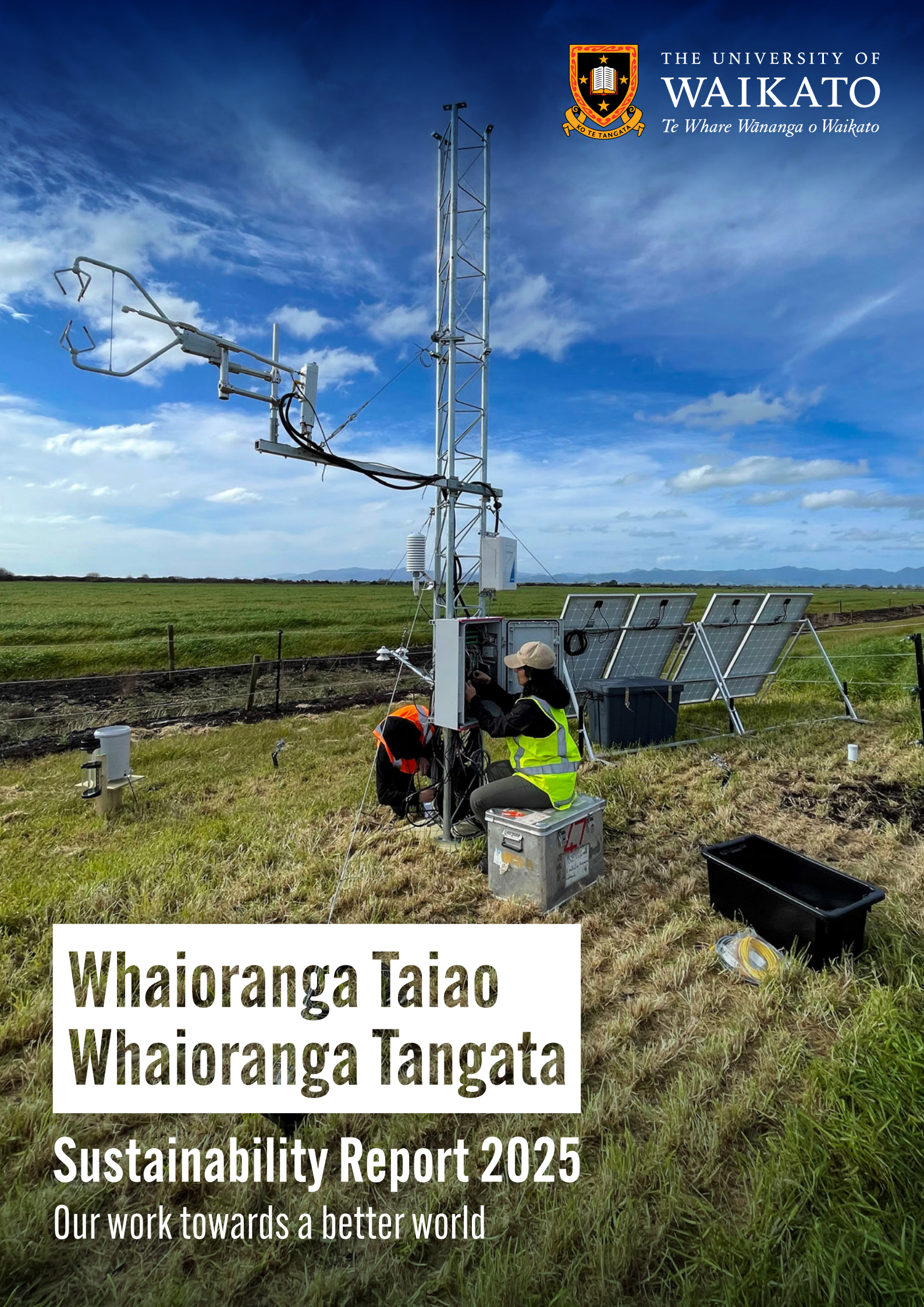

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Whaioranga Taiao Whaioranga Tangata

Sustainability Report 2025

Our work towards a better world

Front cover: The installation of an eddy covariance tower at a rural Waikato town as part of the 2025 REDOS (Reducing Emissions from Drained Organic Soils) project, funded by Ag Emissions Centre. The tower measures greenhouse gas exchanges and environmental conditions to quantify emission reductions from drained peatlands under different land-use strategies.

Photo credit: Georgie Glover-Clark

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Whaioranga Taiao, Whaioranga Tangata is a record and a celebration of our interconnected work at the University of Waikato to build inclusive and equitable communities, and a thriving and healthy environment.

This report demonstrates our commitment to the United Nations' 17 Sustainable Development Goals (SDGs).

waikato.ac.nz/sustainabilityreport

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A message from the Vice-Chancellor

Our 2025 Sustainability Report outlines our proudest achievements in research and campus operations in pursuit of the United Nations' 17 Sustainable Development Goals.

As a research-intensive university, the University of Waikato is committed to delivering impactful research that makes a meaningful difference for New Zealand and the world. Drawing on our distinctive strengths and settings, we work locally, nationally and internationally to address some of the most pressing challenges of our time.

In partnership with the people, businesses and communities we serve, we are delivering work that transforms, is multidimensional and creates economic, social and environmental value.

Strong relationships are central to this work. Alongside our ongoing commitment to the communities our research supports, we foster an environment where bold thinking is encouraged, and we work collaboratively with stakeholders to co-develop research that is relevant, responsive and impactful.

We are proud to be ranked number one in New Zealand for research impact, measured by the QS World University Rankings 2026 in respect to how frequently our researchers work is cited by others. More generally, we rank in the top 2% of universities worldwide, as determined by QS. The 2025 Times Higher Education (THE) Impact Rankings further highlighted our progress in addressing global challenges, with the University holding position within the 101-200 band out of 2,318 institutions worldwide.

Also in 2025, we launched the University Strategy, Kia Haere Whakamua – setting a clear direction for success with a focus on high-quality research, a globally connected and innovative student experience and high levels of community engagement.

As the University enters its next era, we remain focused on ensuring our campus environments reflect regional aspirations and the needs of learners, researchers, industry partners and communities. Campus development highlights this year included breaking ground on the site for the New Zealand Graduate School of Medicine, the construction of a new 75-bed, self-catered, townhouse-style apartment complex and significant work to refurbish and modernise spaces for students and staff.

Professor Neil Quigley
Vice-Chancellor

From the Deputy Vice-Chancellor Research

With changing geopolitical pressures, it is easy to overlook and de-emphasise the importance of sustainability. However, in challenging times, stability and resilience will come from attention to efficiencies, wellbeing, equity, economic security and environmental resilience – all of which are encompassed in the United Nations' 17 Sustainable Development Goals.

Intergovernmental Panel on Climate Change reports make it clear that deep reductions in emissions are necessary if we are to avoid the worst impacts of the changing climate. But the accelerating trend in greenhouse gas emissions and global temperatures implies that emissions reductions on their own are not enough. The best advice available on sequestration and adaptation options will also be required.

The University's Sustainability Plan and this report recognise the contribution we are making through research to inform and advance sustainability actions on:

- Building resilience to climate change
- Carbon storage
- Developing more equitable options for housing
- Engagement with bicultural and multicultural approaches to economy, environment and society
- Reducing pollution and protecting our freshwater, marine and polar ecosystems.

It is easy to think that New Zealand is too small to have much impact in global emissions reduction. However, when it comes to being part of the wider solution, New Zealand has a potentially big role to play. Our location in the mid-southern latitudes puts us in the core of the part of the planet that draws down much of the emissions generated from burning fossil fuels.

We also have some of the more efficient and unimpacted natural systems, and work to secure and restore those natural ecosystems will have benefits well beyond our distant shoreline. The University of Waikato research effort is providing leadership in these and other areas of regional, national and global resilience and we are working with a range of policy and impact partners to ensure the research effort is realised in improved sustainability outcomes.

As well as research leadership, over the last year the University has continued to reduce its reliance on fossil fuel to power its infrastructure. This is something we are very proud of given the level of growth the University is experiencing.

We are now also turning our attention to the emissions associated with staff and student commuting and developing strategies to reduce the number of car journeys undertaken associated with our day-to-day operation. However, being part of the global research effort on sustainability comes at a cost, because of New Zealand's distance across the vast Pacific Ocean from Europe, Asia and the Americas. We are being careful to manage that travel while also contributing to and leveraging wider global research initiatives to improve sustainability outcomes.

We hope our work resonates with you and we look forward to engaging further with you on our continuing efforts to improve sustainable outcomes for our economy, society and environment.

Professor Gary Wilson
Deputy Vice-Chancellor Research

Our sustainability mission

Our sustainability mission is grounded in a commitment to transform the learning and research environment in ways that reflect our responsibility to present and future generations.

The year 2025 was an unprecedented year for climate change and geo-political volatility. Global temperatures have reached ~1.43°C above pre-industrial levels. Record heatwaves swept across Asia and North America, wildfires ravaged more than one million hectares in Europe, and catastrophic floods impacted Pakistan, China and Brazil.

Despite these events, or perhaps because of them, our scholars led innovative research projects to make people more resilient in response to disastrous events. Using data collected in the aftermath of Cyclone Gabrielle, researchers at the University of Waikato have generated insights for how the people of New Zealand may adapt to catastrophic flooding by making better, more informed decisions about how to prepare for and respond to such events. This research will resonate widely with people around the world who have been forced to contend with wildfires, heatwaves, and floods.

Research in the sustainability space has carried over into the University's teaching spaces, too. Academic staff across campus have convened research-led papers that focus on the sustainability-related cultural, environmental, social, and economic topics in New Zealand and around the world. This is especially true when it comes to curating a curriculum with the aim of showing how Indigenous Māori knowledge, histories, and values have contributed to creating more equitable and environmentally sustainable systems.

While sustainability-focused research and teaching have been a highly visible part of our sustainability landscape in 2025, achieving a truly sustainable campus is going to require collective action.

Our student and staff commute currently accounts for approximately 40% of the University's total greenhouse gas ("GHG") emissions, which is well above the typical 15% to 30% observed in the tertiary sector. Reducing this footprint will therefore depend on encouraging and enabling lower-carbon commuting choices across our community.

Accessible, reliable and cost-effective alternatives to single-occupancy vehicle use must be at the forefront of our strategy. Carpooling and ridesharing can reduce per-capita commuting emissions by an estimated 40% to 60%, while also easing congestion and parking. Also, public transport remains a cornerstone of low-carbon mobility.

We're expecting 2026 to be a watershed year for sustainability at our Hamilton and Tauranga campuses:

- We will install solar canopies over two major carparks on the Hamilton campus that will generate approximately 2,800MWh annually and avoid an estimated 280tCO_2-e emissions
- We will assess the feasibility of on-site battery storage of solar energy to maximise its use and improve energy security
- We will partner with external stakeholders to advance passenger rail service from Hamilton to Tauranga.

Guided by the principles of kaitiakitanga (guardianship) and kotahitanga (togetherness), this report reflects both the progress we have made and the journey that lies ahead. Sustainability is not the responsibility of any one group; it is a shared endeavour. Together, through thoughtful investment and everyday choices, we can ensure our University continues to support our community, a healthy environment, and a resilient future for our region.

Dr Joe Ulatowski
Assistant Vice-Chancellor Sustainability

Our University at a glance

Domestic Equivalent Full-Time Students (EFTS)
(+7.7% over 2024)

9,358

International Equivalent Full-Time Students (EFTS)
(2,745 onshore, 962 offshore)

3,707

25% of domestic EFTS generated by Māori students

72% of staff 'recommend the University of Waikato as a great place to work'
(+6% over 2024)

$51.3m research revenue generated in 2025
(+2.9% over 2024)

Sustainability on campus

In 2025, the University's cumulative greenhouse gas emissions increased primarily as a result of higher than expected reliance upon non-renewable energy resources by our energy provider and higher than usual electricity consumption because of strong growth in student enrolments. While electricity in New Zealand is largely generated from renewable sources, 2025's dry conditions meant energy companies had to call upon more non-renewable resources to generate enough energy to feed the grid, thereby increasing our emissions.

At the same time, the University has witnessed significant growth in student numbers. This unprecedented growth placed additional pressure on campus infrastructure, leading to greater demand upon campus spaces. Despite this growth, the University continues to perform well in energy consumption against the baseline data from 2019, having decreased electricity consumption by 14% and gas consumption by 40%.

The University has focused on sustainable campus development that improves quality, functionality, and space efficiency while reducing environmental impact. In 2025, we began consolidating space across the Hamilton campus, reducing the overall footprint through the removal of ageing buildings and the upgrade of key facilities.

Significant progress has been made in decarbonising campus infrastructure. In 2025, the Hamilton campus completed a full transition to LED lighting, replaced gas boilers with a Hybrid Variable Refrigerant Flow system, and converted gas radiant heaters and hot water systems to electric infrared heaters and high-efficiency heat pumps. These initiatives substantially reduce emissions while improving energy performance and resilience.

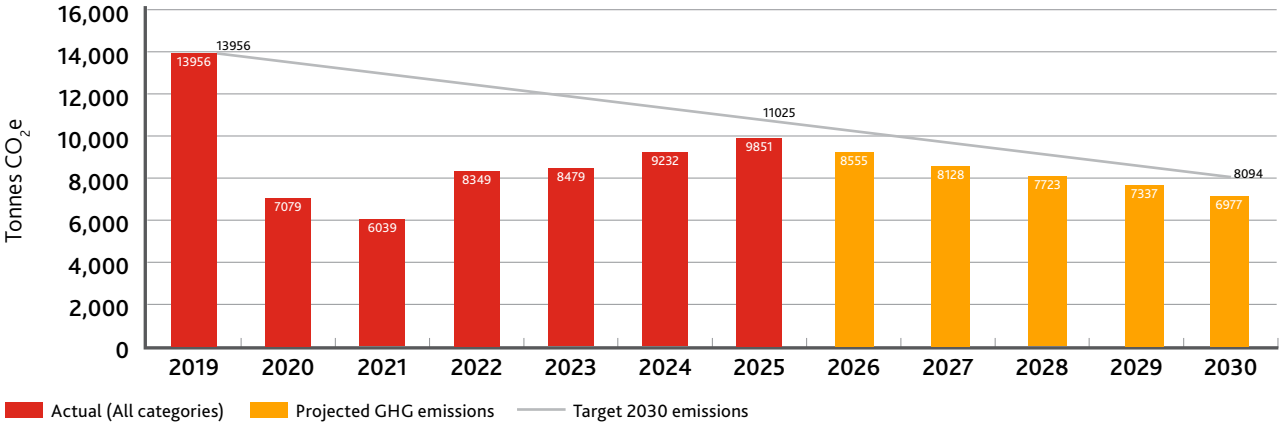
At the end of 2025, the University completed a major project installing new potable water pipes to replace ageing water pipes. This project has achieved significant results with a water consumption reduction of 30% to 40% month-on-month.

A major refurbishment within the University's J Block transformed two floors into flexible, open-plan workspaces. Investment also continued in high-quality, self-catered student accommodation, with the delivery of a new 75-bed, townhouse-style facility. Built using off-site construction methods, the project reduced carbon emissions, construction time, and overall costs.

The University strengthened its community and research partnerships through sustainability-focused initiatives. In partnership with Hamilton City Council, a free e-waste drop-off day collected 38.4 tonnes of electronic waste, which was one of the largest single-day collections ever recorded in New Zealand. A new Memorandum of Understanding with AgriSea expanded collaboration in sustainable aquaculture, supporting native seaweed innovation, environmental restoration, and regional economic growth.

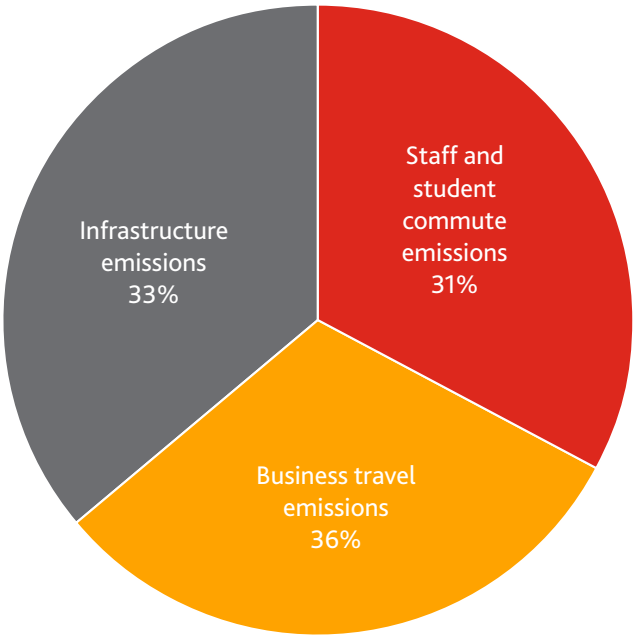
Through the Ahuora Centre for Smart Energy Systems, which unites researchers from the universities of Waikato, Auckland, Massey and around the world, an advanced energy symposium showcased AI-assisted tools helping industry reduce reliance on fossil fuels. Together, these efforts support the University's pathway to carbon neutrality while delivering lasting benefits for communities, industry, and the environment.

Absolute GHG emissions (All categories), with projected GHG emissions goals (2019-2030)



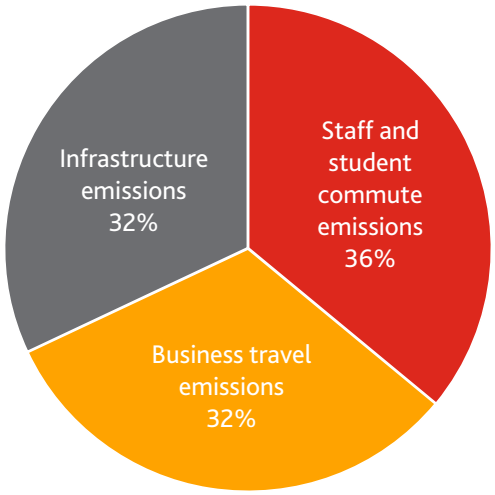
2019 total operational emissions: 13,956 tonnes

Source of emissions
Comparison of commute, travel and infrastructure emissions



2025 total operational emissions: 9,232 tonnes

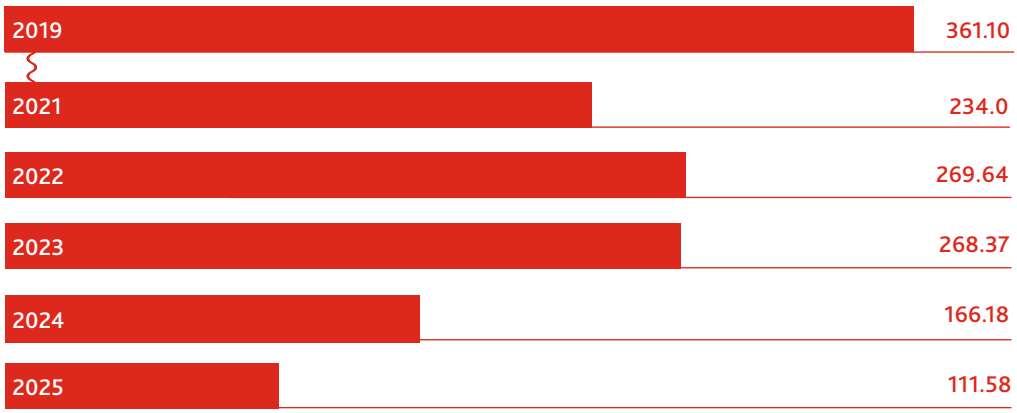
Source of emissions
Comparison of commute, travel and infrastructure emissions



29% ▼

Reduction in total operational emissions
(from 2019 to 2025)

Fuel* by Year (Tonnes CO2-e)

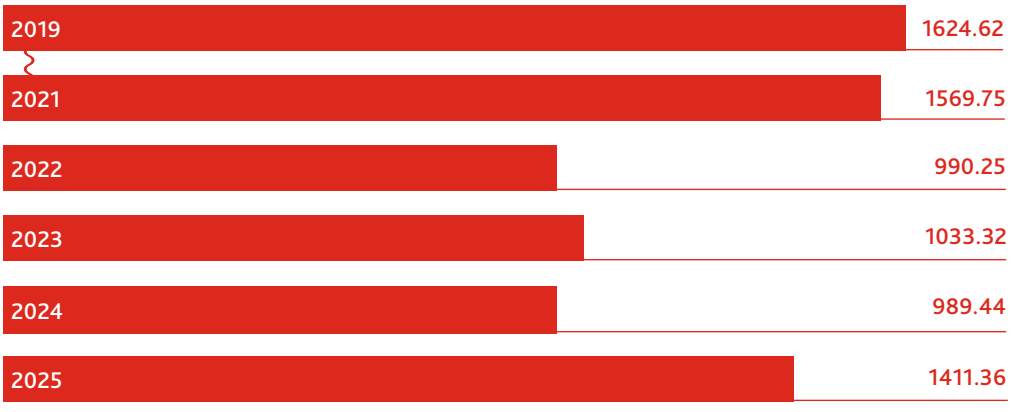


(petrol and diesel)

69% ▼

Reduction in fuel
(against a 2019 baseline)

Purchased energy (Electricity) by year (Tonnes CO2-e)



13% ▼

Reduction in purchased energy (Electricity)
(against a 2019 baseline)

Building for the future: sustainable growth on campus

The University of Waikato has always evolved in response to the needs of its people, its region, and the world around it. Today, the need for change is clear. How we teach, learn, conduct research and work is shifting, and our campuses must keep pace.

With student numbers projected to grow by up to 40% over the next 15 years, we are transforming our teaching and learning environments into spaces that blend physical and digital delivery, enable active and collaborative learning, and bring people together across disciplines.

Our vision is hands-on, connected, and multidisciplinary. We are taking a practical, long-term approach to this growth by retiring buildings that are no longer fit for purpose and upgrading those that will serve the next generation.

Rather than expanding our footprint unnecessarily, our focus is on building only what is needed and ensuring each space works harder for the University community. Across our Hamilton and Tauranga campuses, we are focused on creating environments that support collaboration, inclusion, and high-quality experiences for students, staff, partners, and our wider community.

At our Hamilton campus we currently have more space than we need, and not enough of the right kind of spaces to support our development into the future. The campus spans 65 hectares and more than 140,000m² of buildings. With only one-fifth of this space used at full capacity, we have a significant opportunity to better utilise space while improving the quality and performance of our facilities.

Sustainability sits at the heart of our approach. Where we are required by law to seismically strengthen certain buildings, we are taking the opportunity to modernise and gain better efficiency from them.

Laying the foundation for a smart campus, we are creating spaces that are intuitive, interconnected and aligned with how students, staff and community use them. We are redesigning buildings to be more thermally efficient and embedding smart technologies within them to reduce environmental impact. These include features such as occupancy sensors for LED lighting and air-conditioning, which ensure energy is not wasted in unused spaces.

By upgrading infrastructure, improving utilisation and embedding renewable energy and smart systems, we are creating environments that are resilient, efficient and future-focused.

Hamilton: responding to changes in education with flexible learning spaces

Internationally, the landscape of tertiary education is changing faster than ever, shaped by global competition, digital transformation and new ways of learning. Students expect flexible, connected learning experiences; communities and industry seek closer partnerships; and campuses must not only be places of study, but places to live, collaborate and belong.

Historically, many spaces on our Hamilton campus were designed around how staff worked rather than how students use them. Looking to the future, our building designs are focused on integration, openness and connection.

We are moving away from ad hoc planning and towards consistency across buildings and floors. Lower levels will house research hubs and student-focused environments; middle levels will support collaborative learning; and upper levels will provide flexible, multi-zoned workspaces.

Every environment will be designed to foster interaction, experimentation and connection. This people-centred approach supports an on-campus-first model, where digital tools enhance, rather than replace, the value of in-person learning.

By ensuring we have the right types of spaces, at the right size, we can create an environment where ideas move easily, disciplines collaborate naturally, and people are supported to thrive.

Tauranga: growing a connected university city

At just six years old, our Tauranga campus is focused on steady, demand-led growth aligned with regional needs. With a long-term vision for Tauranga as a 'university city', the campus is part of a wider approach where education, research, innovation, student life and civic activity are increasingly visible and connected within the city centre.

Strong partnerships with the Tauranga City Council, iwi, business and industry are central to this approach. These relationships are supporting the continued growth of our campus, strengthening the student community and contributing to a more active and vibrant city centre.

This aligns with the city's Knowledge Precinct, identified by Tauranga City Council as a key part of Tauranga's future. The precinct brings together learning, research, enterprise and community, strengthening connections between the University, local business and the wider region.

Recent developments reflect this momentum. In 2025, we acquired the Bongard Centre to support our campus expansion as we grow and secured two long-term lease agreements for an additional 300 student beds.

Solar: harnessing energy for a low-carbon future

Over the next 15 years the University's Hamilton campus will deliver solar generation at scale as part of its commitment to a sustainable, future-ready campus.

A large campus-wide programme is underway, with solar panels installed on buildings and plans progressing to further expand renewable energy generation across campus.

This initiative is a central step towards achieving carbon neutrality by 2030, reducing emissions and strengthening the University's environmental performance.

By integrating solar generation into the campus fabric, Waikato is creating a greener, more resilient learning environment while demonstrating leadership in sustainable energy.

Disaster impacts and system resilience

The University of Waikato has a leading research profile in climate adaptation in New Zealand with multiple projects underway examining how communities, systems and environments can better prepare for and respond to climate-related risks. Drawing on expertise across sociology, environmental planning, logistics and supply chain, economics and climate science, Waikato researchers are generating evidence-based insights that support more resilient decision-making.

Cyclone Gabrielle in early 2023 caused widespread damage across the North Island of New Zealand, particularly in Gisborne and Hawke's Bay. Homes were destroyed, infrastructure severely damaged, supply chains disrupted, and communities displaced. Beyond the immediate destruction, the event highlighted how disasters trigger cascading impacts across interconnected systems – affecting health systems, transport networks, housing, finance, and community wellbeing.

As climate change accelerates, extreme weather events are becoming more frequent, more intense, and less predictable – challenging planning approaches that rely heavily on historical patterns. Areas once considered low risk are now experiencing significant impacts. Our researchers are contributing to improved flood risk assessments that incorporate future warming scenarios and examine potential impacts on housing, infrastructure and vulnerable populations. Disasters affect more than physical infrastructure. When roads and transport networks fail, freight movement, essential services and economic activity are affected, exposing New Zealand's reliance on road transport and the lasting social and health impacts that follow.

Our research highlights that recovery decisions are often made on compressed timeframes, under pressure to rebuild quickly and restore normality. However, rebuilding "like for like" in high-risk locations can entrench vulnerability. Repeated rebuilding of damaged infrastructure, ongoing financial strain and cumulative environmental degradation can push regions toward thresholds where recovery becomes increasingly difficult and costly.

While large-scale disasters like Cyclone Gabrielle dominate national attention, our research shows that focusing only on headline events risks overlooking the cumulative effects of smaller, more frequent disasters. All communities face some element of evacuations, insurance pressures, economic disruption, and long-term stress, and our research indicates that disaster resilience must account not only for major events, but also for the steady accumulation of smaller shocks that collectively strain systems over time.

Through strong national and international partnerships with researchers, government agencies and the private sector, we play a key role in translating research into practical guidance, policy inputs and real-world solutions. Our researchers have called for changes to government policy on freight infrastructure after their studies showed the negative impact that small and large disasters on community health and wellbeing, have emphasised the need for improved disaster impact data to inform policy and practice, and advocated for stronger, clearer regulations on environmental risk disclosure.

Our research highlights the need for integrated and forward-looking approaches across all four phases of disaster management (prevention, preparedness, response and recovery), including avoiding development in at-risk areas, building redundancy into infrastructure systems, strengthening legislative and planning frameworks, and embedding long-term resilience into recovery decisions.

2025 highlights

Cyclone Gabrielle revealed how deeply interconnected New Zealand's social, economic, environmental and infrastructure systems are in the face of extreme events. Our researchers examined the broader and longer-term consequences of such disasters.

When transport networks fail

New Zealand is heavily reliant on road transport, making the freight system particularly vulnerable during weather-related disasters that disrupt supply chains, causing delays, increased costs, workforce pressures and reduced access to essential goods. Research examining post-disaster freight disruption, including interviews with fresh fruit and vegetable growers, showed that these impacts are rarely caused by a single failure, but instead arise from interconnected breakdowns across infrastructure, policy, operations and decision-making.

Health and wellbeing

Natural hazards like cyclones do not affect everyone equally; some people and communities are much more vulnerable than others.
Our researchers conducted interviews with residents, health workers and first responders to understand the health and wellbeing impacts of Cyclone Gabrielle and to identify lessons for future preparedness and response. Our studies showed that physical injuries, disrupted access to healthcare, and long-lasting mental health challenges extended well beyond the immediate emergency period. The research also revealed that older people, those with disabilities, and residents of rural and remote areas faced heightened risks and barriers to support, and strong community networks played a critical role in care, recovery and resilience.

Rethinking disaster planning

Our researchers are reshaping how disaster impacts are understood and incorporated into policy and planning. Analysis of flood events across New Zealand over the past three decades shows that economic and social damage occurs across disasters of all sizes – not only the largest, headline-grabbing events. The research identifies gaps and inconsistencies in how disaster data are collected and highlights an over-reliance on rainfall measurements that do not fully capture community impacts.

Biodiversity as a financial risk

Cyclone Gabrielle reinforced that environmental shocks can quickly translate into economic consequences. Our research highlights that biodiversity loss is not only an environmental issue, but also a financial and systemic risk. Studies show investors respond strongly to biodiversity-related events, with share prices and market volatility shifting when companies are linked to environmental damage or new risk disclosures. As climate-driven disasters increase pressure on ecosystems, integrating biodiversity risk into financial decision-making is critical to strengthening long-term economic resilience.

Learning from Mātauranga Māori

University of Waikato researchers are stepping beyond monocultural approaches to explore innovative solutions informed by mātauranga Māori (Māori knowledge systems and values). A multitude of cross-disciplinary outputs are shaping sustainable approaches to wellbeing, technology, environmental responsibility and democratic governance.

When research is relational and grounded in mātauranga Māori, it leads to more inclusive systems that recognise the complex diversity of all people. Māori-centred approaches do more than address inequality; they deepen democracy, strengthen environmental care, and offer practical, culturally grounded pathways toward a more just and sustainable future. Our work offers a clear message: lasting solutions emerge when Māori knowledge, voices and values are placed at the centre. Drawing on holistic approaches from te ao Māori (the Māori world) and concepts of koha (reciprocity), manaakitanga (respect, care and generosity) and mauri (a binding central life-force), our researchers are reshaping healthcare to better serve diverse communities. We seek to challenge inequitable health outcomes and a 'one size fits all' approach across different contexts such as disability and aged care, and extractive models for research and care.

Through research that is relational with tāngata kāpō Māori (Indigenous blind and low-vision persons), we highlight how ethically- and disability-led approaches that put people front and centre are helping to improve participation and more equitable outcomes.

These practices address systems designed without disability-centred knowledge and demonstrate how inclusive responsiveness can improve mental health outcomes, while reducing structural barriers and inequities faced by Māori with disabilities. Our work further outlines an ethical and reciprocal approach to information sharing with research participants who have shared time, knowledge and personal lived experience.

In New Zealand and the world, populations are ageing. Informal family caregivers are playing an increasingly important role in caring for older adults at home. Our researchers have revealed the structural gaps in informal caregiving systems. Instead of focusing on a single 'primary caregiver', our work recognises care as a collective system grounded in aroha (love), whanaungatanga (relationships), and whakapapa (familial connections).

We identify collective care systems as a strength, albeit one that can mask inequities, and show that there is a need for better coordination, clearer knowledge sharing, greater recognition of caregivers' wellbeing and culturally grounded support structures. Supporting these collective systems will improve health and wellbeing outcomes for our elderly and reduce hidden pressures on caregivers.

Our engineering researchers are using tikanga (method, conventions and protocol) to guide prosthetic design and use. Advancing prosthetic technologies can restore movement and independence, but many people reject the function-restoring devices because they do not align with their identity and broader spiritual and social selves.

We are using 'biosignals' – measurements of biological activity – a key interface between the human body and computer systems, to improve prosthetic technologies. By embedding Māori perspectives that emphasise a holistic view of health that encompasses physical, mental, emotional, spiritual, family and social wellbeing, we are reframing biosignals, not as data to extract, but as a taonga (treasure) essential to spiritual and physical wellbeing. The approach has the potential to increase acceptance of prosthetics and improve the wellbeing of many amputees.

2025 highlights

We're producing innovative solutions to today's interconnected challenges – climate change, sustainability, inequality and the pressures on democratic systems. By drawing on Māori worldviews and Indigenous knowledge, our research shows positive pathways forward for New Zealand and the world.

Prioritising Māori perspectives

By centring Māori voices and knowledge, we are addressing environmental wellbeing and the unequal health impacts of climate change, while strengthening our collective capacity to respond. With funding from the Deep South: Te Kōmata o Te Tonga National Science Challenge, we examined the growing intersection between climate change and health governance, with a particular focus on the inequitable impacts experienced by and forecast for Māori. We present a framework informed by te ao Māori to raise conscientised decoloniality and deliberative democracy when considering issues such as climate change. Our researchers argue that deliberative democracy, grounded in te ao Māori and supported by genuine allyship, leads to more effective, legitimate and equitable climate action.

We also explored how national identity and collective memory shape environmental stewardship. By embedding values such as whakapapa and kaitiakitanga (guardianship) into public narratives – including through museums and cultural institutions – we reframe land and ecosystems not as resources to exploit, but as relationships to protect.

Māori approaches to housing

Our research into sustainable housing development recognises mātauranga Māori as a powerful foundation to align economic activity with environmental care and community wellbeing.

Working with Māori organisations, we have shown how Māori ways of organising and managing support the construction process. The inclusion of kaitiakitanga (relational responsibility) and spiritual connection creates environmentally sustainable housing that supports the spiritual wellbeing of the inhabitants.

Indigenous knowledge and governance

We are contributing to more equitable and environmentally sustainable systems by centring Māori knowledge, histories and values. Our research shows how anti-Māori narratives undermine fair, evidence-based decision-making and reinforce inequality.

Complementary research draws on Māori oral traditions, whakapapa and radiocarbon dating to deepen understanding of biocultural landscapes and long-term environmental change. By valuing Indigenous ways of knowing and local knowledge, we support more inclusive governance, strengthen relationships with land and water, and help build systems that address inequality while protecting ecosystems for future generations.

Engineering for low-cost housing using cold-formed steel

University of Waikato engineering researchers are rethinking the future of building design by focusing on cost-effective, sustainable and environmentally responsible solutions that still meet people's design expectations.

Our team is exploring the potential of cold-formed steel buildings as a sustainable, low-cost housing solution. Our focus is on developing new building systems and configurations that incorporate additional stiffening and support, increasing strength and enabling longer spans than are typically achievable with conventional systems. We are working to understand the steel's structural behaviour through experimental testing and advanced computer modelling, examining both load-carrying capacity and bending performance. Fire performance is also a key part of our research.

At the heart of this work is a manufacturing method that shapes steel without heat, unlike conventional steel forming processes that require reheating. Cold-formed steel is produced at room temperature by roll-forming flat steel coils into structural sections. This process uses significantly less energy than hot-rolled steel manufacturing, reducing embodied energy and associated emissions.

While cold-formed steel has been studied internationally, our research contributes new knowledge by developing and validating improved cold-formed steel member designs and design approaches tailored to residential construction. By integrating structural testing, numerical modelling, cyclone and fire performance assessment, as well as cost and environmental analysis, the work advances global understanding of cold-formed steel systems while also providing New Zealand-specific evidence to support their adoption in affordable housing.

Historically, building materials have prioritised safety and resilience with little consideration given to what happens at the end of a building's life.

Cold-formed steel is highly recyclable and can be reused or recycled at end of life rather than sent to landfill, helping to reduce waste and environmental pollution compared with some other building materials.

Our research includes analyses of direct cost and environmental impact, which show reductions in material and labour costs, lower on-site fabrication requirements and faster build times. Together, these benefits suggest that cold-formed steel could help ease New Zealand's long-standing housing crisis. Over the past 20 years, New Zealand has experienced some of the fastest house-price growth in the Organisation for Economic Co-operation Development (OECD), with several cities recording median house prices more than five times the median household income.

Cold-formed steel buildings are also well suited to New Zealand conditions, where single- and double-storey homes dominate and extreme weather events such as cyclones and flooding are becoming more frequent. Our research supports the goals of the United Nations Paris Agreement and aligns with New Zealand's Climate Change Response Amendment Act 2019 target of net-zero carbon emissions by 2050 through its focus on sustainable housing solutions.

Globally, demand for sustainable housing is increasing. In New Zealand, approximately 90% of residential framing is currently timber. While cold-formed steel represents a small share of the market, its high recyclability, cost effectiveness and performance at end of life position it as a viable and sustainable alternative.

2025 highlights

Our team is focused on advancing sustainable housing outcomes through evidence-based evaluation of construction materials that balance environmental performance, structural reliability and cost-effectiveness.

Low-carbon building innovation

Our researchers investigated the environmental impacts of housing using life-cycle assessment methods, exploring how alternative material choices can reduce carbon emissions while maintaining strong structural performance and affordability. Our life-cycle assessments involved evaluating how material choices influence carbon outcomes, from production to end-of-life reuse.

Performance and resilience

Our team investigated how cold-formed steel's strength, stability and durability can be enhanced through changes in section shape, stiffeners, connections, and protective coatings. Using experimental testing and advanced computer modelling, we examined load capacity, seismic behaviour, fire performance, and cyclone resilience. Our insights will help inform more reliable design methods, ensuring homes are built to handle New Zealand's climate and extreme weather events.

Affordable housing solutions

Through detailed cost and environmental analyses, we demonstrate how the use of cold-formed steel in housing construction can reduce material and labour costs, minimise on-site fabrication and accelerate construction timelines. By highlighting the potential of cold-formed steel to improve build efficiency, our research contributes to an understanding of a practical pathway to increasing housing supply and affordability in New Zealand.

The future of carbon storage

University of Waikato researchers are revealing how carbon shapes our planet and influences climate over long timescales. Our research explores the natural and engineered processes that regulate Earth's carbon cycle and help maintain climate stability. These insights are critical in a changing climate as societies confront the dual challenge of reducing greenhouse gas emissions and developing credible ways to remove and store excess carbon already in the atmosphere.

Governments and industries have been exploring ways to capture carbon and prevent it from re-entering the atmosphere. Yet capturing carbon is only part of the challenge. Understanding how long that carbon remains stored, how it behaves once placed into natural systems, and what downstream effects may emerge across land, freshwater, coastal and ocean environments is equally important. Actions taken in one place can have consequences far beyond the site of intervention, unfolding over decades or centuries.

We approach carbon sequestration by examining the whole system. Carbon sequestration is the process of capturing carbon dioxide released largely through human activities, such as burning fossil fuels, and storing it so it does not return to the atmosphere. Our research recognises that Earth's carbon cycle operates across vast spatial and temporal scales, linking biological processes, geological systems, ecosystems and human activity. By studying carbon behaviour over long periods of time, we help clarify how natural systems responded to past climate shifts and what this means for the risks and opportunities associated with modern carbon removal strategies.

Our strength lies in bringing together expertise across Earth system science, engineering, economics, law and policy to address carbon sequestration as both a scientific and societal challenge. This approach helps identify where sequestration solutions show promise, where uncertainty remains, and where environmental, ethical and governance risks must be carefully managed. This includes analysing ancient climate transitions to understand long-term carbon feedback loops, evaluating geological formations suitable for secure carbon storage, and examining the policy and economic systems required to manage carbon removal responsibly.

Our research, undertaken with national and international research partners and alongside government and industry, supports a measured and evidence-based approach to climate action. By grounding carbon sequestration in robust science and clear communication, we help de-risk decisions about how and where carbon is managed, supporting climate solutions that are effective, credible and enduring.

Photo credit: Sofia Rauzi

2025 highlights

Research published in 2025 strengthened understanding of how carbon moves through natural and engineered systems and how decisions about carbon removal and storage can be made more reliably. Across geological, biological and economic studies, researchers examined how carbon cycles have shaped past climate change, how carbon capture and storage technologies can operate safely, and how regulation and finance influence real-world emissions reduction. Together, these studies provide clearer evidence of how carbon sequestration can work at scale and over long timeframes.

Understanding long-term carbon cycle feedbacks

We investigated how interactions between climate, nutrients and marine productivity have influenced carbon storage during past global climate transitions. One study used zinc and carbon isotope records from marine sediments to show how changes in nutrient supply and plankton growth led to increased burial of organic carbon during the onset of a long-lived icehouse climate in the Carboniferous period (358.9 million to 298.9 million years ago). A second study demonstrated that enhanced phosphorus weathering increased marine productivity during the Late Miocene (11.6 million to 5.3 million years ago), drawing down atmospheric CO_2 and contributing to global cooling. These findings show how feedback loops between land, oceans and biological systems can amplify climate change or cooling over millions of years, providing important context for understanding how modern carbon-cycle interventions may influence Earth systems.

Advancing carbon capture and storage solutions

Several of our studies addressed the practical challenges of safely storing captured carbon. Research on sandstone formations overlying deep coal seams showed how mineral composition and microstructure influence the strength and sealing capacity of rock layers critical for preventing CO_2 leakage. Complementary geological screening work identified deep saline aquifers in western Canada capable of storing hundreds of megatonnes of CO_2, demonstrating how subsurface conditions determine storage feasibility. A new biophysical model also improved understanding of how temperature and CO_2 concentrations influence plant carbon fixation, strengthening representation of biological carbon uptake in climate models.

Governance, risk and investment in carbon removal

Our research also focused on the policy and economic systems needed to support carbon sequestration. Our analysis of New Zealand's developing carbon capture and storage framework highlighted the need for clear liability arrangements and long-term monitoring to manage leakage risks and maintain public confidence. Further work examined regulatory questions around which agencies should oversee carbon capture and removal technologies as policy frameworks evolve. Complementary economic research demonstrated how green finance mechanisms and technological innovation together improve carbon emission reduction efficiency, showing how financial systems play a critical role in enabling climate mitigation at scale.

Building sustainable and inclusive economic systems for high-value growth

At the University of Waikato, we recognise that both sustainable development and the generation of decent[1] jobs depend on how economic systems are designed, regulated and connected. From global trade and finance to Indigenous enterprise, labour mobility and circular economies, we're building evidence to inform policy that promotes inclusive and robust economic systems.

Agribusiness, the bioeconomy and financial systems are drivers for the New Zealand economy and emerging economies globally. The design of new enterprise development and financial systems opens opportunities to embed sustainability, broaden inclusivity and improve wellbeing, productivity and resilience.

The University of Waikato is a leader in Indigenous enterprise development. Te Kotahi Research Institute has developed a framework to guide entrepreneurial development and the commercialisation of genomic research using knowledge and values from a Māori world view. With support from Genomics Aotearoa, an alliance of universities and public research organisations, researchers designed *Te pūtahitanga*. The framework is an Indigenous moral view to map how Indigenous-led enterprise can commercialise research while protecting rights in data and knowledge and ensuring benefit sharing.

Our work to grow the Māori economy addresses the long-standing exclusion of Indigenous peoples from high-value innovation sectors. We show how Indigenous-led biotechnology can advance economic inclusivity and reshape entrepreneurship with a focus on responsibility, reciprocity and collective wellbeing.

Inclusive growth also depends on education, skills development and effective regulation. Our research shows that supportive institutions, targeted training and smart policy settings are essential to agribusiness entrepreneurship and regional growth.

We're also looking at the finance systems that underpin development and shape how economies respond to global shocks. Our research shows that while bank competition can improve access to credit and lower costs, it can also increase financial mismatches that make economies more vulnerable during downturns.

Our work also highlights how policy and the balance of payments including trade, investment and financial flows shape economic outcomes across low- to high-income economies. We examine the factors that cause deficits and vulnerabilities for low-income countries and find that healthy banking competition must be paired with robust regulation to support sustainable growth, reduce poverty and aid stability.

Our research has policy implications for both global and local contexts: sustainable economic progress is strongest when it is inclusive, well governed, and grounded in social responsibility.

[1] *Decent work as defined by the International Labour Organisation, is productive employment that delivers a fair income; security in the workplace and social protection for all; better prospects for personal development and social integration; freedom for people to express their concerns, organise and participate in the decisions that affect their lives; and equality of opportunity and treatment for all women and men.*

2025 highlights

The University of Waikato is exploring future-focused, resilient finance and trade systems to protect against geopolitical shocks, resource scarcity and infrastructure shifts. We're demonstrating how good design and smart strategy can support both environmental and economic sustainability.

Trade and economic resilience

Geopolitical change and conflict have far-reaching impacts on markets and trade.

Our research underscores how evidence-based policy can protect industries, support sustainable growth, and strengthen economic resilience in an increasingly uncertain global environment.

Research on global natural gas markets shows how conflicts such as the Russia–Ukraine war can rapidly disrupt energy supply and prices across interconnected economies, underscoring the risks of over-reliance on concentrated supply chains.

Complementary work on trade policy highlights that retreating into economic isolation is neither realistic nor sustainable. Instead, we point to diversification, strategic partnerships, and targeted domestic investment as smarter responses.

Transition to a circular economy

Growing a circular economy helps reduce waste, lower emissions, and protect ecosystems. It also creates new jobs, supports innovation, and reduces costs for households and businesses while aiding resilience to global shocks and resource scarcity.

We looked at statements issued by the Ministry for the Environment and the Ministry for Business, Innovation and Employment to understand how current policy in New Zealand supports the transition to a circular economy and how policy can support sustainability while building a more equitable, future-focused economy.

Sustainable food systems

Sustainable agricultural and food systems are important to realise global objectives of food security, ending hunger, reducing emissions, and responsible production and consumption.

Our research shows that implementing adequately targeted policies based on market measures requires a clear understanding of how consumer preferences and their understanding of environmentally friendly food act as consumption drivers. Understanding regional and global variations will encourage wider adoption of sustainable food practices.

Maritime connectivity and trade

The geographic remoteness of New Zealand is a recognised trading challenge. Using multiple data sets including an extensive industry consultation by the Ministry of Transport, we undertook an in-depth analysis of maritime connectivity, market connections, and how they strengthen, weaken or shift as shipping routes and global trade patterns evolve.

By moving beyond simple static indicators, we're helping policymakers respond to economic, logistical and regional development challenges, enabling better responses to build resilience.

Protecting our aquatic and polar ecosystems

Microplastics and environmental pollutants continue to threaten our marine and freshwater ecosystems across a wide range of settings, from local rivers, estuaries and aquaculture regions to some of the most remote environments on Earth. At the University of Waikato, our researchers are uncovering how these pollutants move through ecosystems, impact wildlife and alter ecological processes.

With a passionate team of marine scientists, ecologists and civil engineers, our researchers have moved beyond documenting the presence of pollution to understand its ecological consequences. Scientists are examining not only direct toxic effects, but also secondary impacts, system-wide impacts, and how plastics and toxins are reshaping our ecosystems.

Our research projects raise awareness of the complex trade-offs between the technologies that make everyday life easier and their unintended environmental consequences: microplastics in air, fish and our freshwater ecosystems; a global decline in mussels; and the implications for marine life from pollution and chemicals.

Our research confirms that pollutants are globally distributed not because they are produced everywhere but because they are transported everywhere through oceanic and atmospheric systems. Many substances break down extremely slowly, and their effects last for decades. These are the "forever chemicals" that we are finding even in Antarctica. One emerging research focus is the "plastisphere": a newly recognised habitat which sees organisms live on plastic waste, altering productivity, species interactions and ecosystems in ways that did not previously exist.

Beyond identifying where pollutants are found, our researchers are uncovering how microplastics and toxic metals affect organisms, ecosystems and critical life stages. This research moves beyond simple toxicology to examine ecosystem processes, species interactions and long-term environmental consequences.

While New Zealand continues to strengthen its management of plastic contamination through initiatives such as phasing out problematic plastics and persistent environmental toxins, strengthening our waste minimisation and recycling systems and growing public awareness and behaviour change initiatives, we highlight that pollution, especially for plastics, is a global challenge. In many parts of the world, plastic waste is difficult to manage, and our research in remote polar environments shows plastics are present wherever scientists look. The impact of plastic pollution is now comparable to that of changes in atmospheric carbon dioxide, affecting all levels of food chains and reshaping ecosystems worldwide.

Our long-standing international collaborations with iwi, Antarctic research programmes and Australian-funded initiatives have contributed to global efforts to understand and address environmental pollutants. For nearly 50 years, our scientists have led Antarctic research, supported by the International Centre for Terrestrial Antarctic Research, providing interdisciplinary science to support the conservation, protection and management of polar ecosystems, including research into long-lasting environmental pollutants in the Ross Sea region.

2025 highlights

Our researchers are advancing understanding of microplastics and environmental pollutants by revealing both their global reach and their complex effects on ecosystems. In 2025, we showed that pollutants are now present across marine, freshwater and polar environments, shaped by human activity and climate change, while also uncovering ecosystem and life-cycle impacts critical to environmental protection and sustainable management.

Pollution is global

Our research in the Antarctic marine environment found chemicals in seawater, seafloor sediment and marine life near research stations, with the highest concentrations in locations most strongly linked to human activity. These pollutants are also carried from other parts of the world and historic accumulations are being released into the environment through enhanced melting of glaciers. While current risks to small marine organisms remain low, the persistence of these substances and their potential to build up over time demonstrate that Antarctica is not isolated from global pollution and environmental stress.

In a world-first study, we also detected microplastics in both airborne and deposited particles in the Arctic, where atmospheric modelling showed that while some pollution likely originated from nearby oceans and polar regions, the highest concentrations were linked to air masses arriving from Europe.

Our complex ecosystem and life cycle effects

Our studies of coastal environments showed that land-derived metal contaminants, particularly zinc and lead, are present in seawater, sediments and mussel tissues, where they can harm the survival and development of mussel larvae. Climate-related stressors, such as stronger storms, marine heatwaves and increased sediment runoff, are likely to worsen these impacts, posing risks to mussel populations, including New Zealand's green-lipped mussel, which is vital to aquaculture.

Further research on coral reef fish showed that consuming microplastics increased internal stress and cellular damage, even though short-term survival during predator encounters was unaffected. These subtle health impacts may influence growth, energy use and long-term survival, with potential implications for marine food webs.

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