

NZ CleanTech Mission

Making it happen for New Zealand

A partnership statement by

CallaghanInnovation
New Zealand's Innovation Agency

NZ GROWTH
CAPITAL PARTNERS

National
SCIENCE
Challenges

SCIENCE FOR
TECHNOLOGICAL
INNOVATION

Kia kotahi mai –
Te Ao Pūtaiao me
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 **THE UNIVERSITY OF
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Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

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Ake**
Future
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Development

 **KiwiNet**
Kiwi Innovation Network

 **MacDiarmid
Institute**
Advanced Materials
& Nanotechnology

To Mana
Tangata Whakawhanake



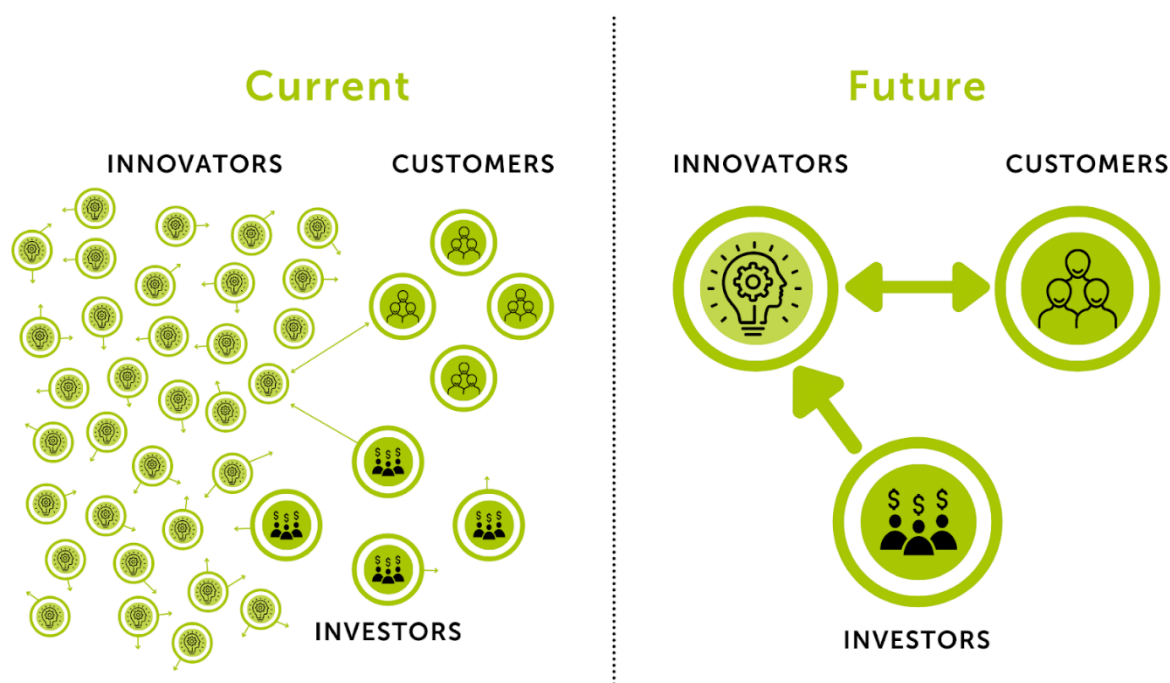
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Foreword

The list of New Zealand CleanTech innovators who have succeeded on the world stage is impressive and includes billion dollar plus companies such as Allbirds with its wool sneakers and LanzaTech's technology which converts waste gas into aviation fuel. It is clear that solving climate change - and other environmental problems - means that CleanTech presents New Zealand with a significant economic opportunity. However, independent research¹ has found that New Zealand's CleanTech innovators are struggling compared to those in other countries. For example, New Zealand's CleanTech innovators are raising 95% less investment than other small advanced economies.

In this partnership statement, we describe how New Zealand can move from the current situation - where CleanTech innovators are often disconnected from each other, customers and investors - to a situation where innovators collaborate across sectors, work closely with large businesses, and routinely raise significant capital from investors.



We also advocate for a stronger commitment to environmental innovation because new ways of thinking are needed not just in technology but across culture, policy, infrastructure and business models. For example, more Kiwis are buying electric vehicles (technology) as charging stations become more widely available (infrastructure) and electric vehicle owners are exempt from road user charges (policy). Whilst CleanTech innovators tend to innovate in the areas of technology and business models, their global success often depends on new ways of thinking across culture, policy and infrastructure.

¹ [New Zealand Climate Tech for the World](#) (Cleantech Group, 2021)

Introduction

All of us are interconnected with Te Taiao, our natural environment, and have a responsibility to not only preserve it, but to leave it better for future generations. We respectfully acknowledge the indigenous people of Aotearoa, tangata Māori, their intergenerational mātauranga, and the Te Ao Māori lens that will inspire how we realise our vision.

The organisations in this partnership regularly work with New Zealand CleanTech innovators². We have come together to provide insights on the current situation and set out how this partnership will assist New Zealand CleanTech innovators to:

- Work closely with customers to solve real world problems
- Routinely raise significant capital from investors
- Collaborate with innovators in adjacent sectors to bring about breakthroughs.

To do this, the partnership proposes to:

- Develop a roadmap that sets out key milestones
- Improve the commercialisation of CleanTech Research & Development (R&D)
- Showcase groups of innovators that provide step-change benefits to customers.

Whatungarongaro te tangata toitū te whenua.
As man disappears from sight, the land remains.

² By CleanTech innovators, we mean early stage and growth high-tech businesses that create products, services or processes to solve climate change and other environmental problems. We use 'CleanTech' rather than 'climate tech' because it covers a slightly broader set of innovators and because there's tangible momentum in New Zealand around 'CleanTech'.

Situation

Innovation is critical for a zero carbon, sustainable future

Business As Usual is not enough. Climate change is a highly dynamic, complex and significant issue. Global greenhouse gas emissions are currently 52 billion tonnes³. Significant emission reductions are needed to limit global warming to 1.5°C or less and New Zealand is committed to reaching net zero emissions of long-lived greenhouse gases by 2050, in addition to reducing biogenic methane emissions by between 24% and 47% by 2050⁴.

Falling back on established mindsets, approaches and structures won't result in significant carbon reductions, or in building a society that's resilient to the physical and financial impacts of climate change.

Even with massive and widespread economic downturns, we only see modest, short-lived emission reductions. In 2020, COVID-19 caused global carbon emissions to fall by 2.3 billion tonnes⁵. The economic cost of 'achieving' these modest reductions during the pandemic has been substantial - between USD3,200 and USD 5,400 per tonne in the USA⁶. This compares to the clearing price of NZD36 per tonne under New Zealand's Emissions Trading Scheme in March 2021⁷.

In its 2021 advice⁸ to the New Zealand Government, the Climate Change Commission recognises the role of innovation in achieving New Zealand's climate goals. For example, page 6 lists the key elements of the Commission's policy direction including "Drive system transformation by supporting innovation, mobilising finance for low-emissions investments and supporting behaviour change." Another example are the Commission's recommendations for delivering deeper emissions reductions on page 13 which include "The Government can help make sure Aotearoa will have more options for reducing its emissions in the future by putting in place measures to support and encourage research, development and innovation for low-emissions solutions."

In terms of our economic transformation opportunity, the Productivity Commission⁹ noted that innovation is required for New Zealand to successfully export specialised, distinctive high value products. The Commission also stated that New Zealand should invest in building innovation ecosystems¹⁰ around their frontier firms in select focus areas and recommended that these focus areas include climate change and be consistent with New Zealand's environmental objectives. The Commission also highlighted that the Māori economy has many of the characteristics needed for firms to innovate and that Māori values add brand value overseas, as they align closely with consumer demand for strong environmental and social credentials.

³ [Annual Greenhouse Gas Emissions](#) (Bloomberg Green, 2021)

⁴ [Ināia tonu nei: a low emissions future for Aotearoa](#) (He Pou a Rangi / Climate Change Commission 2021)

⁵ [COVID curbed carbon emissions in 2020 — but not by much](#) (Nature, 2021)

⁶ [Taking Stock 2020 - The Covid-19 Edition](#) (Rhodium Group, 2020)

⁷ [Emissions Trading Scheme: New Zealand's carbon market explained](#) (Newsroom, 2021)

⁸ [Ināia tonu nei: a low emissions future for Aotearoa](#) (He Pou a Rangi / Climate Change Commission 2021)

⁹ [New Zealand firms: Reaching for the frontier](#) (Productivity Commission, 2021)

¹⁰ Ecosystems are how organizations - including innovators, customers, investors, government agencies, universities etc - collaborate to increase innovation.

In summary, New Zealand needs innovation to address climate change and other environmental problems - particularly given the very significant economic shock from COVID-19. In addition to this, CleanTech presents New Zealand with an opportunity to create emissions reducing products, services and processes that feed global demand while growing our exports and creating meaningful employment.

We lack a common language on climate innovation - and environmental innovation

Most organisations in New Zealand agree that climate innovation is important, to different degrees, but lack a common language to describe it. Because of this, policy makers and CleanTech innovators share the same overall goal but often find it difficult to have meaningful discussions and find a practical way to work together.

Organisations often confuse innovation with technologies and vice versa. Organisations tend to talk about technologies as a single group, without differentiating them in terms of price, readiness, and carbon-reduction potential. Some organisations want to focus on transformative technologies, others on all technologies including those that provide incremental carbon reductions.

There are existing, tried-and-tested ways of talking about climate innovation. For example, the whole-of-system view of climate innovation, developed by the Institute for Sustainable Resources, University College London (Figure 1, Appendix 1). In this, climate innovation has five inter-dependent layers:

- Culture and values
- Policy and regulations
- Infrastructure and production systems
- Business models
- Technologies, products and processes.

A good example of how the different layers of innovation work together is seen in New Zealand's approach to improving human health. New policies are being developed and implemented (e.g. the replacement of District Health Boards by Health NZ and a Māori Health Authority) whilst at the same time, New Zealand healthtech is thriving with 2020/21 revenues of [\\$2.85 billion](#) up from \$2.1 billion in the previous year. Upcoming changes to the DHB structure look to further catapult innovation adoption in the sector. A similar joined up approach - where policy makers work closely with the likes of the [HealthTech Activator](#) - could lead to a step change in the way New Zealand improves planetary health.

New technology is important for solving climate change and other environmental problems

Technology is one of the five layers of whole-of-system climate innovation. When the other four layers are supportive of a particular technology, the technology will be more widely adopted and carbon emissions more significantly reduced.

Most people think of technology as being 'existing' or 'new'. Some believe that New Zealand should focus only on adopting existing technologies to reduce emissions. However, many existing technologies are too expensive or impractical for widespread adoption.

This gap between what people will pay and what the technology costs, sometimes known as the ‘Green Premium’, can be addressed in the short term by policy support (e.g. subsidies, grants) and in the medium- and long-term by innovation and economies of scale.

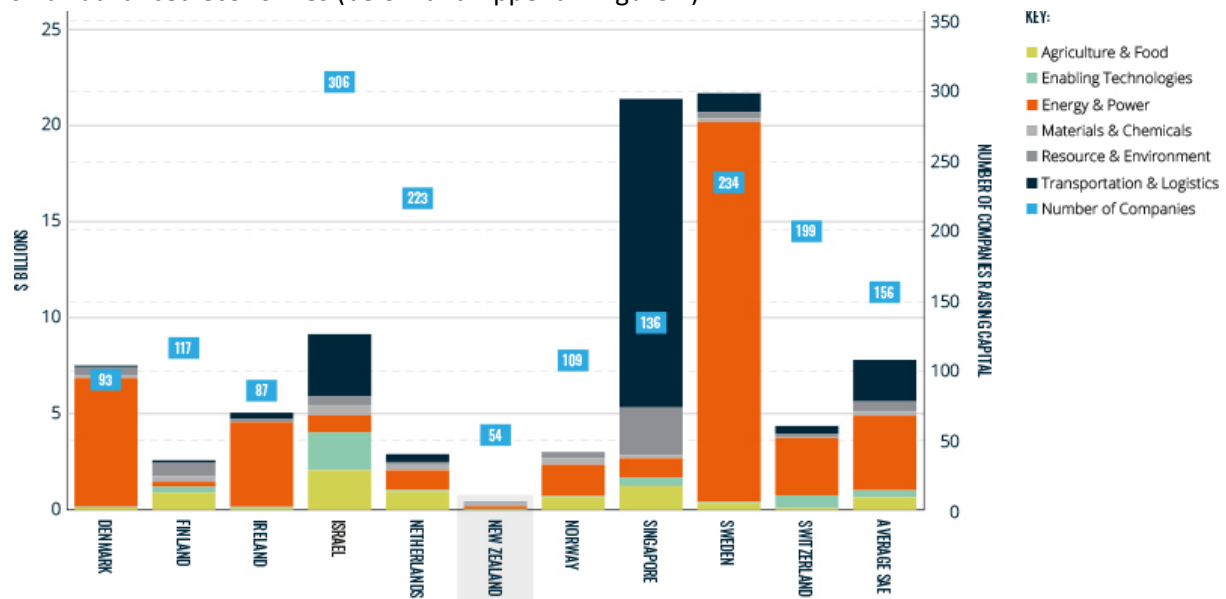
Other people believe that New Zealand should adopt existing technologies *and* create new technologies. Creating new technologies involves significant risk and time but it helps to bring down the cost of existing technologies, and results in new ways of solving environmental issues.

Lastly, climate policies in some countries have led carbon intensive industries to relocate to other geographies. This ‘carbon leakage’ means that a country’s territorial emissions decrease, but global emissions remain the same or even increase. Again, new technology has a role to play in fundamentally reducing emissions¹¹.

New Zealand CleanTech innovators are struggling compared to other countries

The Productivity Commission recently found that New Zealand’s labour productivity is significantly lower than in other small advanced economies (SAEs)¹². Despite New Zealand’s commitment to Te Taiao and producing globally significant innovators, such as Xero, Allbirds Rocket Lab and LanzaTech, New Zealand is lagging behind on CleanTech. For example, in the [Global CleanTech Innovation Index 2017](#), New Zealand was ranked 22nd overall and was the lowest scoring small advanced economy. Similarly, MIT’s [Green Future Index 2021](#) ranked New Zealand first on climate policy and 61st on clean innovation.

Independent research¹³ commissioned by Callaghan Innovation suggests that New Zealand’s CleanTech innovators are raising 95% less funding than those in other small advanced economies. In addition, the number of New Zealand CleanTech innovators raising funds is less than that in other small advanced economies (below and Appendix Figure 1).



CleanTech investments in small advanced economies 2011-2021 (Cleantech Group, 2021)

¹¹ Other people think in terms of [Technology Readiness Levels](#), a standard method for describing the maturity - but often not the cost - of technologies.

¹² [New Zealand firms: Reaching for the frontier](#) (Productivity Commission, 2021)

¹³ [New Zealand Climate Tech for the World](#) (Cleantech Group, 2021)

Solutions

1. The partnership will develop a five year roadmap to advance the New Zealand CleanTech ecosystem.

Other New Zealand technology areas have developed roadmaps, or similar, with support from dedicated resources to realise particular opportunities. Examples include the HealthTech Activator, and the Industry Transformation Plans for Agritech and Digital Technologies.

Without such a roadmap, New Zealand CleanTech will struggle to gain long-term momentum and establish itself as a solid export sector. Over the past decade, there have been cycles of interest in CleanTech in New Zealand. For example in 2013, the New Zealand Clean Tech & Environment Network (NZCEN) was launched in conjunction with New Zealand Trade & Enterprise and made some progress before disbanding.

Currently, New Zealand supports individual CleanTech innovators and does not invest in the wider CleanTech ecosystem. This differs from the more intentional approach, implemented by government agencies in other SAEs aiming to lift the CleanTech ecosystem, such as CleanTech for Europe and Swedish CleanTech.

The roadmap will need to be centred on ambitious targets and robust data. New Zealand still has a way to go on this, but we've made a decent start. In November 2020, Callaghan Innovation's Chief Executive, Vic Crone, set an ambitious but much needed target for New Zealand to be in the top 10 CleanTech countries by the end of 2022 – up from New Zealand's ranking of 22nd in 2017. In addition, Callaghan Innovation has established a baseline of the number and scale of New Zealand CleanTech innovators (Figure 3, Appendix 1).

2. The partnership will create a strong and consistent connection between New Zealand CleanTech innovators and large customers overseas and in New Zealand - including Māori trusts and incorporations.

Unlike other SAEs, New Zealand is geographically distant from large markets, and has few multinational corporations. As a result, New Zealand CleanTech innovators find it difficult to pair up with large customers, specifically the right people within overseas multinational corporations, who are actively working to solve significant environmental problems.

Additionally, innovators need to be ahead of the competition, and ahead of the curve. As Reid Hoffman, co-founder of LinkedIn, notes, "As a strategic entrepreneur, you're not trying to get in at the peak of a trend. You're trying to be one to three years early, so you can have time to build toward it. So when the moment arrives, you already have momentum, while everyone else scrambles to get up to speed."¹⁴

Another challenge is, in order to attract interest from overseas customers and investors, innovators need to prove that the technology performs in the real world. From a practical perspective, such

¹⁴ [Masters of Scale](#), 2021

pilots or trials should take place in New Zealand, and involve New Zealand customers. Almost all CleanTech innovators report low levels of engagement and high levels of risk aversion around pilots and trials from large New Zealand businesses and council-controlled organisations.

The culmination of the above challenges means that New Zealand CleanTech innovators find it difficult to understand the problems of large customers, build relationships, validate products, access markets or obtain funding. This is reflected by independent research that suggests New Zealand's CleanTech ecosystem lags that of other SAEs, as shown in the table below.

New Zealand	Israel	Sweden	Netherlands	Switzerland	Finland
4.7	6.6	6.6	7.6	6.8	6.0

Comparison of how well CleanTech ecosystems connect to demand (Cleantech Group, 2021). Scores out of 10, further information in Figure 6, Appendix 1

SAEs provide a number of other case studies of how New Zealand could lift its game in CleanTech. For example, establishing overseas promotion offices for technology, such as Swissnex and the Israel Export Institute or setting up antennae offices in other global clusters, such as Switzerland and Denmark.

In addition, we can build on examples of where New Zealand innovators and businesses have successfully worked together to pilot innovative technologies and business models.

These include Geo40 and Contact Energy, CoGo and Westpac as well as Emrod and Powerco.

We can also establish initiatives to pilot new technologies in New Zealand that intentionally include overseas customers and investors from the start. An example of this is [Farm 2050](#), part of the Agritech Industry Transformation Plan, a collective of global partners advancing AgTech entrepreneurs and startups. We could develop similar testbeds for technologies adjacent to geothermal (e.g. via [Taupo's geothermal cluster](#)) and biological waste-to-value (e.g. at [Ngawha's innovation park](#) and [Timaru's food processors](#)). Another area for a testbed would be technologies adjacent to green hydrogen, particularly if Tiwai Point were to close and New Zealand became a major producer of green hydrogen.

3. The partnership will consider how to improve the commercialisation of CleanTech R&D, including: involvement in the development of relevant policies and strategies, improved market validation for publicly-funded and business-led R&D, improved monitoring of the progress and outcomes of publicly-funded R&D and greater connection with global CleanTech hubs and accelerators.

Some of the partnership organisations are already involved in the complex challenge of improving the commercialisation of CleanTech R&D. This task has similar issues to those discussed above, for example trying to solve real world problems without key connections to early commercialisation partners that offer pilot opportunities. This can be especially problematic for publicly-funded R&D given the longer timescales and deeper research.

The Parliamentary Commissioner for the Environment (PCE) recently reviewed how environmental research in New Zealand was funded and prioritised¹⁵. The PCE concluded that the way approximately \$500m per year of public funds are invested in environmental research is fragmented, and not aligned with national priorities. As a result, the Government is preparing a climate and environmental research strategy in addition to other key policy documents such as New Zealand’s Emissions Reduction Plan.

A key theme identified in the recent independent research, and consistent with NZ R&D in general, is that New Zealand’s CleanTech ecosystem lags behind other SAEs in terms of R&D commercialisation, as per the table below.

New Zealand	Israel	Sweden	Netherlands	Switzerland	Finland
5.0	7.5	6.0	7.9	6.0	6.3

*Comparison of how well CleanTech ecosystems commercialise R&D (Cleantech Group, 2021).
Scores out of 10, further information in Figure 6, Appendix 1*

4. The partnership will create a strong and consistent connection between New Zealand CleanTech innovators and local and international investors, with a strong CleanTech interest.

As noted previously, independent research suggests New Zealand’s CleanTech innovators are raising significantly less investment than those in SAEs. At the same time, venture capital investment in CleanTech globally is growing five times faster than the average¹⁶. In addition to this, the research suggests New Zealand’s CleanTech ecosystem lags other small advanced economies in terms of financing strength as per the table below.

New Zealand	Israel	Sweden	Netherlands	Switzerland	Finland
4.0	7.0	5.0	7.0	4.0	5.0

*Comparison of the financing strength of CleanTech ecosystems (Cleantech Group, 2021).
Scores out of 10, further information in Figure 6, Appendix 1*

5. The partnership will develop one or more CleanTech clusters that provide step-change benefits to customers and that promote high levels of collaboration and community amongst innovators.

Both overseas and in New Zealand, customers are more likely to engage with our innovators if they’re confident that our CleanTech can provide step change benefits rather than incremental benefits. Such step-change benefits are more likely to come from ‘clusters of innovators’ rather than

¹⁵ [A review of the funding and prioritisation of environmental research in New Zealand](#) (PCE, 2020)

¹⁶ [The State of Climate Tech](#) (PWC, 2020)

individual innovators. An example of a cluster that provides such step changes is [waterNEXT](#), Western Canada's water technology cluster.

New Zealand has limited resources to support CleanTech innovators but currently our focus is broad - we have not attempted to identify or develop focused CleanTech clusters for impact. This means that we are unable to present a 'stack' of solutions for corporate customers or to identify high value collaboration opportunities between innovators.

Our view based on independent research - but to be assessed further during roadmap development - is that we consider how to build collaboration across clusters that we have a current advantage, foundation or aptitude for. 'AgriFood' and 'Energy & Materials' are identified in the report as ideal target cluster options to explore.

AgriFood: CleanTech will be important for New Zealand agriculture and food. Environmental drivers are clear and present in the form of policy, legislation, supply-chain requirements, consumer expectations, costs reductions and operational efficiencies. Independent research suggests that New Zealand CleanTech is well positioned to lead here in significant markets and to solve the most complex challenges including methane. For example, Figure 4 in Appendix 1 shows that the 'Advance' category (i.e. technologies for New Zealand to develop intentionally) is dominated by innovators in the AgriFood space.

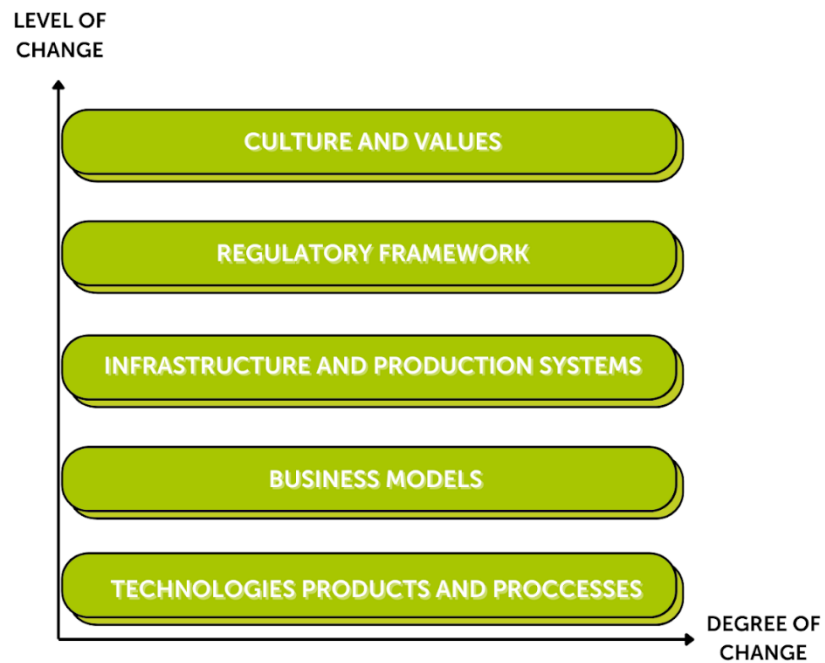
Energy & Materials: Energy - its conversion, usage and how it is embodied in products - is critical to all sectors of the New Zealand economy including transport, construction, manufacturing and agriculture. Independent research suggests that the convergence of energy and materials is a niche area for New Zealand CleanTech innovators. For example, Figure 4 in Appendix 1 shows a considerable number of such innovators in the 'Explore' category (i.e. technologies for New Zealand to explore before developing intentionally), with one in 'Advance'. Rather than separate energy and materials into two separate groups, New Zealand is likely to see the most value when these two areas intersect.

New Zealand CleanTech is a niche community within a small country. One of New Zealand's advantages is that we can bring together innovators from different sectors, and from across the country, fairly easily. We know that in other SAEs (e.g. Israel, Sweden), such cluster collaborations have led to breakthroughs and the ability to compete in related niche markets.

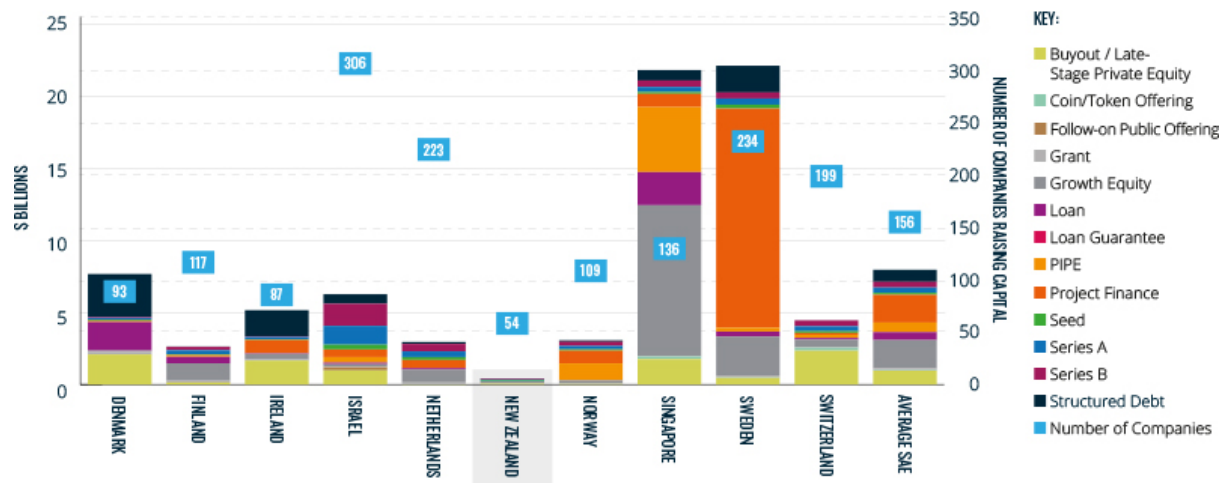
6. The partnership will clearly communicate with CleanTech innovators about our different roles and services ("who does what") and improve coordination across government and other organizations in the ecosystem. Other organizations supporting CleanTech innovators (directly or indirectly) are welcome to work with or join the partnership.

In April 2021, a CleanTech innovator stated, "We talk to many different government agencies but they're not talking with each other.... Action is slow or non-existent." There are many reasons for situations like this including confusion about mandates and services, as well as finite resources. This is subjective but it is clear we can improve to deliver a consistently high level of service to CleanTech innovators.

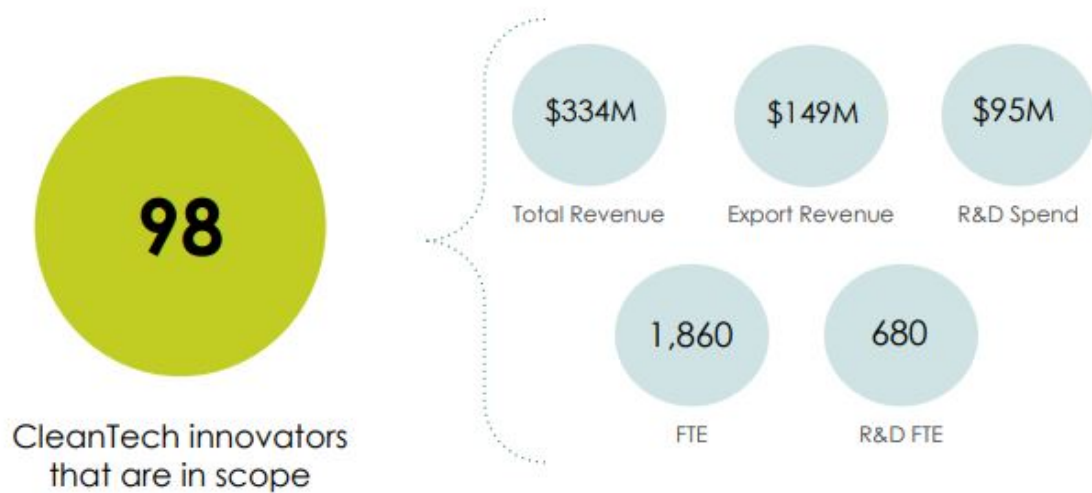
Appendix 1 - Supporting information



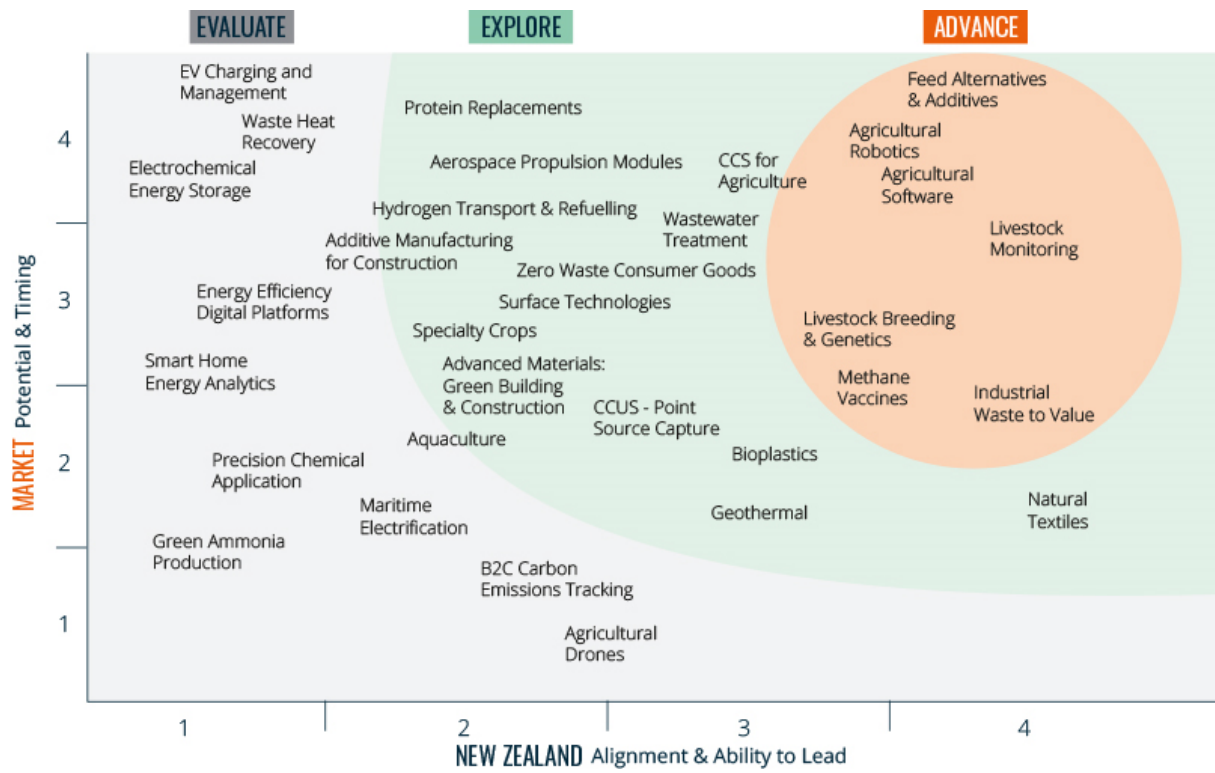
*Appendix Figure 1: A common language for whole-of-system climate innovation
Based on Climate Innovation Insights ([University College London, 2017](#))*



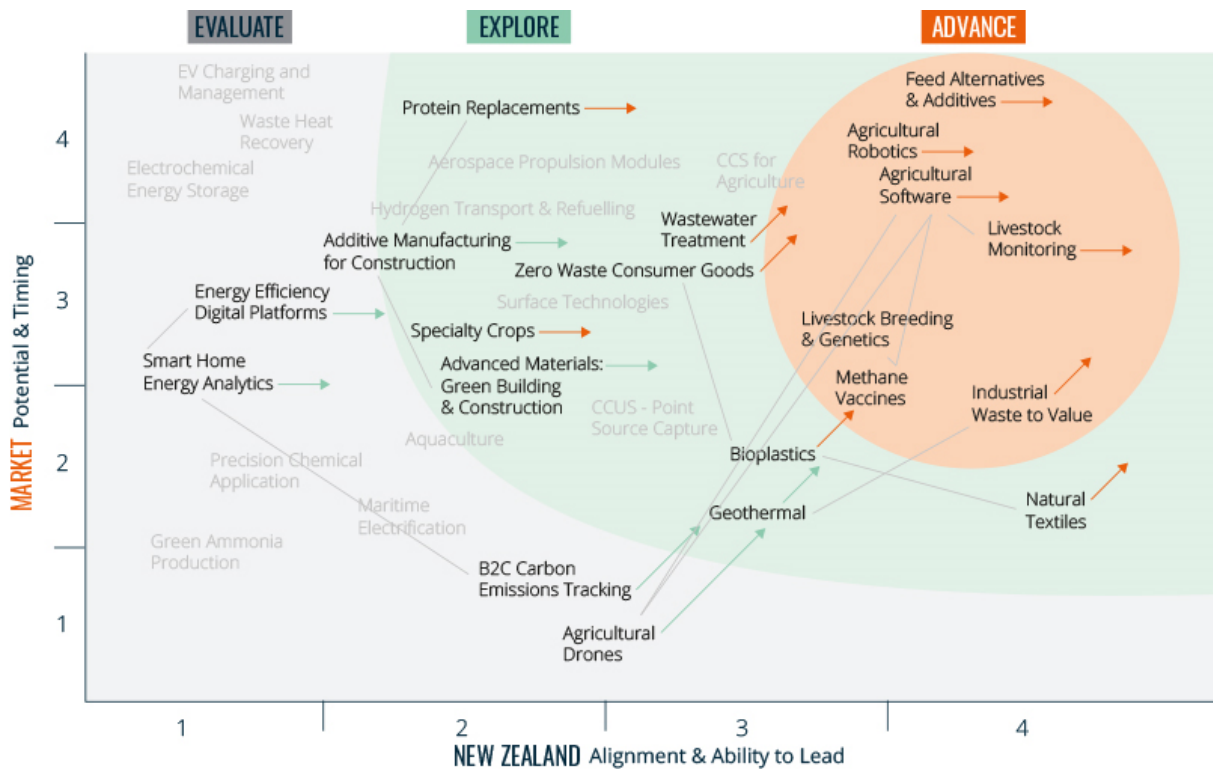
Appendix Figure 2: Comparison of climate tech investments in SAEs
(Cleantech Group, 2021)



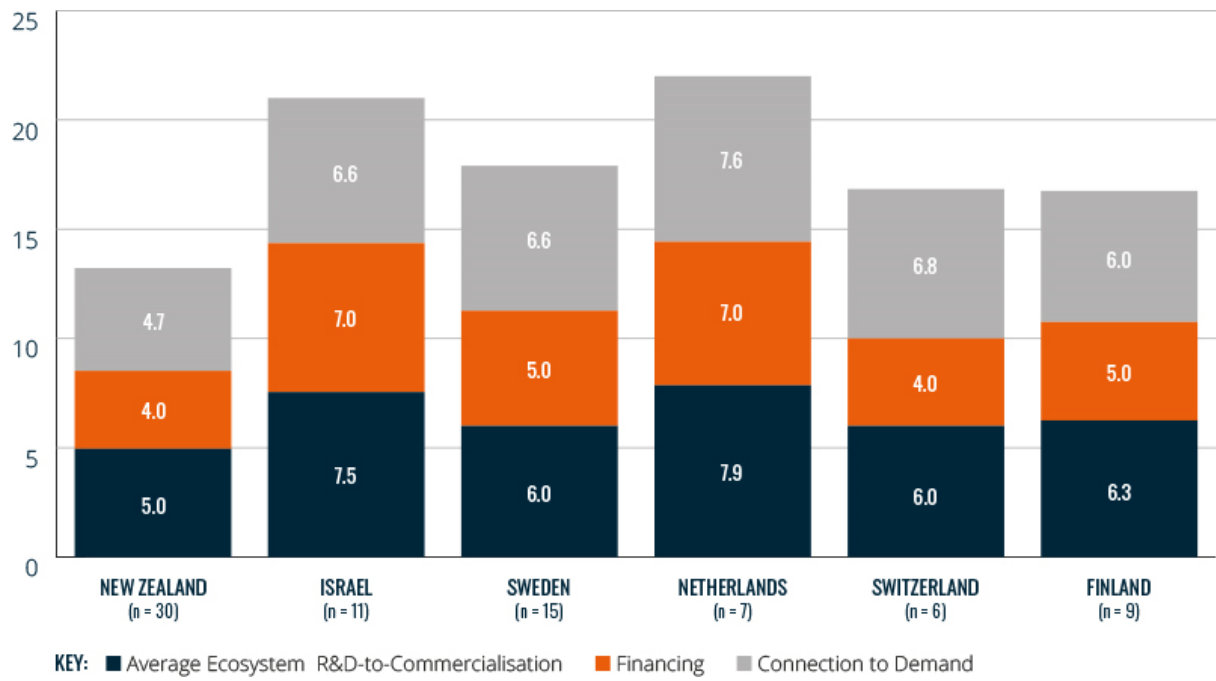
Appendix Figure 3: Assessment of CleanTech innovators that work with [Callaghan Innovation](#) (FY20) ([Callaghan Innovation, 2021](#))



Appendix Figure 4: Prioritisation of Climate Technology Development (Cleantech Group, 2021)



Appendix Figure 5: Value Chain Dependencies and Potential Shifts in Priorities (Cleantech Group, 2021)



Appendix Figure 6: Comparison of average ecosystem ratings across SAEs

(Cleantech Group, 2021)

'n' is the number of CleanTech innovators that are assessed in independent research.

Appendix 2 - New Zealand CleanTech partners

Callaghan Innovation

We activate innovation and help businesses grow faster for a better New Zealand. We partner with ambitious businesses of all sizes, providing a range of innovation and research and development (R&D) services to suit each stage of growth. Our people – including more than 200 of New Zealand’s leading scientists and engineers – empower innovators by connecting people, opportunities and networks, and providing tailored technical solutions, skills and capability development programmes, and grants co-funding. Information about how Callaghan Innovation and others support CleanTech innovators can be found at the NZ CleanTech Mission.

Auckland Unlimited

Auckland Unlimited is Tāmaki Makaurau Auckland’s economic and cultural agency committed to making our region a desirable place to live, work, visit, invest and do business. Nau mai ki Auckland Unlimited – te pokapū ōhanga, ahurea hoki o Tāmaki Makaurau e ngākau titikaha ana ki te whakarite i tō mātou rohe kia matenuitia ai hei wāhi noho, mahi, torotoro, whakangao pūtea, whakahaere pakihi hoki. As an Auckland Council-controlled organisation, we deliver a co-ordinated, region-wide programme to maximise cultural, social and economic benefits for our residents and visitors. Driving investment and innovation, we support Auckland businesses to thrive.

New Zealand Growth Capital Partners

New Zealand Growth Capital Partners (NZGCP, formerly New Zealand Venture Investment Fund) was established to support early-stage technology companies and to stimulate private investment into this space. The objective of NZGCP is to stimulate a well-functioning capital market for early-stage technology companies. Our two investment vehicles are designed to stimulate private investment into this space through fund of funds and co-investment models. We are also involved in a range of market development initiatives alongside investors, New Zealand Private Capital and the Angel Association of New Zealand.

Science for Technological Innovation National Science Challenge

The Science for Technological Innovation Challenge (SfTI) is one of 11 National Science Challenges overseen by the Ministry of Business, Innovation and Employment (MBIE) and hosted Callaghan Innovation. The NSCs are a core part of the NZ government’s investment in science, with just over \$680 million of funding over 10 years. SfTI’s mission is to grow a hi-tech Aotearoa New Zealand economy via the physical sciences and engineering. We design innovative processes that bring together our top scientists to work collaboratively with Māori and industry to address important missions such as CleanTech, whilst investing in research that spans many different applications and industry sectors.

Auckland UniServices

UniServices is a not-for-profit company of the University of Auckland that champions research and ideas with the power to change the world. From seeking out and bringing together partners in academic institutions, industry and government to build new knowledge and solutions through research; to whakatupu (nurturing) and commercialising the ideas and intellectual property that arise from the University of Auckland’s great minds, we act as the kaihono (those who join and link

people to people, and people to projects) firmly entrenched in the ecosystem that bridges the world of academia with business, government and our communities.

Ara Ake

Ara Ake is New Zealand's Future Energy Centre, working with businesses to facilitate demonstration projects of new and emerging emissions lowering technologies. Ara Ake helps New Zealand innovators access financial and technical support to develop their technologies, brings in offshore tech and expertise and helps unravel regulatory and commercial barriers. They share knowledge from across the energy innovation landscape and help connect the dots between an idea and reality.

Kiwi Innovation Network (KiwiNet)

KiwiNet is the combined power of 19 of New Zealand's Universities, Crown Research Institutes, and other research organisations, working together to transform early-stage discoveries into products and services that will have longstanding social, environmental, and economic impact for NZ. Through PreSeed Accelerator funding from MBIE, training programs, support, and industry connections, KiwiNet helps commercialisation teams and entrepreneurial scientists take their discoveries from the lab to the world. To date KiwiNet has provided \$48m in PreSeed investment, with 723 patents secured and 60 start-up companies established. Our PreSeed projects since 2003 have created over \$400m in known revenue to NZ businesses.

The MacDiarmid Institute

The MacDiarmid Institute is a network of leading researchers from seven institutions across Aotearoa who combine their expertise to create and explore innovative, sustainable materials that will positively transform the lives of people in Aotearoa and around the world. The institutions include five of New Zealand's universities - the University of Auckland, Massey University, Victoria University of Wellington, the University of Canterbury and the University of Otago - along with Callaghan Innovation and GNS Science, the country's leading provider of Earth, geoscience and isotope research. They work together and partner with industry and government to address global challenges such as clean water, renewable energy and climate change.

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