaging and waste management
- protection of natural capital.

These impacts have particular relevance to manufacturing and point to opportunities for circular approaches to strengthen the performance of New Zealand manufacturing and its contribution to GDP and exports.

Experience from other countries shows that transitioning to a more circular economy is both rewarding and challenging, involving change in production and consumption patterns, requiring comprehensive approaches and sustained action over decades. Sustained action is particularly important for buildings and infrastructure, where the benefits of greater durability manifest not at the point of construction, but at the time when these assets would otherwise have been replaced.

Our research identified that industry is wanting to shift to more resource-efficient practices and are open to collaborating across industry and with government but need access to better data to support decision-making.

C. Internationally, many policies and regulations are driving toward circular approaches and have implications for New Zealand exporters

There are approximately 40 national or trans-national level circular economy strategies worldwide and more than 180 international legislative instruments. Governments have adopted circular approaches to address limited raw material availability and supply chain shocks, increase productivity and jobs, and address climate change and degenerating natural capital.

A wide range of measures are used including bans, levies, taxes, minimum prices, standards, requirements for information on products, extended producer responsibility, procurement, grants and other regulatory and fiscal incentives.

Policies focussed on upstream waste prevention and resource recovery are of growing interest and include incentives for circular design, repairability, and use of digital product passports and other transparency measures to provide consumers with information about the origin, footprint, recyclability and life cycle of products. New Zealand is also among 175 countries that have agreed to develop a legally binding Global Plastics Treaty, including circular economy approaches to address plastic pollution.

Most attention on emissions and climate change mitigation to date focus on the role of energy (largely scope 1 and 2 emissions). However, increasing attention globally is being paid to material and wider supply chain-related emissions (scope 3). A shift to a circular

economy is a key part of reducing scope 3 emissions in material production and supply chains.

Our trading partners' circular economy transitions will likely have implications for some New Zealand exporters and our place in wider global trade flows. Circular economy objectives are reflected in the trade and economic policies of New Zealand's top four trade partners: China, Australia, US and Japan, as well as in the UK, EU, and indications towards this in India. There are explicit circular economy provisions in New Zealand's recent Free Trade Agreements with the EU, UK, and the updated Closer Economic Relations (CER) Sustainable and Inclusive Trade Declaration with Australia. Shared interest in working together on circular economy is part of the joint statement on California-New Zealand Climate Cooperation signed in July 2024.

New Zealand will require ongoing awareness of international circular economy developments to make timely responses to opportunities and risks, including where regulatory interventions may be needed. Failure to comply with international standards and practices may mean reductions in market access, additional trade costs, or loss of competitive advantage.

Examples of international developments with implications for New Zealand include:

- Changes to Australian sustainability and recyclability requirements which will need to be met by New Zealand exporters for Australia's 2025 National Packaging Targets.
- EU reporting and disclosure measures that will have implications for some products placed in the EU market, including recyclability or recycled content requirements, labelling, eco-design, traceability, and product data.

New Zealand has limited ability to influence design and manufacturing abroad. This makes strategic collaboration with trade partners on circular economy approaches important to mitigate risks of supply chain disruptions and market volatility. Government has roles through our information networks and trade relationships to monitor developments and support our exporter community to adapt to these global transitions.

D. Data, information, and digital tools can help track and manage resources more efficiently to support the functioning of markets and create transparency for consumers

Sophisticated use of data and information enabled by digital tools will be needed to significantly increase resource efficiency and extend the lifespan of products, buildings and infrastructure.

Digital tools under development include sharing platforms, reverse logistics support, and product passports that provide advanced barcode-like information about what is in a product, how it is made and how it can be reused or recycled. These digital tools will involve the use of artificial intelligence, big data analytics, internet of things, 3D printing, digital engineering and digital twins.

Digital twins are ‘a dynamic and interconnected digital representation of a physical asset or system, enabling comprehensive insights and informed decision making’. They can help track materials in the value chain, facilitate predictive maintenance of machines, and fill gaps in information about product composition and availability to enable markets to function well for product reuse or recycling. In a manufacturing industry context, digital twins are part of the shift to Industry 4.0, allowing more automated and connected supply chain management. For built environment uses, digital twin technology could unlock cost and resource savings by allowing virtual trials of design changes, material and equipment choices, and infrastructure upgrades.

There are a wide range of digital twins in development or early-stage use in New Zealand. Most twins are of cities, buildings, or infrastructure, often developed by councils, to enable efficient design, planning and management of resources and assets. Sector-oriented R&D programmes include forest, vineyard and orchard twins to support sustainable and productive growing systems. These current uses are consistent with circular objectives for resource efficiency.

Digital twins are not yet being developed in a way to realise their full potential in New Zealand. A lack of data literacy is reducing the effective exchange and use of data. Limits in collaboration across industry and data standardisation mean digital twins are being developed without optimal interoperability (ability for multiple systems to exchange and use information in real time). Adoption of standardised frameworks and technical capabilities, such as artificial intelligence, would enable digital twins to operate in more connected ways.

E. New Zealand is at an early stage on the shift to a more circular economy

New Zealand’s economy, like most other countries, is not very circular. We are one of the highest generators of waste in the OECD, with 700kg per person sent to municipal landfills. Our research estimated that less than 1 per cent of materials that flow into the New Zealand economy are recovered through recycling.

There is a growing niche of businesses adopting circular practices and a network of community organisations focussed on resource efficiency with particular efforts on food rescue initiatives. Modest government investments have supported these initiatives while the circular concept is beginning to be embedded in some areas of government policy.

Regional initiatives using circular practices are emerging in New Zealand, particularly in the bioeconomy. For example, Northland’s Ngawha Innovation and Enterprise Park is a collaborative hub for business and process innovation, focussed on kaitiaki, circular economies, employment opportunities and regional capability development. There are also existing communities involved in networks supporting avoidance of waste and circular approaches; such as Para Kore, Zero Waste Network, New Zealand Food Waste Champions and Repair Café Aotearoa.

Organisations such as the Sustainable Business Network have been supporting circular business practices for many years. Their Circular Economy Directory lists 129 organisations and has had 34,000 users since 2019.

Many circular businesses remain small and have difficulty scaling in an economic system and business environment that is still fundamentally linear. Product end-of-life considerations tend to be the focus for many businesses wanting to be more circular. Reinventing products and designing out waste in the first place has been less prominent but are growing.

F. Material shifts to a circular economy and a higher value bioeconomy would need to be supported by sustained Government investment.

Shifting towards a more circular economy could support market competitiveness and supply chain resilience for critical materials, reduce emissions and environmental degradation, and generate local jobs. While the shift to circularity requires action from the business sector, consumers and communities due to the scale of change required, government has a substantive role to play. Experience from other countries shows the shift can be slow, requires multiple levers, and governments turning to stronger market-shaping interventions to accelerate the shift to reduced and better use of resources.

Moving to higher-value lower-emissions products in the bioeconomy will be needed for New Zealand's transition to a low-emissions economy and will help contribute to the government's doubling of exports goal. Moving from volume to value has been a long-term yet challenging goal for New Zealand.

Collectively, the research programme finds that New Zealand's shift to a circular economy and to a high-value bioeconomy could be a means to achieving a range of government goals: emissions reduction, as well as economic productivity and growth, growing export value, and supply chain resilience. A material shift will require sustained investment and multiple initiatives across different policy areas.

Annex Two summarises the shifts needed by New Zealand as a whole and the role the government would need to play in accelerating these.

Annex Two. Shifts required if New Zealand wanted a significant and accelerated transition to a circular economy and high-value low-emissions bioeconomy

The table below draws on the research findings and MBIE analysis. It shows two main things:

1. **How multiple outcomes of importance to New Zealand** (row 1) can be enabled by a more circular economy and sustainable high-value bioeconomy through four (indicative) objectives (row 2).
   In addition to emissions reduction 🟠, transitioning to a circular economy and high-value bioeconomy would contribute to the Government's economic goals, including: economic productivity and growth 🔵, greater export value 🟣, and supply chain resilience 🔴.
2. **A number of shifts that would be required** should New Zealand want to materially reduce emissions through circular approaches and materially increase the value-add derived from the bioeconomy (row 4). These draw on knowledge about what is needed to support change in systems and represent areas with the best potential to leverage change with impact on multiple outcomes and therefore cover a mix of incremental and transformative shifts/actions as well as a range of levers across different policy areas.

   The shifts are set out at a high level, with dots indicating alignment with outcomes. Possible government actions to support these shifts are indicated (row 5). These are examples only and would require further analysis and consultation, including analysis of emissions reduction and costs, to be progressed.

(Row 1) Outcomes: Emissions Reduction🟠; Economic Productivity and Growth🔵; Greater Export Value🟣; Supply Chain Resilience🔴			
(Row 2) Objectives	**Keep up with global change** 🟠🔴🟣 Information and insights to collaborate globally and remain competitive in a world moving towards circularity.	**Measure and track resources** 🟠🔵🔴 Technology, standards, and digital capability required to measure, track and improve circular resource use in products and across supply chains.	**Incentivise resource efficiency, durability, and recovery** 🟠🔵🔴 Designing out waste and extending the life and use of high-value and critical materials in our economy, including a durable and adaptable built environment and infrastructure.	**Greater value from our bioeconomy** 🟠🔵🟣🔴 A bioeconomy (land and sea) that builds on regional, sector and Māori economy strengths, with greater innovation, capability, and resilience. Biological resources are managed and utilised to their highest value, reducing reliance on fossil fuels.
(Row 3) Current state and initiatives within New Zealand			
New Zealand's trading partners are well-advanced in implementing circular economy policies, creating new market and trade requirements that many exporters will need to meet. Early awareness of these global shifts would provide New Zealand with time to innovate to protect market access and premiums. Global constraints on the supply of critical materials (eg, for the green energy transition) could bring price volatility and disruption. New Zealand could increase supply chain resilience by recovering critical materials, but the government may need to help broker partnerships with other countries for capturing materials from complex products.	A low-emissions, resource-efficient economy will involve sophisticated use of data and information about use of resources, enabled by digital tools. This will involve data at the product level, eg on bar codes or passports, but increasingly also information across value chains that show the full life cycle of products. This will better enable business to design for circularity in products and business models, working with other parts of a value chain, to ensure and demonstrate low-emissions footprints, less waste, and pathways for recovery and reuse.	Generating a shift to a circular economy requires levelling the playing field for businesses. Circular products internalise the cost of waste and emissions which makes it difficult to compete on price with businesses that transfer those costs to the public. Internationally, governments are using regulations, public procurement, refinements to the tax system, and capability support to level the playing field and incentivise business investment in circular and low emissions production. Some areas have greater impact, such as focussing on sectors with high emissions and waste profiles such as construction. The early or upstream stage of product development holds the most potential to reduce environmental impact and add value.	Achieving greater value-add from our bioeconomy would increase productivity and support the government's export and climate goals. The New Zealand industry has deep and enduring capabilities in the production, processing and exporting of commodities, but we are underdeveloped in added-value consumer goods markets. Scaling value-add biological industries will benefit from a coordinated and targeted approach. Government has roles to develop the necessary capabilities and infrastructures through regulation, investment, export facilitation and capability building, and support for regional and industry innovation cluster networks, and incubators.
There are circular economy provisions in New Zealand's recent FTAs with the EU, UK, and updated Australian CER agreement. New Zealand has several current mechanisms for monitoring global	New Zealand has limited product level data about resource use, though this is growing in response to resource constraints and sustainability expectations being integrated into supply	Circular economy principles currently inform the basis of the New Zealand Waste Strategy, the recent waste policy changes (such as bans on single use plastic and proposed investment in	Several initiatives have been established to lift value including: • The New Zealand Food Innovation Network (ie new product development, commercialisation)

developments and insights, including market intelligence briefings, market guides and export advice. New Zealand is also involved in global cooperation to better manage material and waste flows (eg, the Global Plastics Treaty, Climate Cooperation Statement with California) with signs that there will be more international cooperation to come on material and waste issues. New Zealand has strong relationships with international partners and standard setting bodies like the ISO, which are currently implementing a range of new global standards on the circular economy. The draft Minerals Strategy includes a circular economy objective to recover critical minerals.	chains. Key industries are ready to test the use of digital tools like material or product passports and traceability. There is some use of digital twins for building and infrastructure, particularly at regional/city levels, though they are not yet being developed with optimal interoperability in a way to realise their full potential in New Zealand. The ability to leverage such technology is connected to wider developments in digital and AI frameworks and capability across government and businesses.	resource recovery), and the direction of Waste Minimisation Act legislative reforms. For the built environment, there is information provision to promote low-waste and low-carbon building and construction, low-waste sustainability practices of Kāinga Ora, and the circular economy components of the New Zealand Infrastructure strategy. The government provides modest funding to a range of private business-facing and community networks who are leading circularity in New Zealand. The Government Procurement Rules include a broader outcome rule that seeks to support a reduction of emissions and waste through government procurement. However, many circular businesses, manufacturers and initiatives remain small and have difficulty scaling in an economic system and business environment that is still fundamentally linear.	• The Product Accelerator and Bioresource Processing Alliance (ie access to research expertise, commercialisation) • The Ngawha Innovation and Enterprise Park • The Marlborough Research Centre • SCION, in the context of new bioeconomy products, biofuels, biochemicals • Community-based initiatives for food and bio waste recovery/valorisation. Enabling policies to support nature-based solutions to climate change (eg non-forest removals such as wetland restoration) are currently being consulted on through the development of the second Emissions Reduction Plan. There is early exploration on the future use and feasibility of biological resources for energy. Standards are currently being developed for bioenergy feedstocks and studies underway on the feasibility of producing sustainable aviation fuel in New Zealand.
(Row 4) Shifts that would be required if New Zealand wanted a significant and accelerated transition to a circular economy and high-value low-emissions bioeconomy			
Global trade and cooperation: • Further circular economy focus in our relationships with international partners and standard-setting bodies, including in the context of FTAs, to maintain New Zealand competitiveness. 🟠🔵🟣🔴 • Strengthened international supply chains for economic resilience and growth through circular economy (especially at the regional level and supporting the recovery and reuse of critical materials). 🔵🟣🔴 • Strong Māori trade and cooperation, signalled in trade agreements, enabling global reach of Māori leadership in Mātauranga-based circular practices. 🟠🔵🟣	**Data and digital:** • More accessible and reliable data about resources available widely, enabled through data platforms with relevant governance structures. 🔴🟠 • Better digital twin interoperability and uptake, potentially a federated model supporting whole system or national insights. 🔵🔴 • Widespread and effective use of digital tools (eg product passports) to enable traceable, transparent, and sustainable supply chains (and reverse logistics) to meet export market and business requirements, and support consumer choices, especially in the **Food** and broader **Manufacturing sectors** to support export premiums. 🟠🔵🟣🔴	**Support sectors and economy with circular shift** **Manufacturing** 🟠🔵🟣🔴 • Strengthened process innovation capabilities enabling resource and energy efficiency, for example through tech-enabled reduced waste/inputs, improved asset management, and business model innovation to support capitalisation. • More use of mass timber and innovative bio-based materials for use in domestic built environment and for high-value exports. • More businesses involved in recovery and remanufacturing, for example in clean technology innovation, and recycling for critical minerals/materials. **Building** 🟠🔵🔴 • Low waste and low embodied carbon design and construction becomes the norm.	**Realise bioeconomy opportunities:** **Local and foreign Investment** 🔵🟣🔴 • More investment in the New Zealand bioeconomy business. **Innovation, R&D and commercialisation** 🟠🔵🟣🔴 • Scale up and expand existing innovation and commercialisation institutions (connecting science, firms, and markets) to meet increasing demand. • Development of new capabilities such as a pilot scale biorefinery to support the development of new high-value bioeconomy industries (biofuels, biomaterials). • Leveraging New Zealand's brand and premium eg through Māori-led Mātauranga-based exports, and use of data and technology to demonstrate provenance/sustainability. **Sustainable biological resource and land use** 🔴🟠🔵 • Accelerated transition to low-extraction, agricultural practices (eg through phasing in sustainable fertilisers, feed, irrigation, treatments).

		• More recovery and reuse of construction material waste, enabled by data and digital tools. • Increased utilisation of buildings, for example through design which allows for repurposing. **Whole economy** • More upstream consideration of resource efficiency in the design and management of infrastructure and assets. • Expanded secondary material processing and supporting infrastructure. • Competitive options for business model innovation, such as product-as-a-service or industrial symbiosis, to support sustainability and productivity. • A level playing field for businesses that internalise the costs of emissions and waste so they can compete with those that do not and pass these costs to consumers. • Improved prevention of food loss and waste, supported by system-wide coordination across supply/value chains, from production, to manufacturing and food service, to retail and household consumption. ***Further food sector shifts and actions in bioeconomy column**	• Further carbon removals on land (private and public) and marine to sequester and store carbon, while providing additional benefits such as biodiversity and water storage and purification. • More coordination of policies, advice, and actions for the sustainable use of biological resources. **Regional economic development** • More/scaled up regional bio-based manufacturing, eg supporting existing local Māori initiatives, and opportunities in wood products, blue economy, high-value bio-products and food innovations strengths. • More connected food system networks, enabling place-based circular and resilient food systems.
(Row 5) The types of actions that would need to be explored if New Zealand wanted a significant and accelerated transition to a circular economy and high-value low-emissions bioeconomy			

Possible government actions – examples:
• Partner with overseas governments and standard-setting bodies on actions that support New Zealand exporters, eg circular standards.
• Provide bespoke support to exporters to meet global circular trading standards.
• Work with close partners in the region (eg Australia) to identify opportunities for joint circular infrastructure and interoperability (such as critical material recovery, recycling and remanufacturing).
• Establish an institutional scanning capability to anticipate and respond to global developments, similar to the
	Possible government actions – examples:
	• Support availability and use of data about materials and emissions for products and across supply chains.
	• Enable a data market about resources, potentially involving a regulatory framework for a fee-for-use access to private data held (eg in engineering firms).
	• For digital twins, support coordination and integration of disparate datasets, utilising AI and technical capabilities.
	• Lead a pilot project to establish an AI-enabled digital model for infrastructure development; this could identify and resolve coordination and regulatory
		Possible government actions – examples:
		• Increase resource efficiency over the life cycle of major infrastructure, through design and asset management.
		• Scale up nationwide infrastructure for resource recovery with coordinated support for generating local business opportunities.
		• Expand the product stewardship programme.
		• Remove current barriers in tax system for circular business models (eg GST rules on products-as-a-service). Explore green taxes as a market incentive.
		• Incentivise product reuse and repair, eg through progressing right-to-repair legislation.
		• Develop consistent standards for reused materials.
			Possible government actions – examples:
			• Investment in comprehensive bioeconomy market analysis made publicly available in a form familiar and useful to business, and regularly updated.
			• Investment in development of new capabilities and institutions to realise high-value bioeconomy opportunities eg through:
			  ○ scaling up and better connecting existing food and bioresources innovation networks
			  ○ development of infrastructure eg refineries, biotech facilities
			  ○ fund new regional innovation hubs that demonstrate and scale circular and bio-based manufacturing aligned with local bioresource streams and capabilities.
			• Support coordination of bioeconomy policy and actions across government and sectors.

Singapore Government's Centre for Strategic Futures.	issues as a precursor to national rollout. • Develop and use national and sector-based metrics to track progress in resource efficiency and circularity shifts.	• Incentivise lower waste in the construction sector (eg through regulatory levers, standards and government procurement). • Enable government IT suppliers to lower waste and support reuse through business advice and facilitation support. • Support circular economy technology adoption by businesses. • Support knowledge brokering, eg through hubs, forums or targeted capability advice, to enable sectors and businesses to develop and share best practice. • Support expansion of existing local economy networks that engage communities, businesses and households in shifts to low waste and efficient use of resources eg eco hubs, repair cafés, and zero-waste initiatives. • Monitor and support reduction in food waste generated across supply chains through better availability of food waste data and digital tools.	

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Circular economy + Bioeconomy

Insights from MBIE research

What is a circular economy?

'An economic system that uses a systemic approach to maintain a circular flow of resources, by recovering, retaining or adding to their value while contributing to sustainable development.' (new **Circular economy standard ISO 59004 ,** 2024)

Why do we need this…?

Our global economy is extractive, linear and unsustainable:

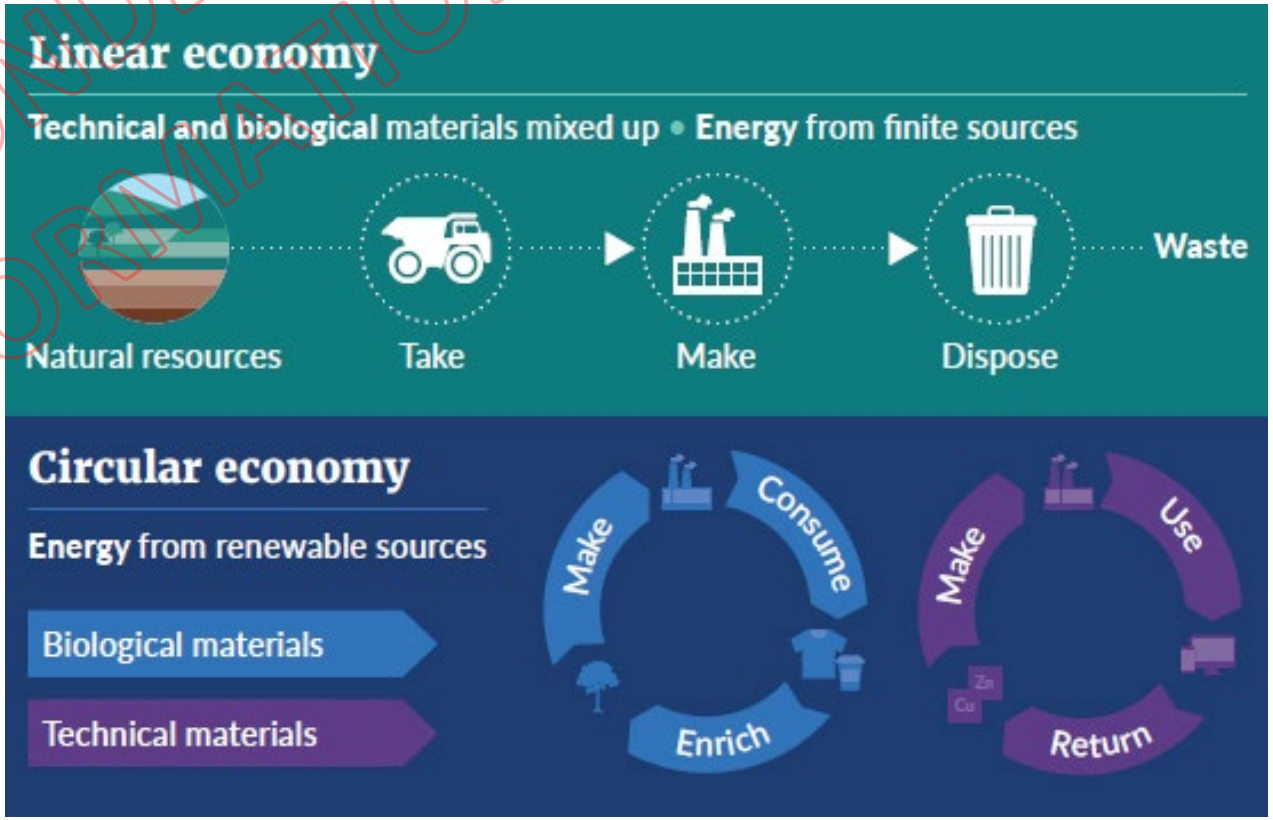
- In 2022, the world extracted more than 100 billion tonnes of biomass, fossil fuels, metal ores and non-metallic minerals, 3 times the amount of 50 years ago.

- One-third of all extracted material is discarded within a year. This extractive process represents a 'linear economy. "Take – make – waste"

A circular economy offers an alternative model:

- More than just 'recycling – CE aims to design out waste from the outset, keep materials at their highest value for the longest time, and regenerate natural systems and resources.

- Reversing this loss of natural capital could unlock enormous value and make a significant difference to climate change impacts.

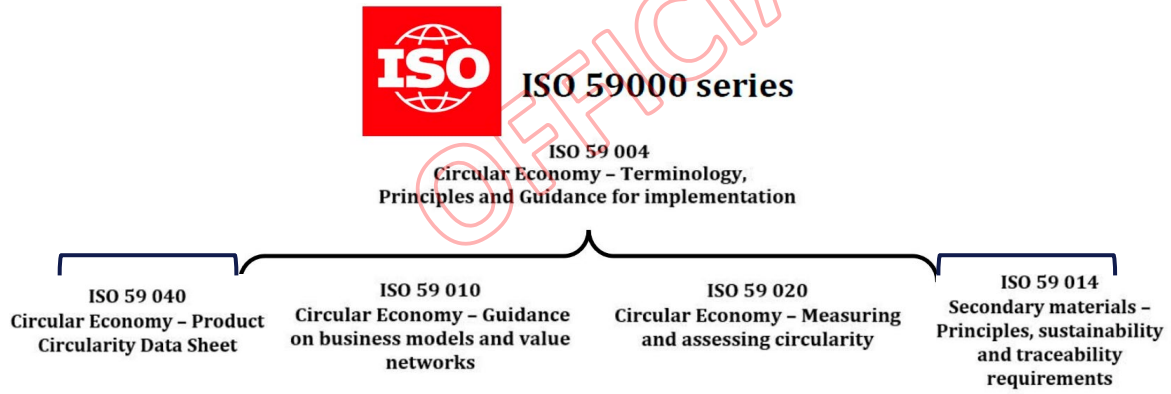


CE is becoming standardised

The new ISO CE standards are an important milestone. This marks a change from hundreds of definitions (221 identified in 2023) toward much more consistency.

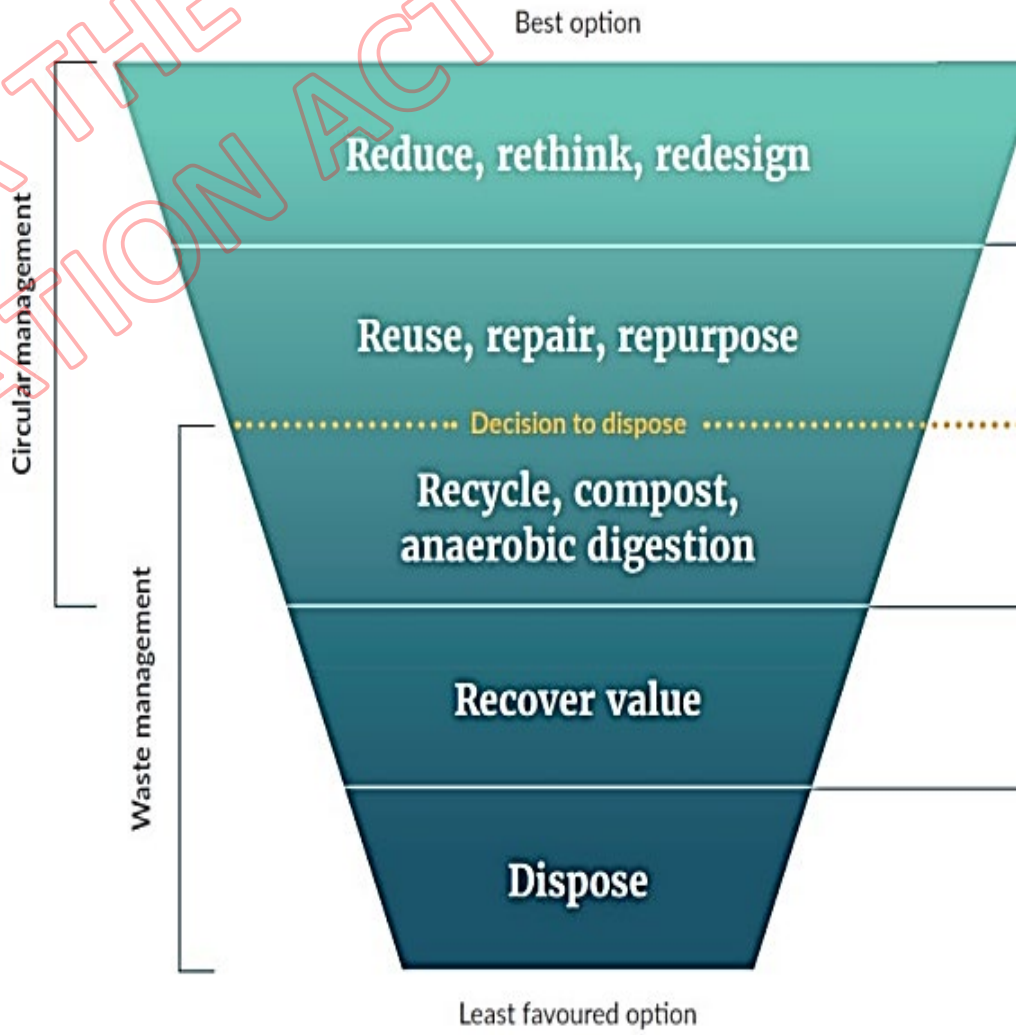
Our insights…

- New standard and consistent definitions will accelerate regulatory embedding and business adoption of circular practices.
- Alongside 'circular economy', also seeing more use of terms 'resource efficiency' and 'material productivity'
- Waste hierarchy (right) will continue to be relevant. Circular approaches favour top of hierarchy as best options.
- Circularity will continue to be used by governments and industries for sustainable development. Green growth will be the near-term focus; longer term will see more attention to supporting consumption within environmental limits.



Waste hierarchy

From [Aotearoa New Zealand Waste Strategy]

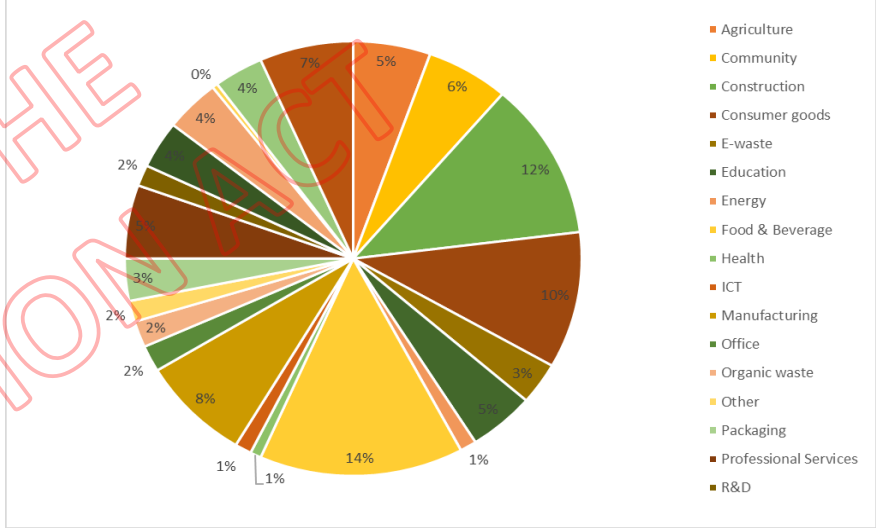


Source: [MBIE, 2024. Barriers, enablers and approaches for a more circular economy]

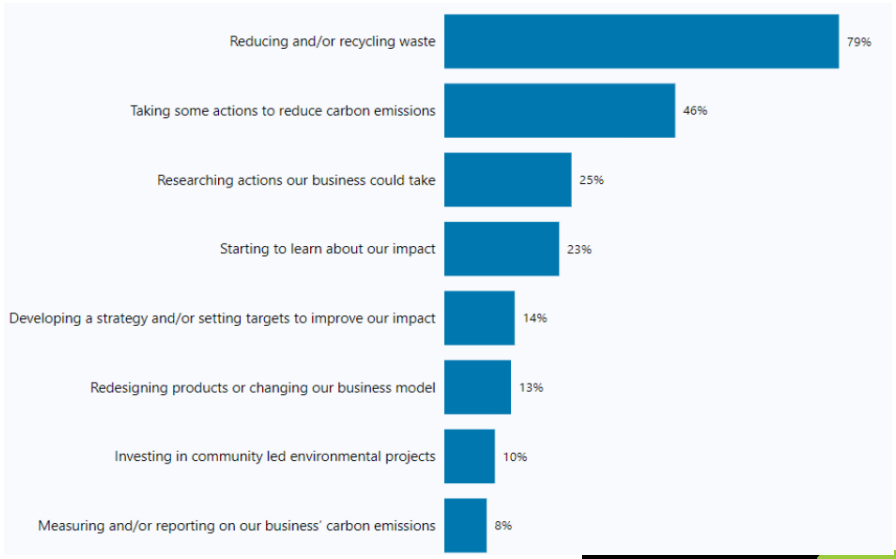
How circular is New Zealand?

- Not very…. (early days!). We are currently one of the highest generators of waste in the OECD, with an average of 700kg per person sent to municipal landfills in 2021. Less than 1% of materials that flow into the NZ economy are recovered through recycling.
- Several businesses are adopting circular practices – but still emerging and niche. Many circular businesses remain small and have difficulty scaling in an economic system and business environment that is still fundamentally linear.
- These businesses operate in a wide range of sectors, but particularly in construction, food and consumer goods.
- Product end-of-life considerations tend to be the focus for many businesses wanting to be more circular. Reinventing products and designing out waste in the first place has been less prominent but is growing.
- 75% of businesses report they consider the impact their business has on the environment. (Environmental awareness & action survey/report (2024)
- Businesses taking environmental action are primarily focused on ways to reduce and/or recycle waste. Businesses report that what they need most is access to solutions to reduce their environmental impact

New Zealand business using circular practices span a wide range of sectors



What actions are businesses taking to improve their environmental impact?

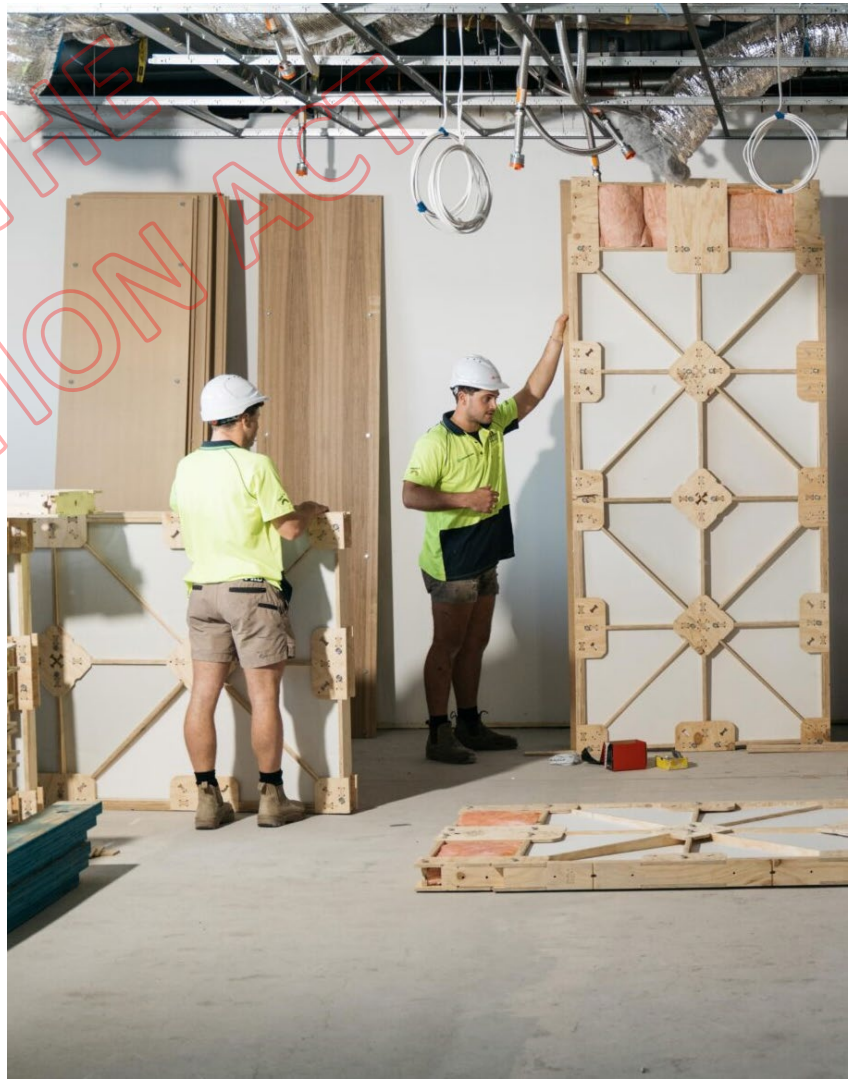


Source: MBIE Business environmental awareness, action and support

Source: Thinkstep-anz, 2024. Impacts of circular approaches on emissions, jobs and other factors

How circular is New Zealand?

- Not very…. (early days!). We are currently one of the highest generators of waste in the OECD, with an average of 700kg per person sent to municipal landfills in 2021. Less than 1% of materials that flow into the NZ economy are recovered through recycling.
- Several businesses are adopting circular practices – but still emerging and niche. These businesses operate in a wide range of sectors, but particularly in construction, food and consumer goods.
- Tend to remain small and have difficulty scaling in an economic system and business environment that is still fundamentally linear.
- Product end-of-life considerations tend to be the focus for many businesses wanting to be more circular. Reinventing products and designing out waste in the first place has been less prominent but is growing.
- 75% of businesses report they consider the impact their business has on the environment. (Environmental awareness & action survey/report (2024)
- Businesses taking environmental action are primarily focused on ways to reduce and/or recycle waste. Businesses report that what they need most is access to solutions to reduce their environmental impact.
- **New Zealand is at an early stage of the shift to more circular economy; there is emergent activity in sustainable businesses and communities**



Source: MXFrame transforms building at the click of a panel - TonsleyBIE
Business environmental awareness, action and support

Source: Thinkstep-anz, 2024. Impacts of circular approaches on emissions, jobs and other factors

What is happening?

PARLIAMENT

Infrastructure Commission – 30year plan includes range of circular actions for resource efficiency and recovery
Parliamentary Commissioner for the Environment - research on resources – metals required for renewable energy, plastic waste, future resource use and impacts
Right to Repair Bill – introduced in 2024 to enable repair of goods, with more responsibility for producers, if passed would amend Consumer Guarantees Act.

CENTRAL GOVERNMENT

MBIE
Manufacturing - developing data on manufacturing emissions and waste
Government procurement, 'broader outcomes' includes transition to net-zero and designing out waste for office supplies, light vehicles
Minerals Strategy – includes actions on recycling / circularity of critical minerals
Building Performance & Resilience incentivising waste reduction and resilient buildings
Business.govt.nz – sustainability advice (also NZTE), climate action toolbox

MPI
Te Uru Rakau, Wood Processing Growth Fund – supporting onshore long-lived wood product production

MfE
Waste policies- Waste Strategy, Waste Minimisation Fund, product stewardship priority products: eg plastic packaging, tyres, e-waste; resource recovery infrastructure

BUSINESS & COMMUNITY

Sustainable Business Network and **Circularity X-Labs** support circular business practices and capability. The SBN Circular Economy Directory lists 129 organisations and has had 34,000 users since 2019.
Northland's Ngawha Innovation and Enterprise Park is a collaborative hub for business and process innovation, focussed on kaitiaki, circular economies, employment opportunities and regional capability development.
Communities involved in **networks** supporting avoidance of waste and circular approaches; such as Para Kore, Zero Waste Network, New Zealand Food Waste Champions and Repair Café Aotearoa.

LOCAL GOVERNMENT

Local waste minimisation project support
Circular city initiatives as part of economic plans, eg Auckland, Wellington

What are our trade partners doing?

- Circular economy objectives are reflected in the trade and economic policies of New Zealand's **top four trade partners: China, Australia, US and Japan**, as well as in the UK, EU, and indications towards this in India.
- There are explicit circular economy provisions in our recent **FTAs with the EU, UK**, and the updated CER **Sustainable & Inclusive Trade Declaration with Aus**.
- **Emerging global and regional CE architecture** includes the Global Plastics Treaty, ASEAN Circular Economy Framework and ANZPAC - the Australian, New Zealand, and Pacific Islands Plastics Pact.

Our insights…

- **Internationally, many policies and regulations are aimed at circular practices.**
- This will have implications for New Zealand exporters and our place in wider global trade flows.

Source: International developments and implications for New Zealand

Example: Australia

- Many countries have developed policy and regulatory measures to support the circular economy shift.
- Circular economy objectives are reflected in the trade and economic policies of **Australia**
- **Established a Circular Economy Ministerial Advisory Group in 2023**
- Circular economy provisions in our updated CER **Sustainable & Inclusive Trade Declaration.**
- ANZPAC - the Australian, New Zealand, and Pacific Islands Plastics Pact.
- Australia's 2025 packaging reforms/requirements: NZ export product packaging will eventually have to comply with new, nationwide sustainable packaging laws in Australia.
- The federal government, and all states and territories want to make businesses responsible for the packaging they produce and introduce to the market.
- In a historic agreement, all levels of government have agreed to mandate packaging design standards under Australia's 2025 National Packaging Targets.

AUSTRALIAN CIRCULAR ECONOMY HUB

CIRCULAR ECONOMY VICTORIA

ANZPAC PLASTICS PACT

CEWA
Circular Economy Western Australia

Source: International developments and implications for New Zealand

What is the bioeconomy?

- **The bioeconomy** is the production, utilization, conservation, and regeneration of **biological resources**, including related knowledge, science, technology, and innovation, to provide **sustainable solutions** (information, products, processes and services) within and across **all economic sectors** enabling a transformation to a sustainable economy.*

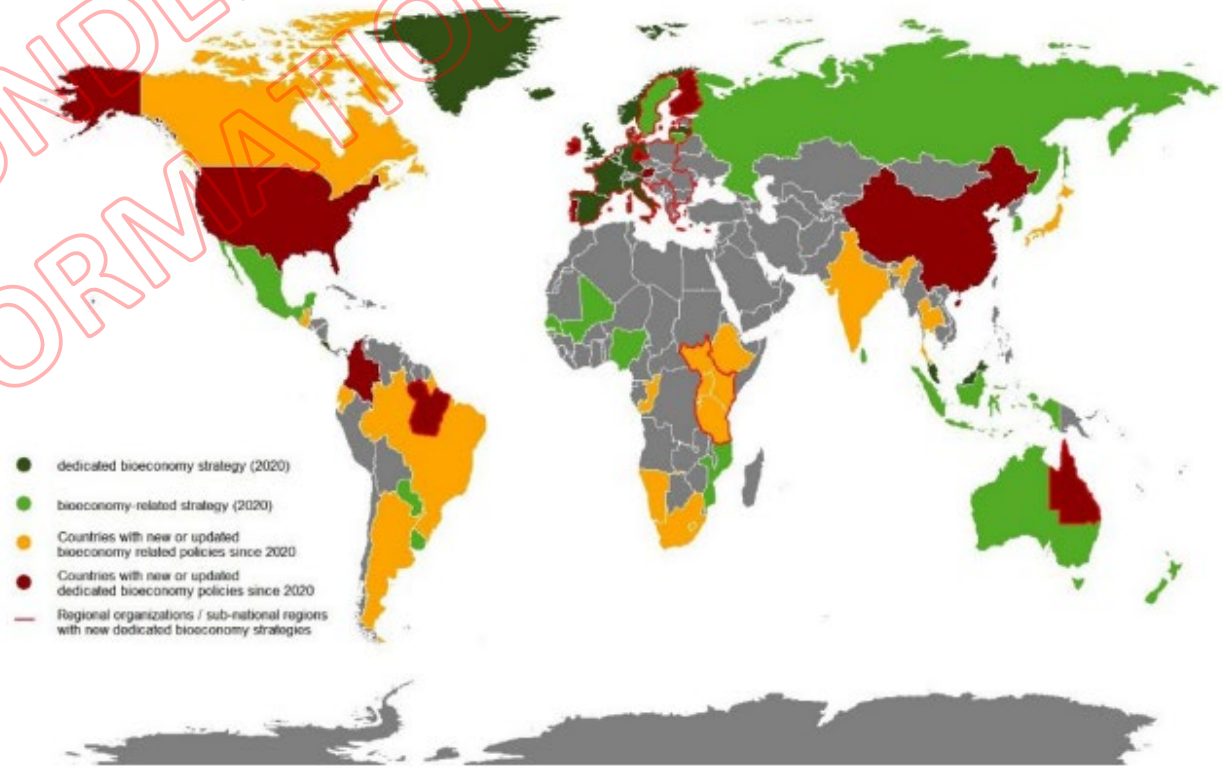
Encompasses:

- **Biomass production systems** (raw materials): forestry; arable, non-tree horticulture; tree/bush/vine; aquaculture; wild capture.
- **Biomass processing systems** (products): wood processing; fibre processing; non-food consumer packaged goods (CPG)/fast moving consumer goods (FMCG); beverages; food processing; farm inputs; fossil fuel substitutes.
- Both may include **biotechnology applications**

The bioeconomy is increasingly seen as a source of solutions to humanity's basic challenges. This is reflected in a growing number of bioeconomy related policies globally.

Trend: growing number of bioeconomy policies

Countries coloured gold and brown have new policies since 2020.



*Source for definition and figure: International Advisory Council of the Global Bioeconomy

New Zealand's bioeconomy?

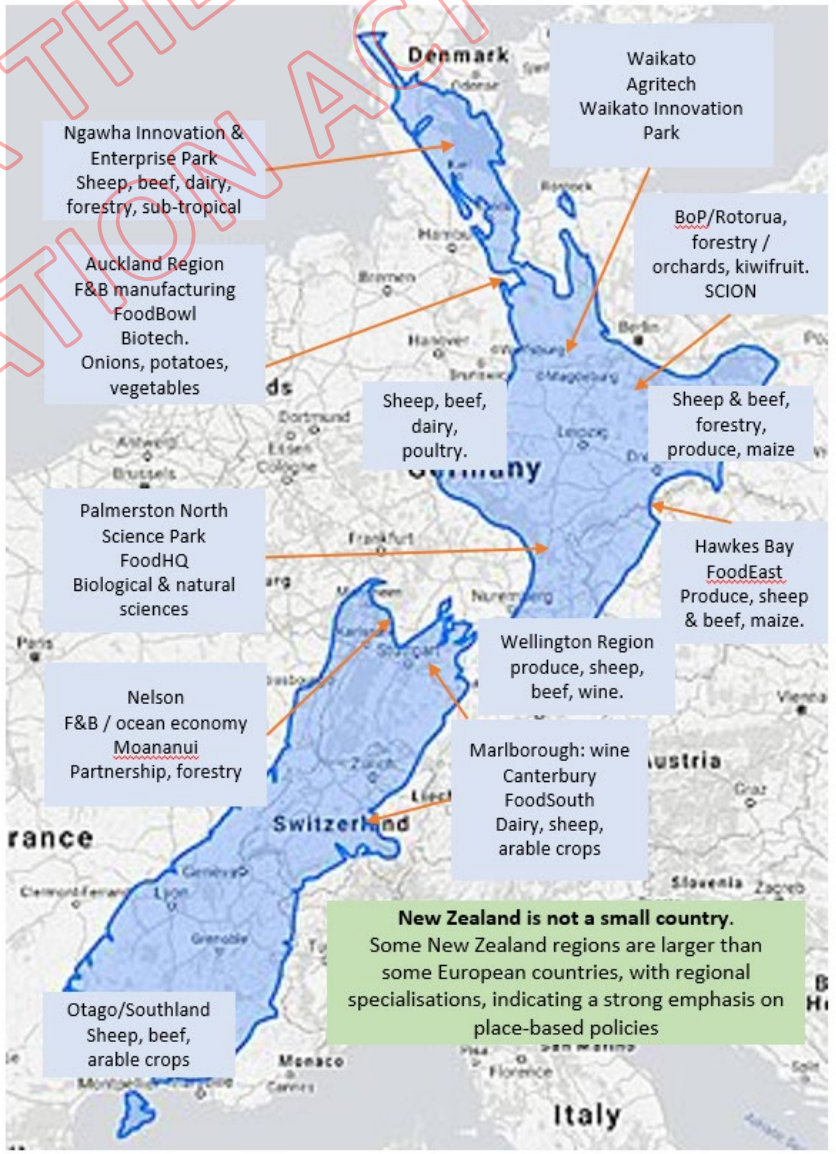
- The bioeconomy accounts for about 60% of our land use, two thirds of which is exotic grassland ie paddocks. Human settlements make up 1%.
- Biomass is our weightiest resource - 100,499 kt per annum or 64% of total extracted and imported resources. Of our annual imports of materials, 4,453kt (32%) is animal feed and fertiliser.
- Bioeconomy based exports were $53 billion in 2022, 80% of total exports. While most are NZ core products (dairy, meat, wine, horticulture, forestry) added-value products are showing strong growth, c$8.3b in 2023.
- Our bioeconomy contributes 57% of New Zealand's emissions.

Our insights…

- The bioeconomy provides the most significant opportunity for New Zealand to shift the economy to higher value and lower emissions.
- This will involve a move from being 'part of the problem' to being 'part of the solution'.
- New Zealand is a large country. Strengthening the value from our bioeconomy is a regional story. Bio-innovation and production tends to be place-based, located near bio resources and govt-supported facilities.

Sources: Thinkstep-anz, 2024. Impacts of circular approaches on emissions, jobs and other factors
Coriolis, 2023. Emerging and future platforms in New Zealand's bioeconomy

New Zealand's Regional Bioeconomies

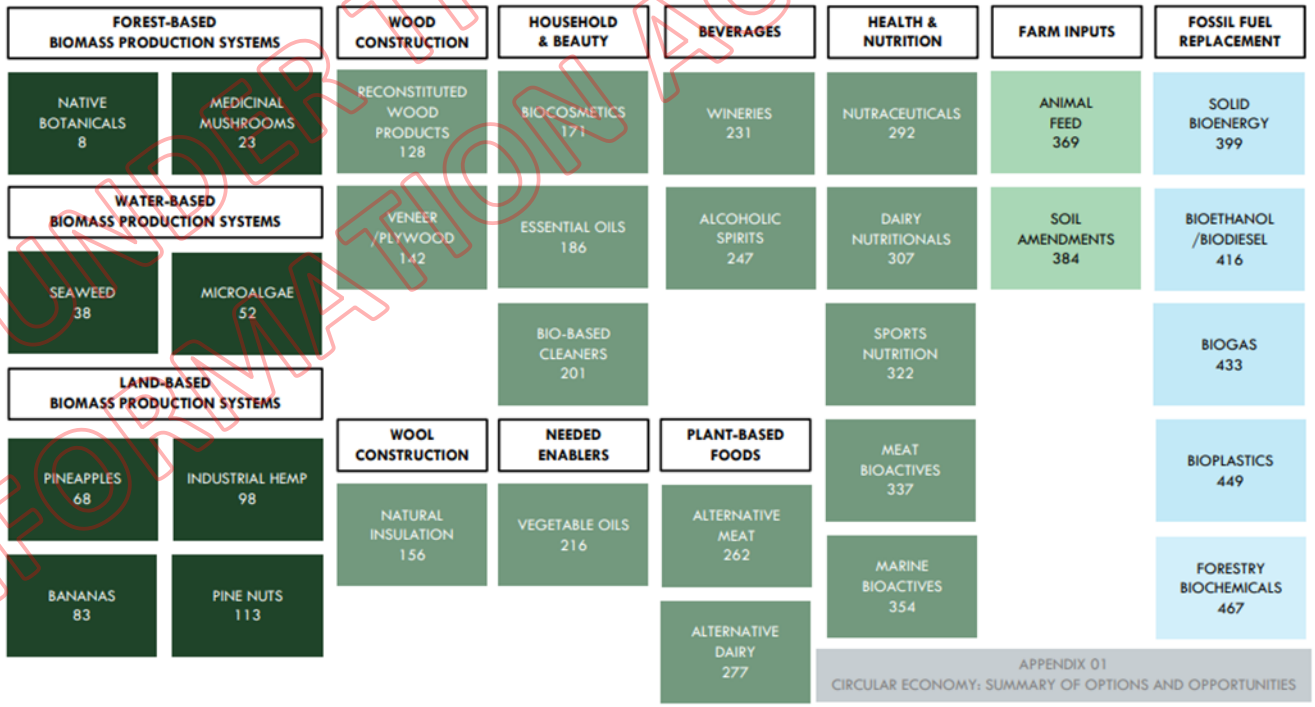


What are our best bioeconomy opportunities?

- 100 biomass production (52) and processing (48) systems were scored for being both (A) attractive growth opportunities and (B) moving the New Zealand bioeconomy forward.
- Thirty platforms emerged as solid opportunities (right). Eight of the thirty are potential new sources of biomass (e.g., hemp, bananas, seaweed) while the remaining 22 all entail some form of processing.

Our insights…

- **Bioeconomy opportunities, near term and future, are key for New Zealand's shift from volume to value**
- New Zealand can grow many different types of biomass, but only some are, or could be, globally competitive.
- Some platforms such as microalgae and seaweed are currently either small or at a more experimental stage and will require developments such as the adoption or invention of mechanised farming systems.
- Others, such as dairy nutritionals, meat and marine bioactives and nutraceuticals, are well established with significant potential to grow.



Adding value to existing biomass systems is easier and less risky

- Extend products already succeeding
- Short to medium term approach

New biomass products = hard and risky

- Requires new capabilities/government support
- Long term approach

Source: Coriolis, 2023. Emerging and future platforms in New Zealand's bioeconomy

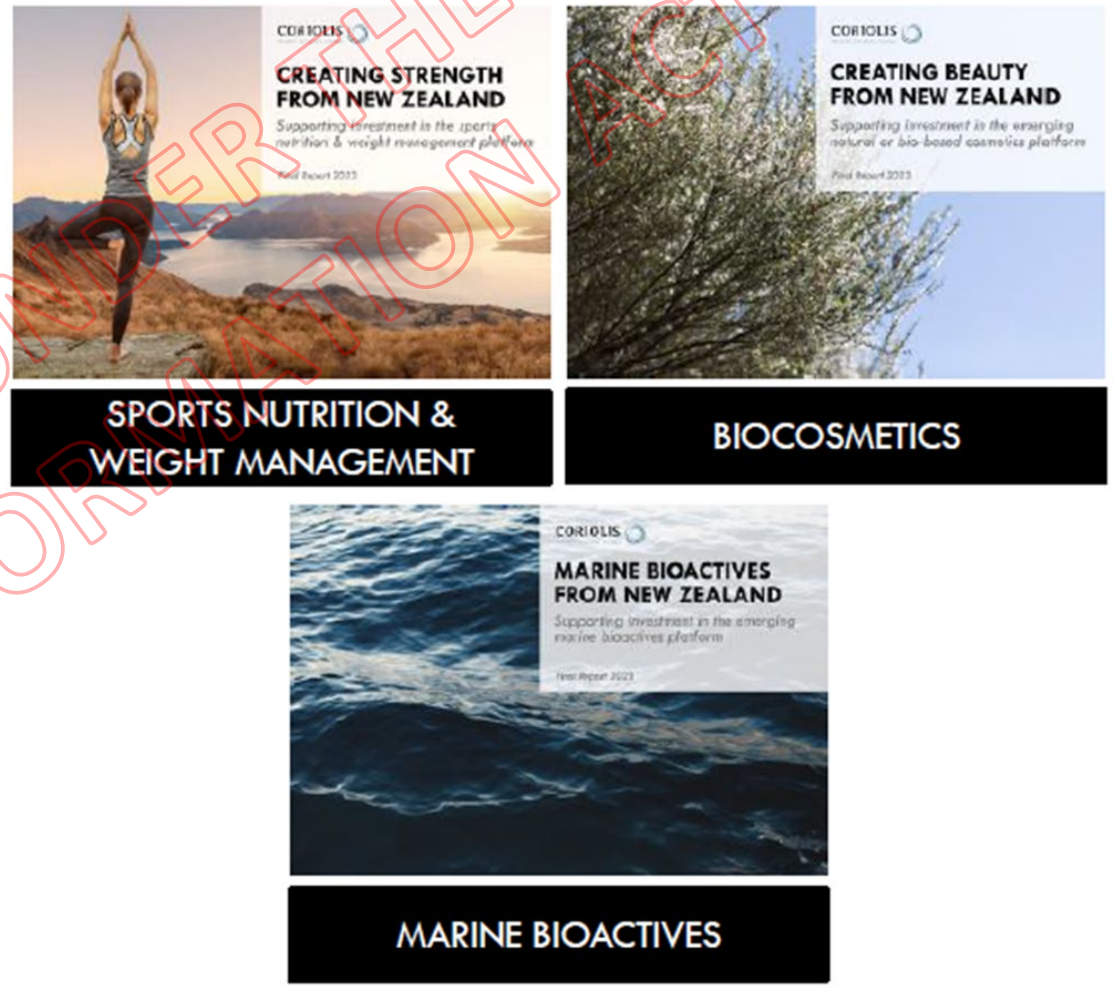
What are desirable product characteristics?

- Three platforms were highlighted for further development as separate documents and as exemplars.
- These are all platforms that create high value from New Zealand's biomass.

Our insights…

These platforms demonstrate the following:

- Create very high value knowledge-intensive products from New Zealand's biomaterials (including waste streams).
- Products are typically light weight as well as high value.
- Combine multiple ingredients and complex value chain links
- Multiple New Zealand firms already demonstrating success.
- While generally under the radar, are already generating around $100m in exports each with significant upside.
- Score positively as attractive to Māori investors, particularly marine bioactives.
- Play to New Zealand's branding strengths in the growing "health and wellness" and "natural products" categories.



Detailed analysis to make the high level case for investment in three high potential platforms in the New Zealand bioeconomy

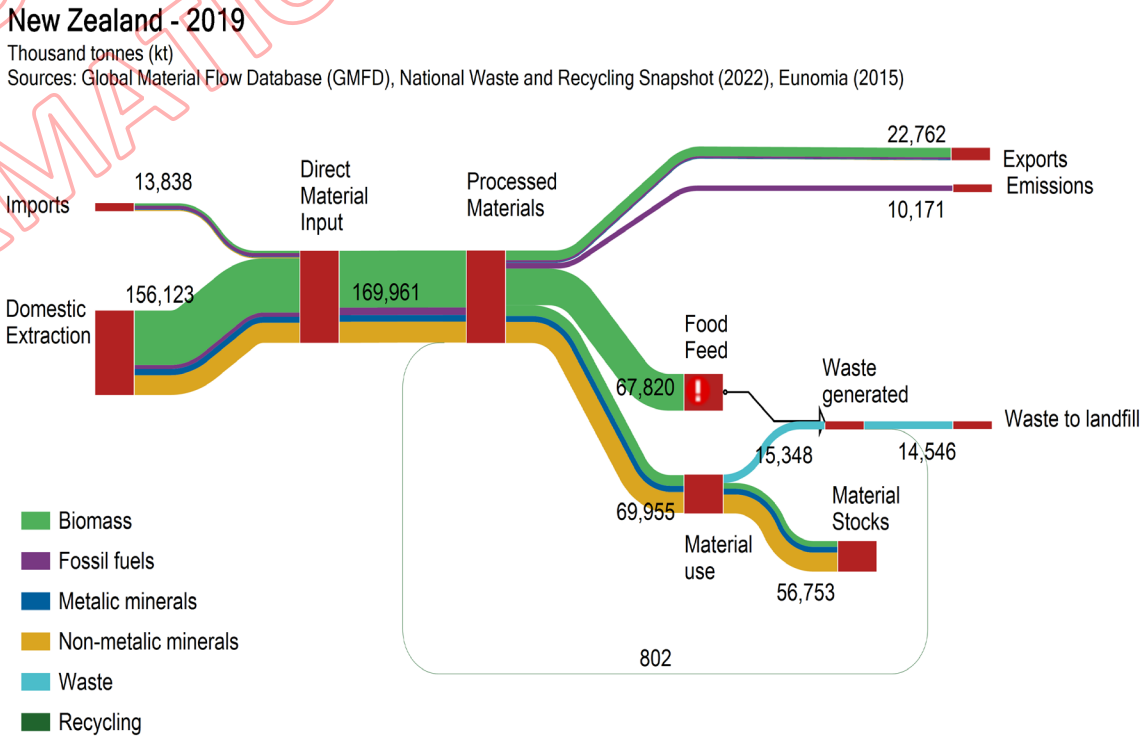
How could circularity help with climate change?

- In short: Less resources = less emissions
- Best areas of opportunity in **buildings and infrastructure** – resource efficient, less carbon intensive eg bio-based, adaptable, longer lasting.
- Opportunities also in **agriculture** (eg more local fertiliser) and **manufacturing / critical materials** (eg product durability / reuse)
- Potential emissions reductions of 1.5 – 1.9 Mt CO_2e per annum calculated (equivalent to a 3% reduction on 2021's net emissions). More savings possible in the longer term, and many not quantifiable.

Our insights ...

- **Circular practices in buildings and infrastructure, agriculture and food and manufacturing will provide significant emissions savings, over time**
- Transitioning to a circular economy is proving challenging in many countries around the world. Ultimately requires changes in consumption.
- Circularity is best understood and progressed as a means to many outcomes, not just climate related (jobs, resilience, productivity/efficiency, social etc).

Whole economy resource flows in New Zealand – a Sankey diagram



Source: Thinkstep-anz, 2024. Impacts of circular approaches on emissions, jobs and other factors

What do digital twins have to do with circularity?

Digital twins can support:

- monitoring and optimisation of resource use to reduce waste, emissions, and costs
- tracking of resources along supply chains, eg alongside emerging material passports
- information flow to reduce barriers to circular economy market development

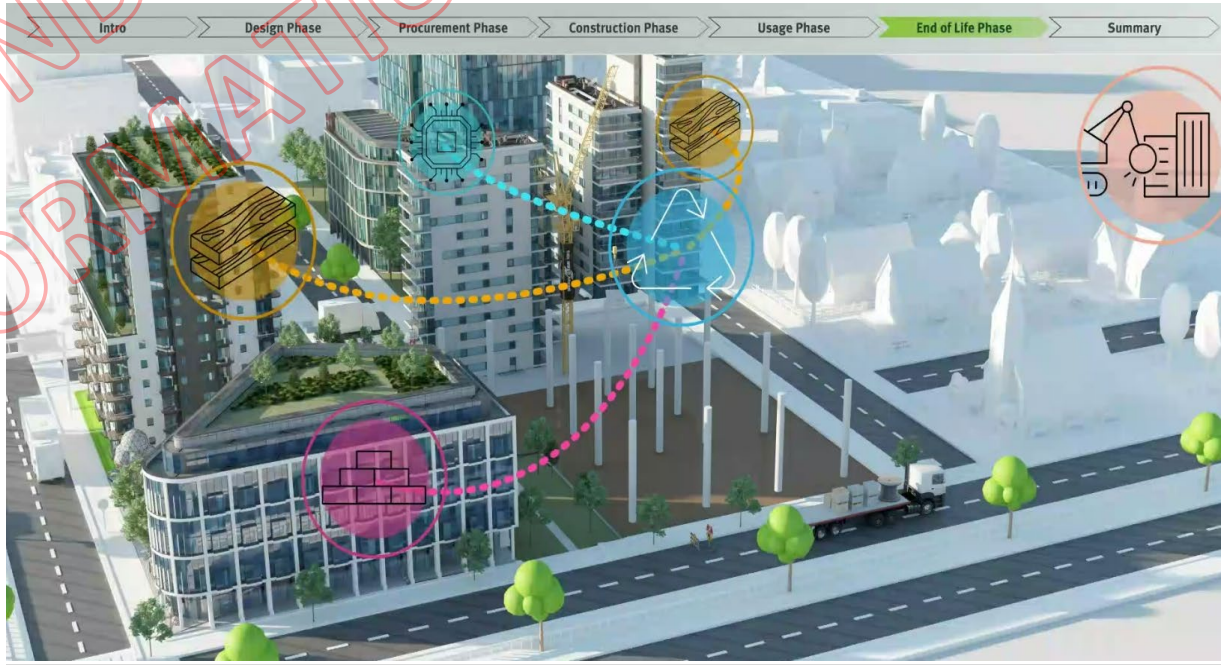
- Wide range of digital twins already in use in New Zealand (eg regional/councils). They are at the start of widespread adoption. Not focussed on ‘circular’ per se.

Our insights ..

- Government leadership needed for New Zealand to make the most of digital twins:
  - data governance, eg how to avoid lock-in of proprietary systems
  - supporting collaboration
  - progressing a national or federated digital twin.

- AI integration with digital twins is a circularity and business growth opportunity for New Zealand.

A digital twin is 'a dynamic and interconnected digital representation of a physical asset or system, enabling comprehensive insights and informed decision making.'



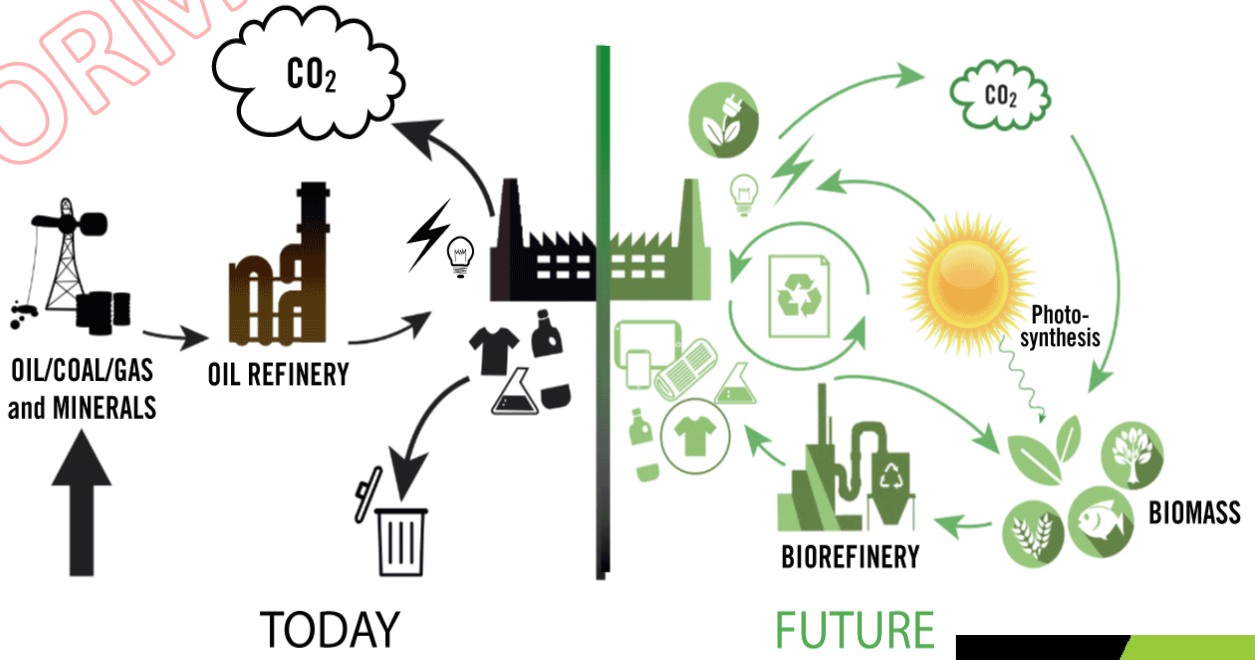
A screenshot from a dynamic ‘built environment’ use case of a digital twin shared at a workshop 28/11/23

Sources: Aurecon, 2024. Digital technologies, digital twins

What could 2050 look like?

- Clusters of advanced innovation and commercial activity, place-based according to bioresource availability, eg marine/blue economy, forestry, industrial symbiosis
- Increased value of exports with improved resilience and competitiveness of NZ bioproducts/biotechnology in global markets
- International connections supporting investment and expertise for firms
- Bio-based renewable alternatives to high emission building and infrastructure materials
- Māori-led bio innovation, eg in botanical based nutraceuticals/ essential oils, using Mātauranga Māori, reaching premium markets
- Highest value use of waste, eg upscaled domestic production of fertiliser and animal feed, organic bitumen, reducing import dependencies and supporting resilient supply

- NZ products have digital material passports, providing real-time data on sustainability and supply chain attributes
- Enterprises using sustainably harvested biomass (eg leaves, flowers), not extracted, that maintain integrity of forest and marine ecosystems
- Regenerative carbon sequestration, eg wetlands, marine, biochar.

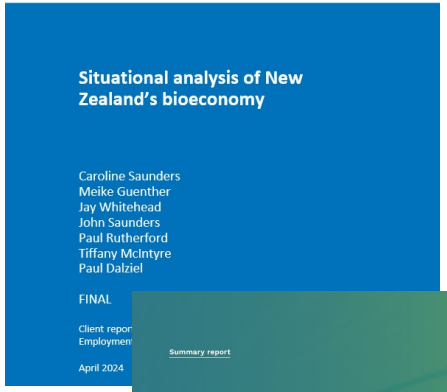


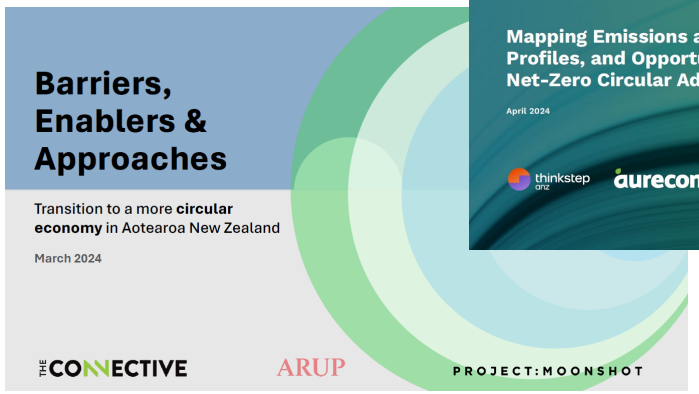
Background slides from here

Circular economy and bioeconomy research projects

FY 22-23

FY 23-24





Research outputs and an overall research summary available on MBIE website:
[Circular Economy and Bioeconomy]

Emissions Reduction Plan context

- New Zealand's first Emissions Reduction Plan (2022) had a chapter on Circular Economy and Bioeconomy.
- MBIE was the lead agency for this chapter and received Budget 2022 funding for research (action 9.2) as input to a strategy (action 9.1).
- Strategy work was discontinued in late 2023. But research programme was completed and findings available to contribute to aligned policy work.
- Draft second Emissions Reduction Plan released for consultation in July and August 2024 – more targeted and without a circular and bioeconomy chapter.

Indicative outcomes and objectives for a significant and accelerated transition to a circular economy and high-value low-emissions bioeconomy

Outcomes:

Emissions Reduction + Economic Productivity and Growth + Greater Export Value + Supply Chain Resilience

Objectives

Keep up with global change

Information and insights to collaborate globally and remain competitive in a world moving towards circularity.

Measure and track resources

Technology, standards, and digital capability required to measure, track and improve circular resource use in products and across supply chains.

Incentivise resource efficiency, durability, and recovery

Designing out waste and extending the life and use of high-value and critical materials in our economy, including a durable and adaptable built environment and infrastructure.

Greater value from our bioeconomy

A bioeconomy (land and sea) that builds on regional, sector and Māori economy strengths, with greater innovation, capability, and resilience. Biological resources are managed and utilised to their highest value, reducing reliance on fossil fuels.

Note: This content was developed by MBIE as an indicative approach (objectives, shifts, and actions) should government want to accelerate the transition to a circular economy and bioeconomy. Not government policy.

Note: This content was developed by MBIE as an indicative approach (objectives, shifts, and actions) should government want to accelerate the transition to a circular economy and bioeconomy. Not government policy.

Keep up with global change

Shifts required

- Further circular economy focus in our relationships with international partners and standard-setting bodies, including in the context of FTAs, to maintain New Zealand competitiveness.
- Strengthened international supply chains for economic resilience and growth through circular economy (especially at the regional level and supporting the recovery and reuse of critical materials)
- Strong Māori trade and cooperation, signalled in trade agreements, enabling global reach of Māori leadership in Mātauranga-based circular practices.

Possible government actions

- Partner with overseas governments and standard-setting bodies on actions that support New Zealand exporters, eg circular standards.
- Provide bespoke support to exporters to meet global circular trading standards.
- Work with close partners in the region (eg Australia) to identify opportunities for joint circular infrastructure and interoperability (such as critical material recovery, recycling and remanufacturing).
- Establish an institutional scanning capability to anticipate and respond to global developments, similar to the Singapore Government's Centre for Strategic Futures.

Note: This slide was developed as an indicative approach (objectives, shifts, and actions) should government want to accelerate the transition to a circular economy and bioeconomy. Not government policy.

Measure and track resources

Shifts required

- More accessible and reliable data about resources available widely, enabled through data platforms with relevant governance structures.
- Better digital twin interoperability and uptake, potentially a federated model supporting whole system or national insights.
- Widespread and effective use of digital tools (eg product passports) to enable traceable, transparent, and sustainable supply chains (and reverse logistics) to meet export market and business requirements, and support consumer choices, especially in the **Food** and broader **Manufacturing sectors** to support export premiums.

Possible government actions

- Support availability and use of data about materials and emissions for products and across supply chains.
- Enable a data market about resources, potentially involving a regulatory framework for a fee-for-use access to private data held (eg in engineering firms).
- For digital twins, support coordination and integration of disparate datasets, utilising AI and technical capabilities.
- Lead a pilot project to establish an AI-enabled digital model for infrastructure development; this could identify and resolve coordination and regulatory issues as a precursor to national rollout.
- Develop and use national and sector-based metrics to track progress in resource efficiency and circularity shifts.

Note: This content was developed by MBIE as an indicative approach (objectives, shifts, and actions) should government want to accelerate the transition to a circular economy and bioeconomy. Not government policy.

Incentivise resource efficiency, durability, and recovery

Shifts required

Manufacturing

Strengthened process innovation capabilities enabling resource and energy efficiency, for example through tech-enabled reduced waste/inputs, improved asset management, and business model innovation to support capitalisation.

More use of mass timber and innovative bio-based materials for use in domestic built environment and for high-value exports.

More businesses involved in recovery and remanufacturing, for example in clean technology innovation, and recycling for critical minerals/materials.

Building

Low waste and low embodied carbon design and construction becomes the norm.

More recovery and reuse of construction material waste, enabled by data and digital tools.

Increased utilisation of buildings, for example through design which allows for repurposing.

Whole economy

More upstream consideration of resource efficiency in the design and management of infrastructure and assets.

Expanded secondary material processing and supporting infrastructure.

Competitive options for business model innovation, such as product-as-a-service or industrial symbiosis, to support sustainability and productivity.

A level playing field for businesses that internalise the costs of emissions and waste so they can compete with those that do not and pass these costs to consumers.

Possible government actions

Increase resource efficiency over life cycle of infrastructure, through design and asset management.

Scale up nationwide infrastructure for resource recovery with coordinated support for generating local business opportunities.

Expand the product stewardship programme.

Remove current barriers in tax system for circular business models (eg GST rules on products-as-a-service). Explore green taxes as a market incentive.

Incentivise product reuse and repair, eg through progressing right-to-repair legislation.

Develop consistent standards for reused materials.

Incentivise lower waste in the construction sector (eg through regulatory levers, standards and government procurement).

Enable government IT suppliers to lower waste and support reuse through business advice and facilitation support.

Support circular economy technology adoption by businesses.

Support knowledge brokering, eg through hubs, forums or targeted capability advice, to enable sectors and businesses to develop and share best practice.

Support expansion of existing local economy networks that engage communities, businesses and households in shifts to low waste and efficient use of resources eg eco hubs, repair cafés, and zero-waste initiatives.

Monitor and support reduction in food waste generated across supply chains through better availability of food waste data and digital tools.

Note: This content was developed by MBIE as an indicative approach (objectives, shifts, and actions) should government want to accelerate the transition to a circular economy and bioeconomy. Not government policy.

Greater value from our bioeconomy

Shifts required

More investment in the New Zealand bioeconomy business

Innovation, R&D and commercialisation

Scale up and expand existing innovation and commercialisation institutions (connecting science, firms, and markets) to meet increasing demand.

Development of new capabilities such as a pilot scale biorefinery to support the development of new high-value bioeconomy industries (biofuels, biomaterials).

Leveraging New Zealand's brand and premium eg through Māori-led Mātauranga-based exports, and use of data and technology to demonstrate provenance/sustainability

Sustainable biological resource and land use

Accelerated transition to low-extraction, agricultural practices (eg through phasing in sustainable fertilisers, feed, irrigation, treatments).

Further carbon removals on land (private and public) and marine to sequester and store carbon, while providing additional benefits such as biodiversity and water storage and purification.

More coordination of policies, advice, and actions for the sustainable use of biological resources.

Regional economic development

More/scaled up regional bio-based manufacturing, eg supporting existing local Māori initiatives, and opportunities in wood products, blue economy, high-value bio-products and food innovations strengths.

More connected food system networks, enabling place-based circular and resilient food systems.

Possible government actions

Investment in comprehensive bioeconomy market analysis made publicly available in a form familiar and useful to business, and regularly updated.

Investment in development of new capabilities and institutions to realise high-value bioeconomy opportunities eg through:

- scaling up and better connecting existing food and bioresources innovation networks
- development of infrastructure eg refineries, biotech facilities
- fund new regional innovation hubs that demonstrate and scale circular and bio-based manufacturing aligned with local bioresource streams and capabilities.

Support coordination of bioeconomy policy and actions across government and sectors.