Motu

New Zealand's Low-Emission Future: Transformational Pathways

Outcomes from Motu's Low-Emission Future Dialogue

Motu Economic and Public Policy Research

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Document information

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These ideas are intended to provoke thought and discussion. They are not intended to be prescriptive or predictive, nor does their inclusion in this document imply any recommendation, consensus or endorsement by Dialogue participants or presenters, their affiliated organisations or the programme funders.

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1 Overview

Summary haiku

What we do matters
The choices we make today
Safeguard our future

From May 2014 through February 2016, Motu Economic and Public Policy Research convened a group of about 20 cross-sector stakeholders to explore pathways to achieving zero net greenhouse gas (GHG) emissions in New Zealand. Participants engaged in their personal capacity, not as organisational or sector representatives. This document presents a synthesis of ideas that emerged during the course of nine meetings. This is the first in a series of outputs from the Dialogue process.

The group's work suggests that a successful zero-net-emission economy lies within New Zealand's reach, and any number of pathways could take us there. New Zealand's strategic approach to the low-emission transition should be adaptive, enabling us to manage risks and capitalise on new opportunities as they emerge. In planning for the future, we can position New Zealand for accelerated transformation by:

1. building our capacity to innovate;
2. enabling experimentation;
3. leaving desirable options open; and
4. avoiding lock-in to high-emission technologies, infrastructure and behaviours that will hold us back in the longer term.

New Zealand would benefit from improved and new cross-sector processes designed to:

1. shape a series of broadly shared and accepted goals for climate change mitigation;
2. enable greater policy certainty across election cycles;
3. align policy with action and investment across the public and private sectors;
4. safeguard vulnerable communities during the transition; and
5. respond to rapid change with greater agility and coordination.

This document presents ideas for a new climate change narrative for New Zealand, explores pathways for sectoral transformation, and identifies options for stakeholder engagement and collaborative decision making on climate change policy and action. Instead of presenting recommendations, this work is intended to challenge New Zealanders to think in new ways about what could become possible. We hope this work will stimulate broader national conversations about the choices that lie ahead for New Zealand and create useful frameworks

for the kinds of actions by government, businesses, and communities that could shift us from incremental to transformational change.

2 A new narrative for New Zealand's low-emission future

In its *Fifth Assessment Report*, the Intergovernmental Panel on Climate Change has sent a clear message: to limit temperature rises below 2°C, the world needs to transition to a zero-net-emission economy by the end of this century. This needs to happen quickly enough to stay below a cumulative emissions ceiling which will be exceeded by 2035 under business as usual. In the 2015 Paris Agreement, participating countries agreed on the need to hold temperature rises "to well below" 2°C and to pursue efforts to limit temperature rises to 1.5°C.

Vision for New Zealand's contribution to mitigating climate change

New Zealand is responding to climate change with smart solutions that safeguard our future, enable a thriving low-emission economy, create new opportunities for our communities, and can be shared with other countries.

We are accelerating this transition by decarbonising our stationary energy and transport sectors, improving energy efficiency, making our agricultural production ultra-efficient, enhancing forest sinks, and strengthening partnerships across sectors.

As a country, we are reaching a point where scientific understanding of mitigation needs and advances in mitigation technologies are converging with social acceptance of the environmental, economic, and moral imperative to reduce our GHG emissions.

From the challenge of climate change arises an opportunity to transition strategically toward a productive, resilient, zero-net-emission economy that offers a high quality of life and positions New Zealand to gain competitive advantage under global carbon constraints.

Making this transition successfully will require coordinated commitment and action by government, businesses, and civil society across sectors to both bring in the new and usher out the old while meeting the fundamental needs of all New Zealanders, including those most vulnerable to change. We can position the welfare of our communities at the centre of our response.

New Zealand's history is one of continual change and innovation. We have never stood still. We have shown leadership by breaking new ground, acting on principle and serving as responsible global citizens. In the face of new kinds of change, we can build from our experience and strength to make decisions that will support the welfare of both today's and tomorrow's New Zealanders. We can also assist other countries in their transition to a zero-net-emission future, with benefits to all.

A successful zero-net-emission economy lies within our reach. It could take any number of forms, and we could choose any number of pathways to get there. Given the rapid rate of change as new opportunities are unfolding, we cannot know today what the optimal pathway and destination should look like. We can start immediately by taking the obvious mitigation actions that are technically and economically feasible today, and taking actions that will leave desirable options open to further development in longer term.

Every country is too small to limit climate change – acting alone. This challenge demands a collective response by citizens as well as countries. All New Zealanders have the capacity to contribute to solutions within their own homes, communities, businesses, and institutions and to reach out to help others. The steps we take to reduce our emissions and encourage others to act will help us to safeguard the country we pass to future generations.

3 What do we mean by zero net emissions for New Zealand?

In the context of this document, the term "zero net emissions" refers to the case where gross emissions of long-lived GHGs[1] are fully offset by removals by forest sinks, industrial processes or other forms of carbon capture and storage (CCS) so there is no net flow of emissions of long-lived gases to the atmosphere on an annual or period basis. This would be accompanied by significant reductions in emissions of short-lived gases.

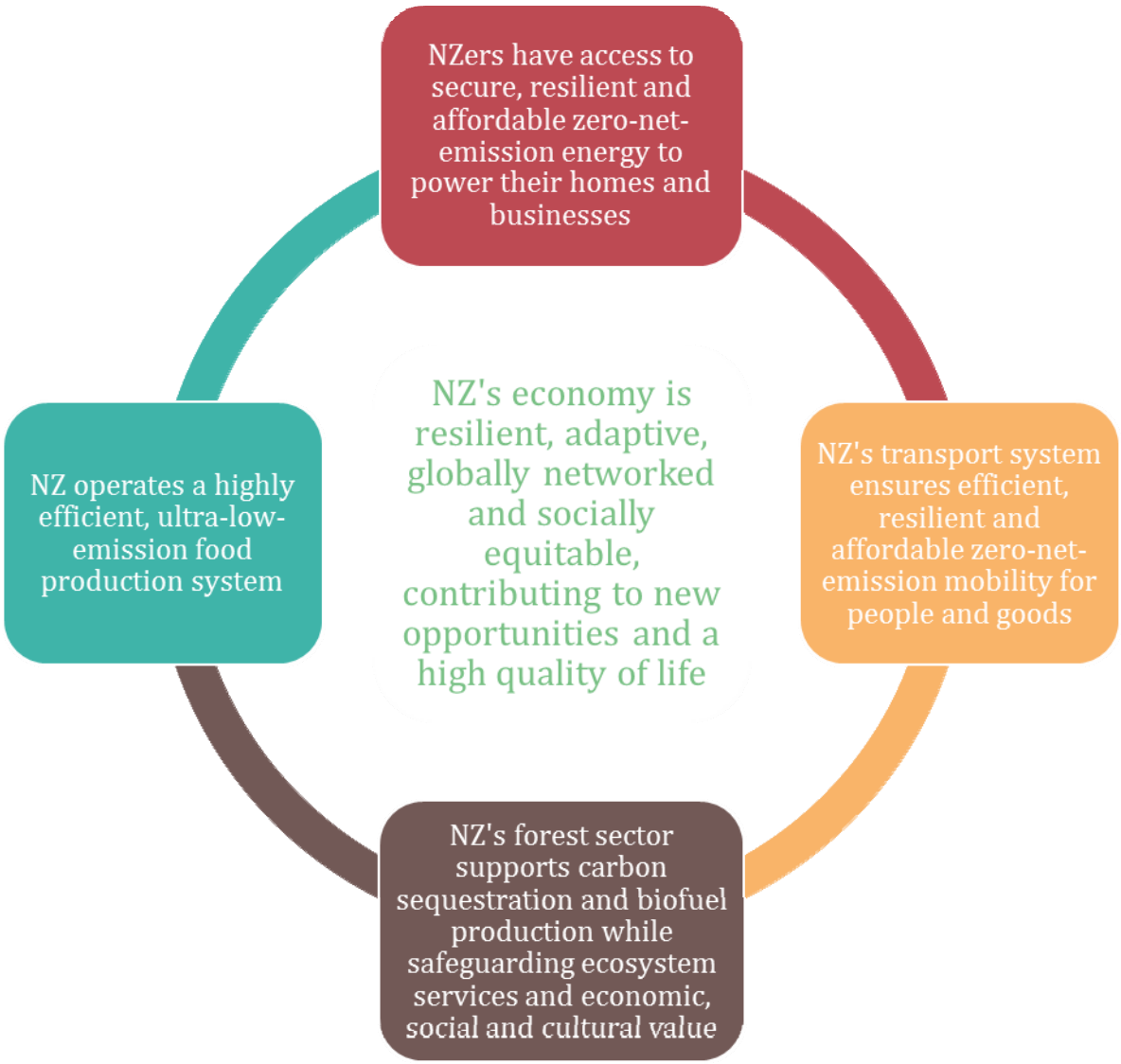
Under the 2015 Paris Agreement, countries have the option to meet part of their Nationally Determined Contributions to global mitigation by investing in emission reductions in other countries. Enabling guidelines and mechanisms are not yet in place. While acknowledging this option, particularly during the transitional phase, the Dialogue focused its efforts on pathways for achieving zero net domestic emissions of long-lived gases and significant reductions in domestic emissions of short-lived gases as a starting point.

[1] The major greenhouse gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). Under the convention used by this Dialogue, CH_4 was considered a short-lived gas, and the others long-lived gases. The *IPCC Guidelines for National Greenhouse Gas Inventories* identify other greenhouse gases that could be included if they become relevant to New Zealand.

4 Developing a vision for New Zealand's low-emission future

From a mitigation standpoint, what might a successful zero-net-emission economy look like for New Zealand? The following vision is offered as a starting point for discussion (Figure 1).

Figure 1: A zero-net-emission vision for New Zealand



How might we get to there from here? The following are two extreme scenarios.

Technology breakthrough: In one scenario, technology breakthroughs have brought us to the point of affordable zero-net-emission energy, enabling us to satisfy the power demands of large homes and commercial buildings; travel widely; and produce, consume and export energy-intensive goods and services. We are able to supply food to a growing population here and abroad with highly efficient, ultra-low-emission agricultural and food-processing systems. This abundance in zero-net-emission energy and food is matched by wisdom in our governance to safeguard air and water quality, biodiversity, sustainable land use, human health, and our cultural capital. People can thrive within both self-enhancing and self-transcending value systems. We've achieved the "zero point" for emissions from energy and food from which abundant possibilities emerge.

Social breakthrough: In a second scenario, transformational technologies for energy and food production have proven to be slow, elusive, prohibitively expensive or socially unacceptable. We cannot rely on decarbonising what we are used to doing and therefore also need to change how we live in order to thrive within carbon constraints. As a society we have risen to the challenge by shifting toward reduced, collaborative and highly efficient consumption. Our governing institutions successfully manage the production and allocation of energy and food to meet the demands of a growing population and economy within emission and other environmental constraints. We have diversified our economy, shifting toward exporting low-emission goods, services and IP. Our physical access to people, goods, services and opportunities is focused at the local community level, and we rely heavily on digital access to broaden our horizons. People thrive within self-transcending value systems and enjoy a high quality of life.

Of course, these are just two of countless possibilities that we could imagine today. Across multiple pathway options, we can identify a basic framework for a zero-net-emission future in which breakthroughs in technologies and practices are supported by deploying enabling infrastructure and shifting demand away from emissions-intensive goods and services. Residual emissions can then be offset by forest sinks, CCS or other means. This is illustrated in Figure 2.

Figure 2: Drivers of a zero-net-emission future: Shifting demand, enabling infrastructure, and innovation in technology and practice

5 Levers for accelerating transformation

Transitioning toward zero net emissions will require changes in technology, policy and regulation, business and financing, and behaviour. The following is a list of transformational levers in each of these areas which were identified in group discussions.

Technology innovation

1. Scanning globally for solutions
2. Researching locally and globally valuable mitigation options where New Zealand has comparative research advantage
3. Encouraging experimentation

Policy and regulations

1. Pricing emissions to reflect the social cost of carbon
2. Repositioning the New Zealand Emissions Trading Scheme (NZ ETS) as a backstop to complement a wider set of actions and policies
3. Applying NZ ETS auction revenue to stimulate innovation and leverage private investment in new technologies by redistributing risk and rewarding spill-overs from 'learning by doing'
4. Providing facilitative regulatory change and removing regulatory and legal barriers
5. Providing a just transition for communities
6. Capturing co-benefits for air and water quality, biodiversity and human health
7. Setting targets and assessing progress using a broader range of indicators that better reflect the complexity of sectoral mitigation opportunities and drivers

Business and financing

1. Changing business models to take advantage of new opportunities
2. Coordinating transformation across supply chains
3. Enabling consumers to reward good practice by producers
4. Facilitating mitigation action through financing and insurance mechanisms
5. Creating new markets overseas for New Zealand goods, services and expertise that support mitigation

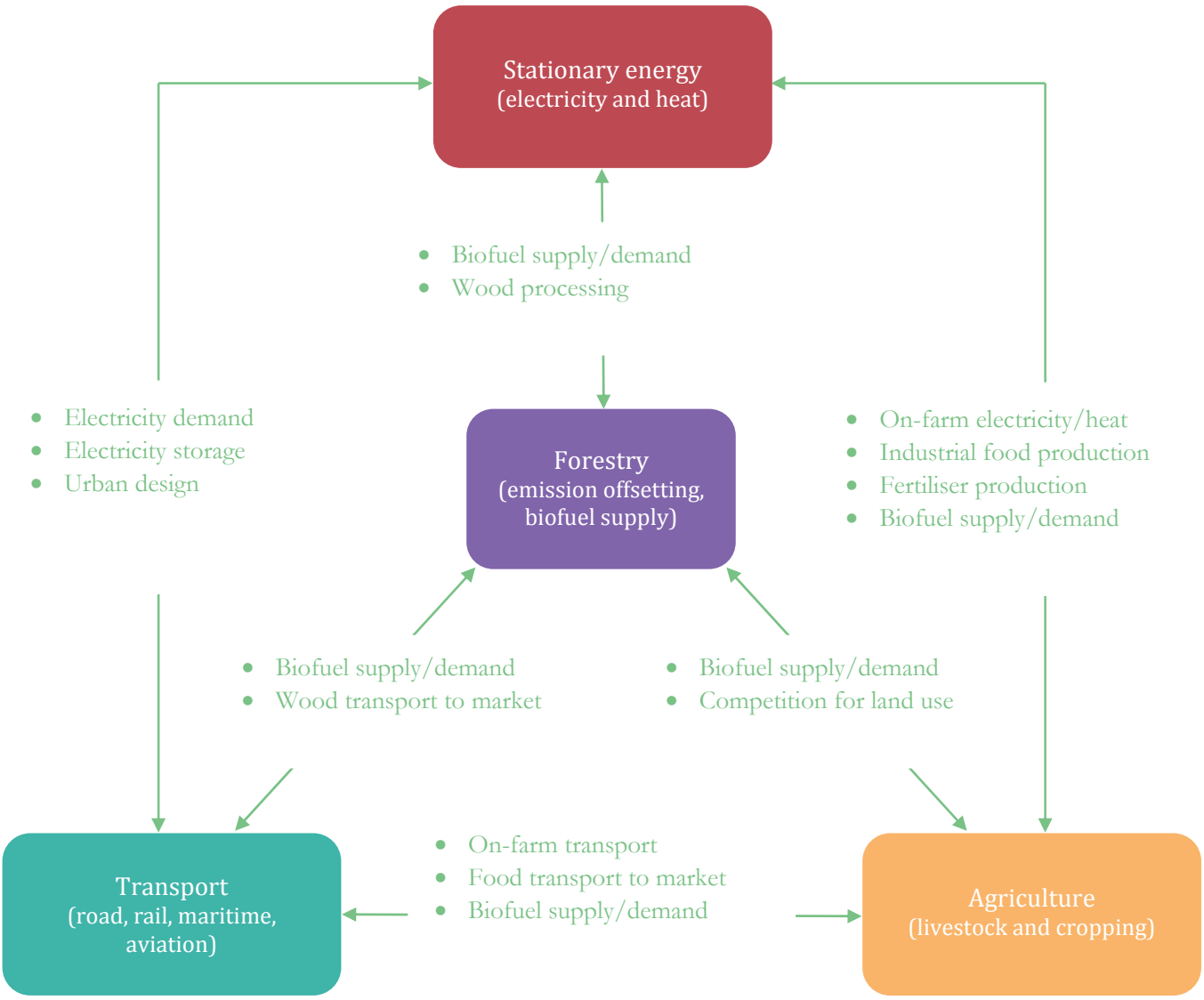
Behaviour change

1. Providing education and training to prepare rising generations for a low-emission future
2. Shifting values and social norms to bring mitigation into the mainstream
3. Encouraging cooperative and visible mitigation effort
4. Making mitigation the default choice (i.e. providing "nudges")
5. Securing and sustaining cross-party and cross-sector support for decarbonisation
6. Creating collaborative processes for problem solving and pathway finding
7. Changing how we tell the story of New Zealand's response to climate change.

6 Linkages among sector pathways

The sectoral pathways to a zero-net-emission future will not unfold in isolation from each other. Instead, they will remain interlinked and interdependent. Figure 3: 2050 sector pathway linkages illustrates some of those linkages.

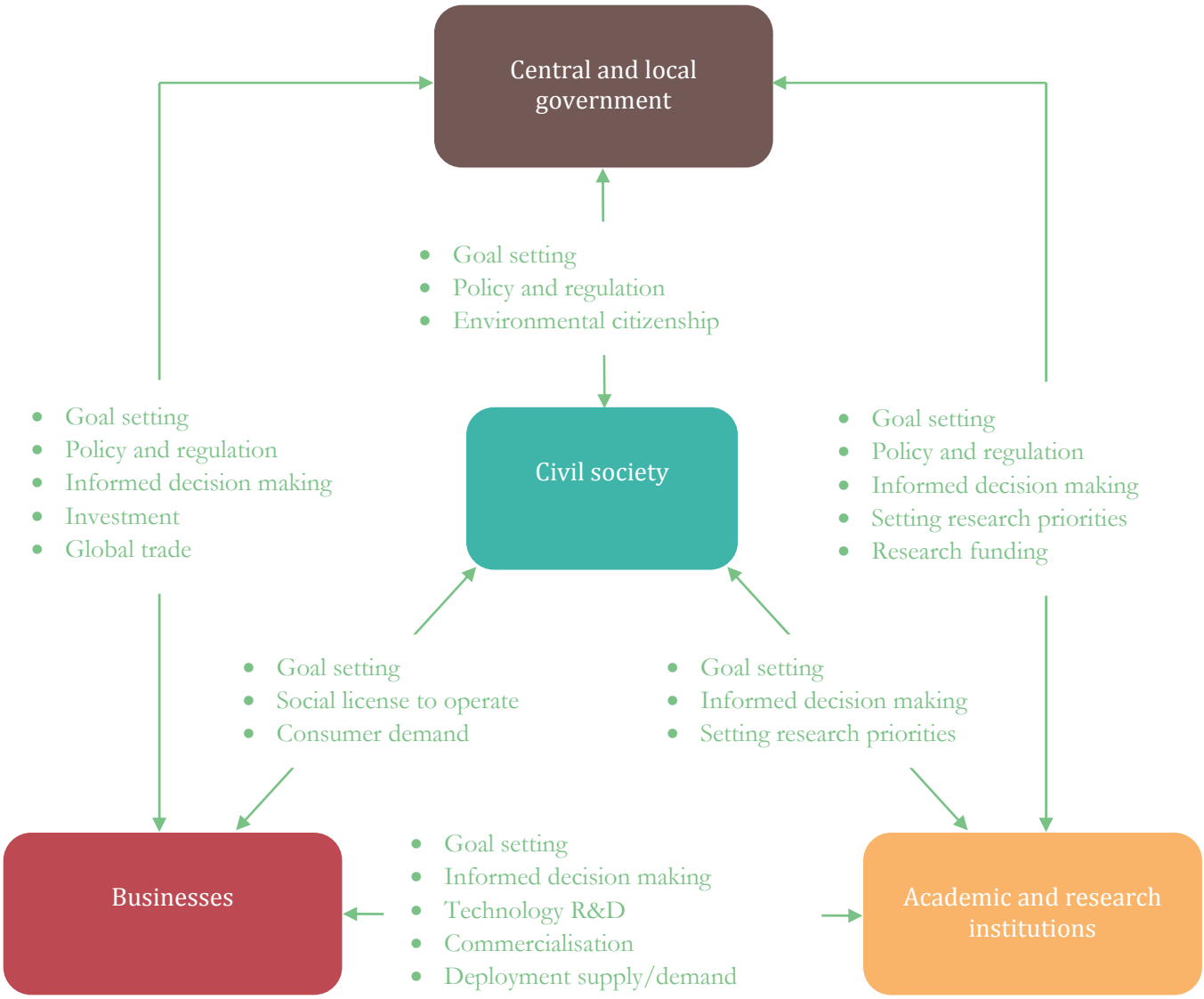
Figure 3: 2050 sector pathway linkages



7 Linkages among actors

Interactions between the government, business, academic/research sectors, and civil society will drive transformational change (Figure 4). All sectors have an important role to play.

Figure 4: Who will make change happen?



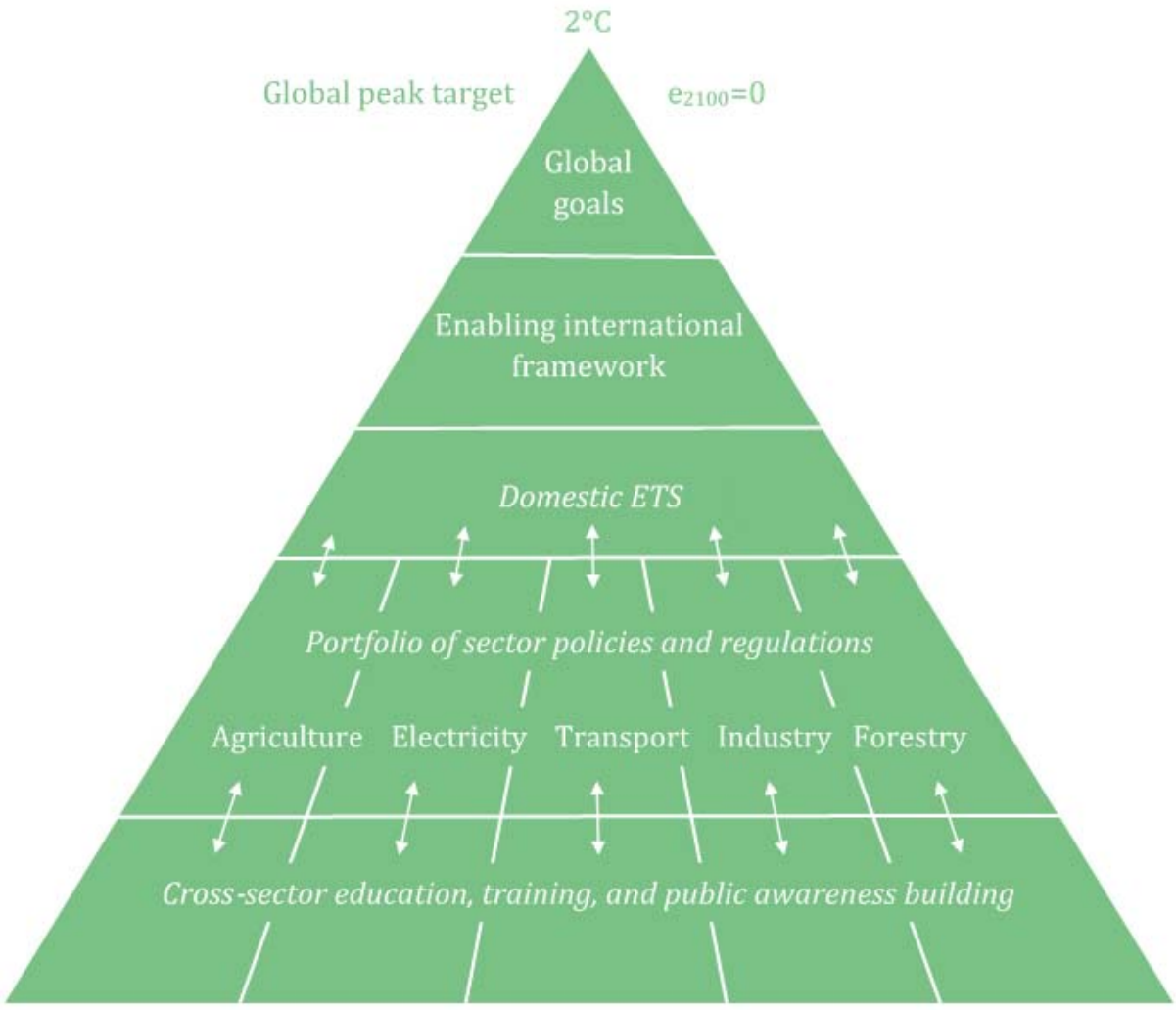
8 Policy linkages

Along the pathways to a zero-net-emission future, government leadership could involve a combination of policies and measures, some specifically targeted at climate change and others designed primarily to achieve other objectives (e.g. relating to air and water quality, energy security, biodiversity, etc.). What we have learned to date from the experience of New Zealand and other countries is that an emissions trading system can be a valuable tool for driving mitigation when it provides an effective long-term price signal but it should not be the only tool used by government to achieve strategic outcomes in key sectors.

New Zealand's domestic policy response should be designed in the context of internationally agreed upon goals for limiting temperature rises below 2°C, and the enabling international

framework emerging from the 2015 Paris Agreement. The response should be grounded in cross-sector education, training, and public awareness building. The low-emission transition in each sector might best be governed through a combination of sectoral policies and regulations and a rising emissions price signal generated by the NZ ETS. This framework is illustrated in Figure 5.

Figure 5: Enabling policy framework for a zero-net-emission future



9 Exploring transitional pathways in key sectors

Any number of pathways can deliver a zero-net-emission future for New Zealand. In the Dialogue, we applied a backcasting process to translate a broad vision for a thriving zero-net-emission economy into a range of potential sectoral characteristics. The adaptive pathway choices made by government, business and civil society in conjunction with external change drivers (nodes) will determine the balance of characteristics that eventuates. Each of these sector characteristics will require the achievement of milestones that can be organised into four

categories: technology, policy and regulation, business, and behaviour. In turn, each milestone will be supported by the actions of specific sector actors. The backcasting process used for group brainstorming is summarised in Figure 6.

Figure 6: The Dialogue's backcasting process

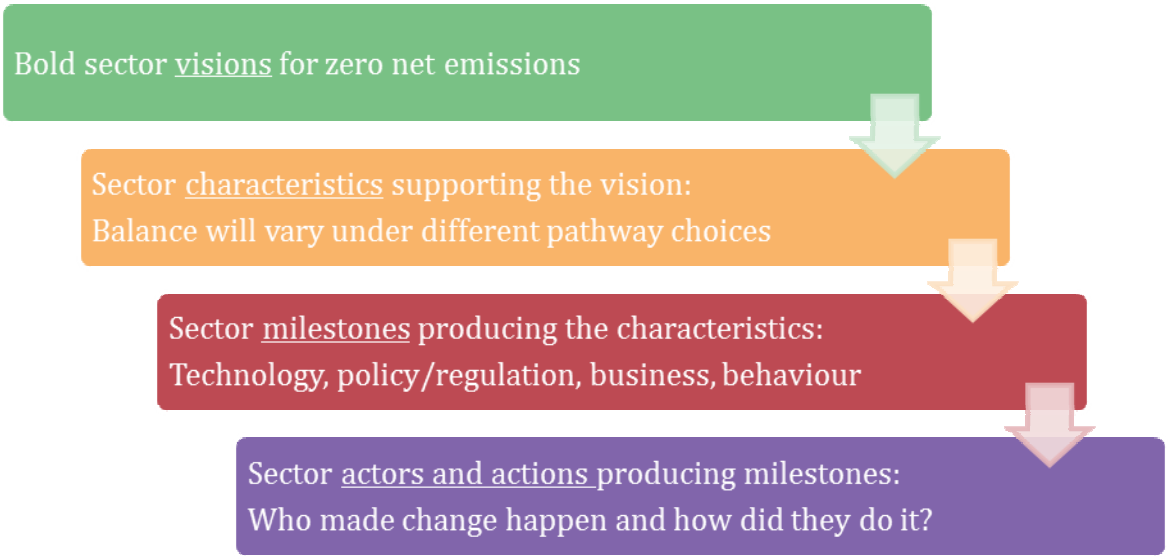


Table 1 summarises the range of potential sector characteristics that could support a low-emission economy in New Zealand as identified by Dialogue participants. The group also brainstormed potential milestones, actors and actions associated with each characteristic. This more detailed work will be made available in a separate document.

Table 1: Possible sector characteristics in a low-emission future

Sector category	Sector characteristics
Stationary energy vision: NZers have access to secure, resilient and affordable zero-net-emission energy to power their homes and businesses.	
Electricity and heat supply	1. Utilities supply (nearly) 100% renewable generation. 2. Distributed renewable generation (DRG) displaces (some) utility generation. 3. Heat for industrial production and buildings (primarily) is produced with renewable electricity or other non-fossil fuels. 4. Emissions from fossil fuel or biomass combustion are removed by CCS. 5. Disruptive technology transforms the supply of power and/or heat.
Electricity and heat demand	6. Enhanced energy efficiency and conservation generates multiple benefits. 7. Disruptive technology transforms demand for power and/or heat.

Sector category	Sector characteristics
Transport vision: NZ's transport system ensures efficient, resilient and affordable zero-net-emission mobility for people and goods.	
Transport fuel supply	8. Transport is powered (primarily) by electricity. 9. Transport is powered (primarily) by biofuel (e.g. bioethanol, biodiesel, biogas [CBG, LBG]). 10. Disruptive technology transforms transport energy supply.
Vehicle fuel demand	11. Vehicle fuel efficiency increases significantly.
Passenger transport demand	12. Private motor vehicle use is heavily displaced by public, other shared or active transport modes. 13. Private motor vehicle use is significantly reduced by urban planning and/or culture change.
Freight transport demand	14. Freight mode shifts significantly from road to rail and shipping. 15. Freight transport demand declines significantly due to changes in technology or consumer demand.
Agriculture vision: NZ operates a highly efficient, ultra-low-emission food production system.	
Food supply	16. NZ operates an ultra-GHG-efficient livestock sector. 17. NZ produces zero-CH_4, low-N_2O nutrition.
Food demand	18. NZ reduces food waste across the chain of food production and consumption. 19. Consumers demand low-emission food.

10 Identifying pathway pivot points (nodes)

"Nodes" are major pivot points, driven by new technology, social change, key decisions or *force majeure* events that would open the door to one set of pathway characteristics and/or close the door to another. They can be considered relatively irreversible. Policies that involve a major investment with irreversible outcomes could serve as a node, but policies that can be reversed are an "action" rather than a "node". Nodes can be externally driven (i.e. beyond the control of domestic actors) and highly uncertain. They can be identified and managed as a source of potential uncertainty, risk, or opportunity. The group identified the following examples of potential nodes that could shape future pathways in key sectors:

Stationary energy

1. Major gas field discovery producing a supply of cheap natural gas
2. Certainty over ongoing operation or closure of the Tiwai Point aluminium smelter
3. Development of affordable grid-scale battery storage technology
4. Development of lower-cost renewable generation that displaces hydro, allowing hydro to serve as the "battery"
5. Rapid uptake of affordable DRG
6. Optimisation of electricity network with effective smart grid
7. Introduction of commercially viable CCS
8. Technology breakthrough in stationary energy generation (e.g. hydrogen, fusion)
9. Technology breakthrough in renewable industrial heat
10. Fundamental process changes in industrial production (e.g. food processing, cement, steel)
11. Increased energy demand due to climate change
12. Social commitment to end energy poverty

Transport

1. Accelerated transition to electric vehicles (EVs) by vehicle producers
2. Technology breakthrough for commercial biofuel production from woody biomass
3. Other disruptive transport technology
4. Significant and sustained changes in the price of oil (upward or downward)
5. Major investment in the Auckland transport network
6. Rail decommissioning, electrification or sale to private operators
7. Lithium shortage/crisis, affecting EV battery technologies
8. Major changes to international shipping supply/demand/cost
9. Change in social norms for vehicle ownership (e.g. it becomes taboo to own/drive your own car)
10. Reduced transport demand due to broadband uptake

Primary sector

1. Development of a CH_4 vaccine for ruminant livestock
2. Pests or disease massively affect forest, livestock or crop production
3. Synthetic milk/meat becomes commercially and socially viable
4. Technology change (transport, refrigeration) combined with water shortages in developing countries supports export of whole milk rather than milk powder
5. Fish stock collapse from ocean acidification

6. Consumer demand for meat and dairy declines significantly (e.g. for health or environmental reasons)
7. Massive or rising demand for biofuel/biomass
8. Other competing land uses increase dramatically

Other

1. Land privatisation restricts land uses (e.g. for stationary energy, transport, primary production)
2. New investment models are developed (e.g. crowdfunding, microfinance, climate bonds, risk sharing)
3. Investors change priorities (e.g. corporate social responsibility, divestment)
4. Change in social norms for work or education
5. Change in social norms for consumption
6. Force majeure events (e.g. natural disaster that disrupts electricity transmission or primary production).

11 Enabling community renewal in the transition to low emissions

Some communities, particularly those that are rural or low income or have traditional ties to emission-intensive industries or land uses, may be disproportionately vulnerable to the impacts of transitioning to a low-emission economy. These could include:

1. rising prices for energy, housing, transport, and food;
2. the rapid uptake of new higher-cost technologies and premature retirement of existing technologies;
3. changing infrastructure requirements;
4. shifting employment opportunities;
5. urban densification;
6. access to specialised training; and
7. other aspects of social change.

Climate change policies as well as the impacts of climate change have the potential to exacerbate many of the longstanding challenges already confronting these communities. Whether the impacts of climate change mitigation policies on these communities are positive or negative overall will depend on how those policies are designed in relation to meeting broader community development needs and how communities and businesses respond to the transition.

Strategic mitigation policy design could contribute toward creating or enhancing development opportunities for vulnerable communities. For example, NZ ETS reform could

improve investment certainty over the carbon value of forests or renewable energy investments managed by these communities and help to restore trust between communities and government. Managing forests for biofuel production could generate new income flows. Revenue generated by future New Zealand Unit (NZU) auctions under the NZ ETS could be used to provide tax relief, offset rising household costs, or support investment in new economic opportunities or technology training programmes. Such communities could offer fruitful opportunities to pilot initiatives such as car sharing with electric vehicles, local ownership of DRG projects, job training for new climate-friendly technologies and services, or energy performance contracting for household improvements with both energy efficiency and health benefits.

Enhancing community renewal during the low-emission transition will require a long-term commitment by both community members and government to implementing interdisciplinary solutions that address multiple problems relating to climate change mitigation and development. Such solutions will need to be prioritised, designed and led by the communities themselves with research, funding and implementation support from the public and private sectors. Gaining practical experience with different approaches tailored to specific communities can help to generate prototypes for replication in other communities across New Zealand and overseas.

12 Framework for stakeholder processes

Across New Zealand there are currently many processes underway, within and across sectors, to address different aspects of climate change mitigation. However, there is no coordinating framework nor is there a broadly shared goal toward which different groups are working. During public consultation on the government's 2030 emission reduction target (intended nationally determined contribution, or INDC), many stakeholders issued a strong call for greater public input into government decision making on climate change mitigation and greater collaboration across sectors in implementing solutions.

In shaping New Zealand's longer-term mitigation response, it would be useful to have a broadly agreed upon low-emission development strategy, something that was endorsed by countries in the 2015 Paris Agreement. This could include the following components:

1. Integrated decision making around mitigation, and economic and social development
2. Transparent emission projections
3. Long-term mitigation goals
4. An economic case for accelerating mitigation action
5. Broadly accepted information on cost-effective mitigation options
6. A list of agreed short- and medium-term mitigation policies and actions
7. Identified triggers for adaptive decision making.

Stakeholder processes could serve different functions, operate at different levels, and have different degrees of direct involvement by government officials and potential to influence government decisions.

Such processes can be divided into three categories:

1. Technical advice through an independent advisory body and/or clusters of research, modelling, and policy development initiatives
2. Agreement on goals and strategies through a large, centralised, representative cross-sector process, clusters of discussions, and/or a political climate leaders group
3. Collaborative action through sector and cross-sector working groups and education and public awareness campaigns.

Discussions among stakeholders could be focused on the following kinds of topics:

1. What are our options and constraints?
2. What risks and opportunities do we face?
3. What is the economic case for mitigation?
4. What goals will we set?
5. What strategies, policies and actions will we implement?
6. How we can work together better?

High-level models for collaborative decision making

The group discussed two high-level models for collaborative decision making and action across sectors:

Ferry: Under a "ferry" approach, a centralised, stakeholder-led forum could be designed to bring together key thought leaders and decision makers across sectors to reach a consensus on mitigation goals and pathway choices for New Zealand. The central process could be supported by a number of subsidiary processes to help with sectoral research and problem solving. This approach could draw from the experience gained in the Land and Water Forum, but would not necessarily replicate its type of mandate or structure.

Flotilla: Under a "flotilla" approach, multiple clusters of activity could operate independently but with better networks in place for information sharing and collaboration. Each could chart its own course while all move broadly in the same direction.

Relative to the "flotilla approach," a "ferry" approach with a large, centralised forum offers both benefits and challenges.

Benefits of a large forum

1. Broadens up-front advice to decision makers
2. Potential for outcomes to be broadly supported and enable sustained action
3. Creates momentum for focused, collaborative effort
4. Enables systematic decision making by a large number of players
5. High profile attracts participants
6. Formal approach creates pressure to reach a positive outcome

Challenges of a large forum

1. Difficulty in securing an effective mandate
2. Slows down decision-making processes
3. May lead to bias toward recommendations that are easily agreed upon and communicated
4. Perceived loss of control over outcome and risk of failure
5. Potential for participant fatigue
6. Administrative burden to coordinate a large process
7. Not all relevant stakeholders have the time and resources to participate
8. Formal approach discourages experimentation and frank discussion

The "ferry" and "flotilla" approaches are not mutually exclusive, nor do they have to be sequential. While a "flotilla" is already underway, is agile and can evolve quickly, a forum designed to build consensus would benefit from having the following drivers in place up front:

1. A clear and effective mandate that establishes its purpose, scope of work, timeframe for delivery, and potential to influence government decision making;
2. A solid foundation of credible information about options;
3. Motivation and resources for key stakeholders to participate;
4. Reputational pressure to deliver outcomes serving collective interests; and
5. Effective leadership and administrative support.

The following is offered as a "straw man" integrated framework for cross-sector stakeholder engagement on climate change mitigation.

1. **Enhance current mitigation initiatives**: Boost, coordinate and align the current "flotilla" of mitigation initiatives through increased networking and funding to facilitate research, information sharing, problem solving, experimentation and collaborative action to reduce emissions.

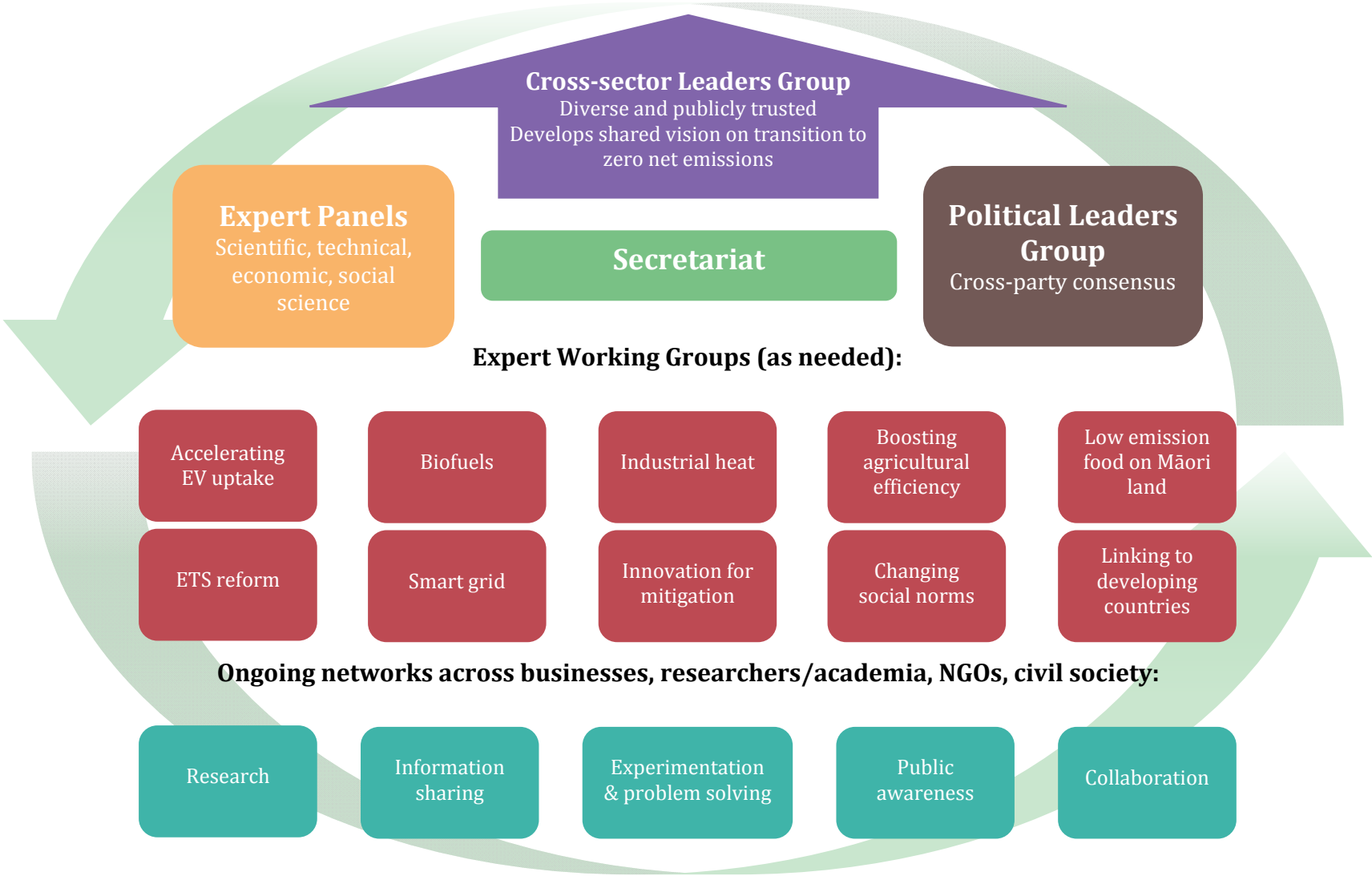
2. **Solve tough problems:** Appoint a series of interdisciplinary expert working groups to do targeted work and provide public advice on challenging cross-sector issues. Examples could include:
    i. Developing broadly accepted and transparent emission and economic projections
    ii. Improving emission pricing policy and boosting sector investment
    iii. Designing and financing major infrastructure change
    iv. Further developing a biomass industry and being prepared to develop a cellulosic biodiesel industry when the technology matures
    v. Accelerating electrification of transport
    vi. Uptake and effective use of distributed renewable generation
    vii. Transitioning to renewable industrial heat
    viii. Linking to mitigation by developing countries.

3. **Build cross-party support for ambitious mitigation:** Create a cross-party Political Leaders Group on Climate Change to agree on foundation principles for guiding the evolution of New Zealand's long-term mitigation policy across election cycles.

4. **Launch a forum supporting cross-sector consensus on priority mitigation issues:** Develop the mandate and secure funding for a stakeholder-led, cross-sector forum with supporting panels. In a first phase of work, participants would focus on achieving shared understanding of mitigation constraints, risks, opportunities and goals within and across sectors. In a second phase, participants would move toward a consensus on adaptive mitigation pathways, opportunities to align policy with investment and action across sectors, and triggers for adaptive policy change.

Figure 7 illustrates the possible elements of a broad, multi-layer process for stakeholder engagement on New Zealand's future climate change mitigation strategy.

Figure 7: Process elements for stakeholder engagement on climate change mitigation strategy



Low-Emission Future Dialogue as a prototype for cross-sector collaboration

The Low-Emission Future Dialogue itself offers a possible prototype for smaller-scale stakeholder engagement and collaboration on climate change. The Dialogue was intentionally designed for information sharing, creative problem solving, and relationship building by individuals engaging in their personal capacity. It did not seek to generate consensus on policy recommendations among organisational or sectoral representatives. Discussions were held under a variant of the Chatham House Rule, under which participants were free to use the information received but neither the identity nor the affiliation of the speaker(s) could be revealed.

Participants brought a broad range of sectoral interests and experience to the discussions. They had varying levels of expertise in climate change issues and different opinions on how New Zealand's government and research institutions, businesses and communities should be responding to the challenge of domestic climate change mitigation. The group started its work from two base assumptions:

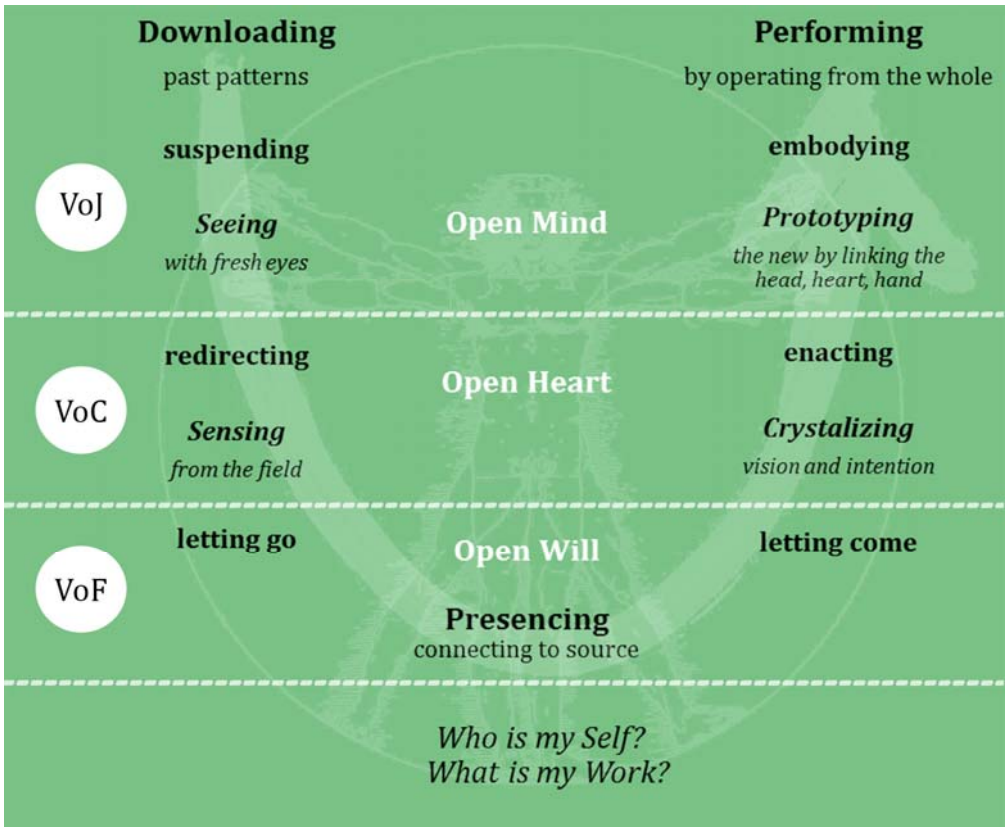
1. We will globally solve the problem.
2. For New Zealand to maintain its political and economic advantages in a low-emission world, it will need to reduce its domestic GHG emissions and support mitigation by other countries.

Recognising that considerable work was already underway by other expert organisations and processes to assess New Zealand's technical and economic mitigation potential, Dialogue participants focused on complementing those efforts by building understanding of how change might actually occur and who might drive it across sectors. They focused their work on a time horizon through 2050, but recognised that practical pathways across sectors may unfold under longer or shorter timeframes.

The group's discussions were structured based on the model "Theory U" advanced by Otto Scharmer and colleagues at the Massachusetts Institute of Technology.[2] Under this model, the work of repairing disconnections across society that threaten sustainable development is advanced by changing the awareness from which we operate and shifting from learning from the past toward learning and leading from the emerging future. The journey is illustrated in Figure 8. Passing down the left side of the U involves a process of observation, suspending, redirecting and letting go. The bottom of the U involves a process of deep reflection, allowing inner knowing to emerge. Passing up the right side involves a process of action, letting come, enacting and embodying through prototyping. Individual behaviour change occurs alongside, and integrated with, system change.

[2]Scharmer, Otto, and Katrin Kaufer. 2013. *Leading from the Emerging Future: From Eco-System to Eco-System Economies*. San Francisco, CA: Berrett-Koehler Publishers Inc.

Figure 8: Theory U



VoJ = Voice of judgment. VoC = Voice of cynicism. VoF = Voice of fear.
The U Process of Co-Sensing and Co-Creating: Presencing. See *www.ottoscharmer.com*.

Importantly, during the course of the process the Dialogue group's thinking shifted into a working space where a zero-net-emission future became a feasible reality for New Zealand and possible solutions could emerge that extended beyond today's constraints and norms. Backcasting from a bold and desirable future as if it had already happened enabled the group to contemplate transformational changes as well as incremental changes to current practice.

13 Conclusion

The Low-Emission Future Dialogue took a diverse group of people on a journey through possible narratives, pathways and stakeholder processes supporting domestic decarbonisation in New Zealand. The process revealed both challenges and exciting possibilities for each sector. More detailed outputs will be forthcoming, and Dialogue members welcome feedback on their efforts. As this Dialogue concludes, a much bigger journey is already underway to forge actual low-emission pathways for New Zealand. Above all, Dialogue members encourage others to take up the most promising ideas that emerged from this process and run with them.


Motu