
CHAPTER 8:

Research, science, innovation and technology



Research, science, innovation and technology

Lead



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Contribution to our long-term vision

Research, science, innovation and technology (RSI&T) provide the knowledge and insights to transform Aotearoa New Zealand to a low-emissions economy that provides economic prosperity and improved wellbeing for all. Good access to new knowledge, technologies and processes provides new ways of doing things to support change and help communities, Māori, the Government and businesses remain resilient over time.

Research, science, innovation and technology



Why research, science, innovation and technology is important

RSI&T activity accelerates the transformation of the economy by enabling development and deployment of innovative low-emissions solutions into industries and sectors. It enables the growth of new sectors, market opportunities and high-value jobs, and the transformation to a prosperous low-emissions economy in an equitable way.



Key actions

- ▶ Provide tools to support knowledge development, help sectors to transition and unlock new opportunities.
 - Work towards mission-focused climate innovation platforms to coordinate action on the greatest climate challenges facing Aotearoa.
 - Reorientate the science system to improve its ability to service a low-emissions future.
 - Scale up and further target research funding and innovation support programmes.
- ▶ Develop strategic partnerships domestically and internationally to ensure research and innovation has greater impact.
 - Support Māori to use the power of mātauranga in the transition.
 - Attract leading innovators to build a sustained research and development presence in Aotearoa.
 - Partner internationally on low-emissions initiatives with leading researchers and frontier firms.

Research, science, innovation and technology make a low-emissions future possible

He Pou a Rangi – Climate Change Commission (the Commission) identified innovation as one of three key pillars for reducing emissions and highlighted the importance of prioritising low-emissions research, science and innovation to our transition.

In 2050, Aotearoa will look markedly different to today. New high value, low-emissions sectors and jobs will emerge and problems will need to be solved that have not yet been identified.

Research, science, innovation and technology (RSI&T) can enable the behaviour change we need to meet our emissions reduction targets. New, more convenient, or cheaper ways of doing things can make the switch from high-emissions approaches to lower ones easier for communities and sectors. Research also provides critical knowledge about what approaches we can take to better inform decision making and behaviour.

Aotearoa will need a flexible, adaptive approach to identifying and supporting different types of innovation across multiple sectors. It is not always clear which innovations and behaviour change will deliver the greatest emissions reductions. We need to invest in the fundamental science and technology that will underpin future innovation, but we also need to be prepared to let some innovation fail, while rapidly increasing investment in approaches that prove most effective.

The Government and the private sector will need to work together to deploy low-emissions innovation

The private sector accounts for over half of RSI&T activity in Aotearoa and is an important partner in the research, science and innovation (RSI) system. Private sector entrepreneurs and innovation are critical to adopting new knowledge, technologies and practices by managing consumer demand and ensuring new innovations are easy to use, readily available and rapidly adopted.

Cutting-edge science expertise and innovative firms give Aotearoa an advantage in designing new, low-emissions technology, establishing frontier firms and new sectors. Exporting our innovations to the global green economy provides an opportunity to grow our economy and impact other countries' emissions as well as our own.

CASE STUDY



PARTNERSHIP WITH AIR NEW ZEALAND ON SUSTAINABLE AVIATION FUELS

Aotearoa New Zealand's physical isolation from the rest of the world means that aviation will remain a critical way to stay globally connected. The aviation industry's current reliance on fossil fuels presents a particular challenge for our national carrier, Air New Zealand.

Sustainable aviation fuel – a fuel that can be made from non-fossil fuel sources such as woody biomass and materials that will otherwise go to landfill – could potentially reduce lifecycle carbon emissions by more than 80 per cent compared to traditional jet fuel. It is critical for decarbonising long-haul aviation travel, and the tourism and export industries that depend upon it.

Air New Zealand and the Ministry of Business, Innovation and Employment are inviting leaders in innovation to demonstrate the feasibility of operating a sustainable aviation fuel plant at scale.

We need to embed transformative innovation across our climate change response

Transformative innovation is often disruptive and difficult to manage within existing sectors or structures, but there is no 'do nothing' option. Given the scale of the challenge globally, disruptive change will be coming whether Aotearoa is ready or not. This is due to factors like changing consumer preferences, international regulation or new technologies and ideas developed overseas. The Government is positioning Aotearoa for resilience through these changes while providing the basis for new opportunities.

Driving transformative change through the RSI system will unlock the following opportunities:

- ▶ achieving an economy that is productive, sustainable and inclusive
- ▶ positioning Aotearoa as a provider of low-emissions solutions
- ▶ accelerating new high value businesses and industries.

The RSI system will continue to support an inclusive, sustainable and productive future

The RSI system supports our communities and businesses to adapt to a new, low-emissions future by:

- ▶ providing grants and funding to help solve the technological challenges of reducing emissions
- ▶ developing the knowledge we need to do things differently.

New knowledge and technologies that we develop here in Aotearoa can be exported to a world that is also transitioning to a low-emissions economy – building a future that is sustainable and productive.



ENDEAVOUR FUND RESEARCH GENERATING NEW KNOWLEDGE FOR THE ENERGY SECTOR

The Endeavour Fund generates new knowledge that supports sectors to transition to a low-emissions and climate-resilient economy, including through the development of new energy opportunities and new materials.

This includes the GNS Science-led Geothermal: The Next Generation project which explores new ways to extract geothermal energy at greater depths. The knowledge developed will deliver new options to significantly reduce emissions for the energy sector and will provide vital regional perspective and opportunities for iwi and regional development.



LOW-EMISSIONS STEELMAKING

Producing steel currently relies on a high-temperature chemical reaction between coal and iron ore, emitting large quantities of carbon dioxide. The process has largely remained unchanged since the Industrial Revolution.

Researchers at the Robinson Research Institute have developed a novel technology which uses hydrogen instead of coal to produce iron and steel, a breakthrough step in the transition to a climate-resilient and low-emissions future. This research also addresses Aotearoa-specific challenges for the manufacture of low-emissions steel due to the unique composition of our indigenous iron sands.

The project was kickstarted in 2019 with a NZ\$6.5 million research grant from the Endeavour Fund, to support the development of this new chemical process. The Robinson Research Institute is now collaborating with Wellington UniVentures and New Zealand Steel to accelerate the development of a pilot-scale reactor at New Zealand Steel's Glenbrook site.

RSI&T can maximise our opportunities in the shift to a global low-emissions economy

The RSI system supports the emergence of new initiatives, companies and sectors which can unlock new opportunities to reduce emissions faster, more cost-effectively, or in a way that enables further growth opportunities. This includes supporting start-up companies that want to take novel technology and practices to market or disrupt the status quo.



CASE STUDY

ORION ENERGY ACCELERATOR

The Orion Energy Accelerator is a 2021 partnership between Canterbury electricity lines company Orion, the Ministry of Awesome – a start-up-support organisation, and Ara Ake, an organisation focused on future energy development.

The accelerator was a 10-week mentorship programme open to individuals and start-up companies, producing innovative ideas across a range of energy sectors, including smart grids, e-mobility, electric vehicle charging and energy storage. It also secured a partnership from Ara Institute of Canterbury, EY and Wynn Williams to aid the start-ups during the programme.

The accelerator provided support for 10 start-ups, to validate their ideas and progress the start-ups towards commercial readiness. Two start-ups are working with Orion: one will save millions of dollars in network upgrades and the other is a promising solution to energy poverty.

The RSI system will continue to drive a low-emissions transformation

Mechanisms such as the innovation grants programme and [Research and Development Tax Incentive](#) – which supports businesses to undertake research and development, including in relation to low-emissions technology and change – stimulate innovation across the economy.

New technology and innovation provide opportunities to accelerate our transformation. Callaghan Innovation – Aotearoa New Zealand’s innovation agency – partners with ambitious businesses of all sizes to provide innovation support services. This includes a cleantech mission that aims to accelerate cleantech innovation and commercialisation.

The RSI system supports the emergence of new businesses and sectors leveraging opportunities for Aotearoa through the start-up support programme. The programme provides capability building mechanisms for start-ups, including Founder Incubators and [Technology Incubators](#).

It also supports access to capital for start-ups through New Zealand Growth Capital Partners. This includes providing support for initiatives such as the CreativeHQ Climate Response Accelerator.

The RSI system also provides targeted support for sectors, including:

- ▶ funding research to reduce agricultural emissions, including support for the New Zealand Agricultural Greenhouse Gas Research Centre and the Global Research Alliance on Agricultural Greenhouse Gases
- ▶ encouraging low-emissions energy innovation and technology, including funding the advanced energy technology platform, which explores technologies with the potential to radically shift the global energy landscape and develop market opportunities for Aotearoa
- ▶ investment in data science to grow our capability, develop useful and transformative data science techniques, and create opportunities for the application of those techniques in our sectors.

Actions to accelerate emissions reduction

The Government is positioning Aotearoa to be resilient to the global move to lower emissions and to seize new opportunities this innovation provides.

This will need a policy and regulatory environment that:

- ▶ develops knowledge and is open to new sources of ideas, including from overseas
- ▶ allows for solutions to be tested and refined here in Aotearoa
- ▶ is attractive to international innovators and investment
- ▶ supports early adopters to absorb and trial innovation
- ▶ provides a reason to change, accelerating the uptake of low-emissions alternatives once they are available.

This requires coordination beyond RSI&T across industry sectors and a wide range of government agencies and settings.

The Government has two key actions to accelerate emissions reduction through:

- ▶ creating a forward looking and adaptive portfolio of climate-focused innovation through the establishment of climate innovation platforms
- ▶ scaling up and reorienting existing programmes to generate the new knowledge and technologies we need to tackle the climate change challenge.

Climate innovation platforms can coordinate action on key challenges

To accelerate emissions reductions, the Government is working towards establishing climate innovation platforms to coordinate action on key challenges and take opportunities in our shift to a low-emissions future. The platforms will improve the competitiveness of our existing sectors, grow new ones, and reduce emissions simultaneously.

Climate innovation platforms will be:

- ▶ outcome or missioned-focused – they will be designed around a specific goal
- ▶ international-facing – they will look for innovation and investment both at home and from across the world
- ▶ designed to help Aotearoa absorb climate innovation at pace – with a mandate stretching across different agencies and sectors to identify and remove barriers to testing and widespread use of innovations
- ▶ flexible and open to change as the global environment changes.

This all-of-government approach will use a wide range of tools and approaches including proactive policy, regulatory settings, and RSI tools to ensure that ideas from here and around the world can be implemented quickly.

The nature of individual platforms and exact mix of Government support (including but not limited to research and development support, international partnerships, training and skills development, and sector regulatory and policy changes) will depend on the particular sector and challenge. However, platforms will be encouraged to use the full range of roles and policy tools and approaches that the Government has at its disposal.

The Government will take a portfolio approach – in which a range of initiatives are pursued at the same time, and support is boosted for the most promising ones – to adapt to changing priorities and levels of uncertainty as Aotearoa progresses to a low-emissions future.

The portfolio will engage across all areas of the economy to develop future-focused platforms. This will involve working closely with the private sector, including supporting platforms proposed by the private sector, to ensure the platforms have an impact.

Action 8.1.1: Establish climate innovation platforms

To coordinate our climate change response and accelerate our transition by removing barriers to the development and adoption of new ways of doing things, the Government is looking to:

- ▶ establish outcome-focused, cross-government climate innovation platforms designed around the key challenges we face, to enable us to develop and absorb innovation at pace.

How a climate innovation platform could work

By way of example, a platform could be focused on reducing the embodied emissions – emissions associated with the manufacture of materials – within the building and construction sector. Opportunities to help reduce embodied emissions, and tools and approaches that could be used by government to promote those opportunities include:

- ▶ adoption of existing international best practise such as building information modelling and offsite manufacturing – tools and approaches the Government could use include: government procurement; sector partnerships through the Construction Sector Accord to showcase approaches; targeted grants to support scaling; and regulation to encourage the use of efficient construction processes
- ▶ lower-emissions alternatives to existing building materials including green steel – tools and approaches the Government could use include: partner with the sector to pilot new processes; build capabilities by partnering internationally and supporting applied research; and support scaling with targeted grants
- ▶ exploration of innovative and advanced materials – tools and approaches the Government could use include: scan the international market for new technologies; establish partnerships with international scientific organisations to explore the feasibility of new materials; establish mechanisms to test new materials; and identify regulatory barriers.

Each of these opportunities are at different stages, from internationally established to emerging. They will require different government tools and approaches to support their impact over time. Sector-wide initiatives – including pricing and regulatory signalling – will support the transition away from high-emissions practices and materials. Work to inform and train local authority regulators, trade agreements to secure the supply of new materials, and skills development for the building and construction sector will also support our transition.

Existing initiatives will be scaled up and reoriented towards the climate change challenge

A range of existing initiatives will be scaled up and reoriented towards tackling the climate challenge and accelerating our transition to a low-emissions economy.

Te Ara Paerangi – Future Pathways will ensure our public science system is capable of solving the challenges we face

The RSI system funds universities, Crown Research Institutes and international partnerships to conduct public good research. This research is focused on developing new knowledge and technology to help existing sectors move to low-emissions. It also provides foundational knowledge and technology to underpin the development of new net-zero sectors.

As at March 2022, approximately NZ\$800 million is invested in projects generating new knowledge about:

- ▶ developing or producing new zero-carbon or green-enabling technologies (NZ\$210 million)
- ▶ surveillance, modelling and the historical record of climate change and its effects (NZ\$227 million)
- ▶ research into direct mitigation of greenhouse gas emissions (NZ\$192 million)
- ▶ developing sustainable, green economies (NZ\$121 million)
- ▶ social science for change and awareness of climate change effects and mitigations (NZ\$48 million).

To reach our 2050 targets and create a prosperous low-emissions economy, the level of research activity in Aotearoa needs to continue to increase. We also need to reorient and optimise our science system to increase the impact of research into climate change, emissions reduction activities and low-emissions technologies - and improve the flow and adoption of knowledge and technology to sectors and communities.

The Government will reorient the RSI system through Te Ara Paerangi – Future Pathways programme, which will set research priorities to address the challenges that we face. The objective of the programme is to create a modern, future-focused research system which is adaptable, resilient to changes and connected – to itself, to industry, to public sector users of research, and internationally. The programme will consider:

- ▶ giving complex challenges, such as climate change, a clear focus and dedicated resourcing
- ▶ reshaping the funding system to give effect to the priorities identified and build our capability now and in the future
- ▶ shaping our institutions so they can act on those priorities and adapt in a fast-changing world.

These priorities will influence how existing programmes and funding will help us tackle climate change challenges, including:

- ▶ the Endeavour Fund – the largest contestable science investment in the country; explicit consideration is given to low-emissions research
- ▶ the Strategic Science Investment Fund – supports research programmes including the Advanced Energy Technology platform and the New Zealand Agricultural Greenhouse Gas Research Centre
- ▶ the International Science Partnerships Programme – develops connections with governments, science and businesses to advance science and innovation opportunities for Aotearoa
- ▶ Te Pūnaha Hihiko: Vision Mātauranga Capability Fund – seeds and grows Māori research capability; most funding awarded to date addresses environmental or sustainability programmes
- ▶ the Catalyst Fund – funds international science collaborations including the New Zealand–Germany Green Hydrogen Research Programme
- ▶ the Marsden Fund – funds investigator-initiated research such as the Greening economies as an engine for sustainable solutions to climate change initiative (hosted by Massey University)
- ▶ research-industry partnership networks – enable impactful engagement with the private sector, for example, the New Zealand Product Accelerator and the Bioresource Processing Alliance.

The programme will work closely with Māori, guided by Te Pae Tawhiti – the whole-of-government response to the Wai 262 claim which looked at the Government’s role in relation to mātauranga Māori – to identify how our science system can best support Māori and mātauranga.

Vision Mātauranga

The Ministry of Business, Innovation and Employment's Vision Mātauranga policy enables the science and innovation potential of Māori knowledge. Mātauranga Māori offers insights and solutions to climate change issues that reflect a holistic worldview. The contribution mātauranga Māori can make to the RSI system will be important for meeting our emissions budgets and 2050 targets, as well as creating a low-emissions economy for all.

To enhance the role of mātauranga Māori and reflect Māori aspirations in the RSI system, the Vision Mātauranga policy will be expanded to assist Māori to make future investments in RSI&T. It will be co-developed with Māori to achieve outcomes that are driven by and for Māori, and that reflect Te Tiriti o Waitangi.

Action 8.1.2: Scale up and further target existing initiatives towards climate change

To accelerate our transition the Government is developing proposals to scale up existing policy initiatives. This will support sectors and communities to mitigate and adapt to climate change, as well as provide the foundations for a future low-emissions economy in Aotearoa.

Key initiatives

- ▶ **Reset research priorities for the RSI system** – including the transition to a low-emissions economy, through [Te Ara Paerangi – Future Pathways](#) programme.
- ▶ **Enable the science and innovation potential of Māori knowledge** – through the [Vision Mātauranga policy](#). The Government is looking to expand Vision Mātauranga to help Māori invest in RSI&T capability and activities.
- ▶ **Develop strategic partnerships for impact** – partner with Māori, regulators, sector policy leads, international research organisations and frontier firms to ensure research and innovation has impact. For example, the [Innovative Partnerships Programme](#) encourages leading innovators to build a sustained research and development presence in Aotearoa.
- ▶ **Develop tools to support knowledge development, help sectors to transition and unlock opportunities** – fund and co-invest in initiatives and infrastructure that play a fundamental role in our response to climate change.
- ▶ **Support the development, assessment and deployment of technology** – technology will assist sectors to reduce their emissions and underpin many of the new opportunities associated with a low-emissions economy. This support ensures that Aotearoa is an active participant in the global market for technology, as both a developer and procurer.

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