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He Pou a Rangi Climate Change Commission

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RE: Submission on the Climate Change Commission's 2021 Draft Advice

The Building Research Association of New Zealand (BRANZ) welcomes the opportunity to make a submission on He Pou a Rangi Climate Change Commission's 2021 Draft Advice.

We support and commend the Commission for their hard work in establishing the three proposed emissions budgets in the draft advice. We support the principles embedded in the advice and the imperative to collaborate and work across sectors and undertake an inclusive and just transition on behalf of all New Zealanders.

ABOUT BRANZ

BRANZ, established in 1969, is a multi-faceted, science led organisation that uses independent research, systems knowledge and its broad networks to identify practical solutions that improve New Zealand's building system performance.

BRANZ has been at the forefront of addressing the built environment's contribution to climate change and helps to drive evidence-based policy and provide expert advice. BRANZ has a history of engaging in climate change research since the year 2000 when it released the seminal *Implications of Climate Change for the Construction Sector* report.

BRANZ today is continuing that legacy of climate change research and creating new research pathways to help support the building and construction industry address the issue of climate change. For example, as BRANZ CEO I am leading the new Environment Workstream of the Construction Sector Accord. This work seeks to set out the built environment's contribution to New Zealand's environment, sustainability and net-zero carbon aspirations.

We acknowledge and support the overall goal and objectives of the proposed emissions budgets.

We look forward to continuing the productive, open and constructive relationship BRANZ has with the Climate Change Commission.

Consultation question 1

Principles to guide our advice

Do you support the principles we have used to guide our analysis? Is there anything we should change, and why?

BRANZ supports the principles of the draft advice on the transition to a thriving, climate-resilient and low emissions Aotearoa. Our comments on the principles are outlined below.

Principle 1: Align with the 2050 targets.
BRANZ supports a path to reduce carbon emissions that sets Aotearoa up for eventual net negative emissions.

We must act globally to limit warming to 1.5°C. There are developing countries with economies and infrastructure that will struggle to meet their reduction targets. As a developed country Aotearoa has a role to play that is bigger than just our own targets. As a developed country we have the ability for taking a long term view of our investments and infrastructure. We need to do so, and we need to form this view as quickly as possible. The longer we (and the globe) wait, the harder it will be to meet the required carbon reduction targets.

Principle 2: Focus on decarbonising the economy.
BRANZ agrees that reduction of emission needs to be prioritised to meet our targets.

Forest sequestration will not help to change practices towards reducing emissions. Aotearoa (and the globe) cannot continue to increase their carbon emissions and expect that forestry sequestration will remove the emissions. At some point, we will simply run out of space. We need to change practice.

Later in this submission we identify that the transition to a net-zero economy will require great change for the building and construction industry. This is in relation to the knowledge, skills and competencies required for net-zero carbon building. See Consultation question 13 for more information.

BRANZ research estimates that a residential home cannot emit more than 35 tonnes CO_2eq over its lifetime – construction, operation and end-of-life to achieve the 1.5°C warming limit. This 35 tonnes CO_2eq is the maximum for a

home to emit and collectively will support meeting the warming limit. However, the average home today emits at least seven times more than the allowable carbon budget at around 270 tonnes CO_2eq.

BRANZ forecast that new dwelling consents in 2030 will be 23,500. If all these were built in 2030, and all met the 35 tonnes CO2eq budget, then those homes could reduce total lifetime carbon emissions by up to 5.1 Gtonnes CO_2eq. See response to Consultation question 12, for further detail and references.

A consumption view is important in the building and construction sector. Our work has shown that over the lifetime of a home (up to 90 years), the carbon emissions from operating (consumption) is 64% of the total carbon emissions. The remainder is from materials (in construction and maintenance) and water. This points to the opportunities to decarbonise the economy through taking a consumption lens, rather than just a production view. See response to Consultation question 12, for further detail and references.

Principle 3: Create options.

BRANZ agrees that Aotearoa will need many different options to address carbon reductions.

However, we also know that changing behaviour can be difficult. We therefore think that this principle needs to be expanded to include incentivisation and change behaviour thinking. Incentivisation may take many forms. The Government is able to leverage uptake of options through fiscal, social and legal avenues.

In terms of building and construction, there already exist a number of solutions to cut emissions in buildings. Existing knowledge on how to reduce emissions needs to be communicated to, and adopted by, consumers and industry more widely.

Principle 4: Avoid unnecessary cost.

BRANZ agrees with this principle.

To illustrate the strength of this principle and that it can be applied now, we draw your attention to existing solutions that can significantly reduce the greenhouse gas emissions of buildings. These also avoid unnecessary cost. Examples include:

- Specifying robust passive solar design that has been thermally refined using computer models so that it provides year-round thermal comfort to all living spaces.
- Specifying heat pump water heaters or those that are renewable-assisted (such as wetbacks or solar boosted).

- Specifying heat pump air conditioners or highly efficient, low-emission wood burners.
- Increasing the level of thermal insulation (including glazing) of the envelope beyond Building Code requirements.
- Reducing the size of the house.
- Using low-carbon/low-impact building materials and encouraging waste reduction.

Principle 5: Transition in an equitable and inclusive way.
BRANZ absolutely agrees with this principal.

We feel that not only should early movers **not** be penalised but should be actively encouraged and supported to enable their transition. There may be a first mover advantage here, but Aotearoa needs action now to build momentum.

The built environment includes a number of challenges that will impact the ability of Aotearoa to undertake a just transition. For example, Statistics New Zealand notes that "at the time of the 2018 Census, New Zealand's homeownership rates were at their lowest since the 1950s. Further, by 2018 1.4 million people lived in houses they did not own[1]". The large section of Aotearoa's population that rent will mean strategies to reduce emissions within existing housing could be impacted by the ability of landlords to pay costs and arrange construction work. These costs are typically passed on to tenants through increased rents.

BRANZ has not considered the role that building and construction has on an equitable and inclusive transition. It is something that we can investigate, then socialise with Government.

Principle 6: Increase resilience to climate impacts.
BRANZ supports this principle.

There is plenty of work being carried out across the country showing the critical role that good investment and planning of infrastructure and urban policy and design has for resilience.

Increasing the resilience to climate impacts is important for our building stock as most of it will still exist in 2050. However, there is a need to address many of the knowledge gaps associated with doing this. There are a number of significant evidence gaps in relation to climate change mitigation and adaptation that need to be filled. Once filled, these gaps would help lay a foundation in order to respond to climate change. Many of the knowledge gaps outlined below

[1] Statistics New Zealand (2020) Housing in Aotearoa: 2020. Retrieved from www.stats.govt.nz

are complex problems that require further research so that relevant data is available to help plan and address the climate risks specific to us.

Gaps in our ability to address the carbon performance of buildings:

- There is a need to improve embodied carbon building material data, products and services for Aotearoa.
- Research is needed on the importance of building refurbishment, both in terms of the carbon benefit compared to demolition and rebuild. There is a need to have credible and transparent embodied carbon values for common refurbishment activities and products.
- There is a need to establish high-quality information and credible methodologies for carbon accounting such as a carbon budget at the building stock and building level.
- The cost-effectiveness of net-zero energy buildings is unclear – costs in Aotearoa are likely to be higher because of current small-scale and bespoke design. However, there is currently no robust information available of their costs and benefits, let alone how economies of scale might reduce costs.
- There is no robust information on the expected impact of net-zero energy building variants in the Aotearoa context. This includes not only the cost of materials issues (as above) but the external impacts on the electricity system (for example, does applying the net-zero concept exacerbate peak loads on the network?).

Evidence gaps for opportunities for energy conservation and efficiency:

- Gain experience with deep retrofitting. The work of Ghose[2] adds technical knowledge about deep retrofitting commercial buildings – further work is required to assess costs and benefits.
- International assessment suggests deep retrofitting is best carried out to coincide with other building renovations. This view needs to be informed by Aotearoa's experience where earthquake strengthening potentially provides these conditions. It is not clear that undertaking major energy refurbishment at that time is realistic because many building owners may already be financially stretched.

Evidence gaps for the implementation of energy performance certificates (EPCs):

- At present, there is no assessment framework around which to consider costs and benefits of EPCs in Aotearoa.
- There is a lack of information as to the characteristics of the most successful EPCs as compared to those that have been implemented but haven't worked. These findings would be useful to avoid repeating the

[2] Ghose A, Pizzol M, McLaren S, Vignes M & Dowdell D (2019); Refurbishment of office buildings in New Zealand: identifying priorities for reducing environmental impacts, International Journal of Life Cycle Assessment, pgs. 1 – 16, January 2019. https://doi.org/10.1007/s11367-018-1570-5

mistakes that other jurisdictions have made and to maximise the effectiveness of such an intervention.

Evidence gaps to address sea level rise and flooding:

- More research that defines building and design solutions for future climate risk due to flooding, such as examining guidance on minimum floor levels and adjusting building life expectancy within at-risk areas.
- Information on the costs and benefits of flood-resistant building materials and their viability as an adaptation response.
- Evaluate current flood mitigation schemes to see if they are fit for purpose and able to address future climate risk.
- Communicate future flood risk and the promotion of climate readiness for building projects in development or undergoing extensive refurbishment.
- Examine how climate change preparedness is impacted by longer-term planning, such as a 25-year plan at varying degrees of scale such as building level, city and district level.
- Explore the use of natural and artificial ecosystems such as wetlands across Aotearoa for use in flooding and storm surges.
- Examine the effectiveness of various community initiatives that could be used to help create awareness and solutions to rising sea levels, such as dune restoration initiatives.

Evidence gaps to address overheating:

- More research into the extent and severity of overheating in Aotearoa buildings. More research would enable the creation of an accepted Aotearoa definition of overheating or acceptable upper and lower indoor temperature thresholds in buildings (other than early childhood centres and aged care facilities).
- More specific knowledge in terms of the need to establish best-practice design and construction principles that address overheating within Aotearoa's buildings. Further, a Aotearoa-specific design methodology for the assessment of overheating risk in buildings is needed.
- Accepted best-practice operational principles that addresses overheating within Aotearoa's buildings.
- Set performance-based indoor environment settings for different building typologies to reflect overheating risk. A key part of creating a performance-based measure is to enable a greater understanding of building occupants' behaviour and choices in relation to the indoor environment. For example, this could include why homeowners do not use their existing ventilation adequately.
- Preparing for more overheating into the future – health promotion programmes are required to educate and inform building occupants, designers and builders about the dangers of overheating.

Principle 7: Leverage co-benefits.
BRANZ supports this principle.

The draft advice notes a number of co-benefits that could be leveraged. BRANZ has nothing further to add.

Consultation question 2

Emissions budget levels

Do you support budget recommendation 1? Is there anything we should change, and why?

BRANZ supports the budget recommendations as a whole and the stepped approach is appropriate.

In BRANZ's response to MBIE's Building for Climate Change "Transforming Operational Efficiency" consultation, we challenged MBIE that for the building and construction industry targets should be more ambitious. MBIE were proposing (for example) fossil fuel combustion reduction from 18 $CO_2e/(m^2.a)$[3] reduction to zero in 15 years. We recommended reducing the timeframe from 15 years to 10 years.

The building and construction industry in general is driven by regulation and consequently has considerable inertia to changing practice. Therefore, a shorter timeframe was encouraged to encourage and drive action.

A stepped approach is a good approach, as it can be clearly communicated and gives certainty and visibility of what is required and by when. It gives distinct points in time where step changes are made, which gives industry time to create/adapt solutions to meet the next level of performance.

Consumption progress indicator?

See our response to Principle 2 (Decarbonising the Economy) why we see a consumption view as important.

Measurement of progress: BRANZ completed a Household Energy End-use Project (HEEP) in 2005. This provides us with a baseline level of energy use in homes across Aotearoa. We are currently undertaking a second assessment and will be able to see changes in energy use, this will be available in 2023. This,

[3] CO_2 equivalent per square meter per annum

and future studies, could be used by the Climate Change Commission to monitor progress towards carbon emission reduction.

Consultation question 3

Break down of emissions budget

Do you support our proposed break down of emissions budgets between gross long-lived gases, biogenic methane and carbon removals from forestry? Is there anything we should change, and why?

BRANZ supports the proposed breakdown of emission budgets as described in the draft advice.

The composition of "greenhouse gases" varies from sector to sector. For example, building and construction industry has little nitrous oxide emissions. Providing this level of specificity allows sectors to focus on reduction of the gases relevant to them. It will make it easier to hold the sectors, via Government, to account for their reductions.

As we described in Principle 2, carbon removal via forestry sequestration is an important option to support carbon reduction. Placing a budget on removals gives the forestry sector targets to achieve. Importantly it signals to emitters that there is "limit" and that they need to do their bit to *reduce* their emissions.

Consultation question 4

Limit on offshore mitigation for emissions budgets and circumstances justifying its use

Do you support budget recommendation 4? Is there anything we should change, and why?

BRANZ supports allowing and limiting offshore mitigation for emissions budgets. We think this is an interim tool while Government focusses people on long term change to decarbonise the economy.

We agree that this should only be used as a last resort after all Aotearoa-based mitigation has been exhausted. It should only be used in exceptional circumstances that are beyond Government control.

As described in our response to Principle 1, Aotearoa (and other developed economies) have had the benefit of a carbon intensive economy. Limiting offshore mitigation to extreme circumstances allows Aotearoa to step into the role of a global player and not anticipating that other countries will solve our carbon reduction targets. BRANZ are not experts in international regulations but are unaware of any international obligations or regulations that may alter this view.

Allowance to use offshore mitigation should only be allowed through the Government and should be transparently and openly reported. This would allow the Climate Change Commission to monitor and report on any approved offshore mitigation. It would also allow the Climate Change Commission opportunity to comment on the appropriateness of the offshore mitigation.

Consultation question 5

Cross-party support for emissions budget

Do you support enabling recommendation 1? Is there anything we should change, and why?

BRANZ believes cross party support is critical to reaching net-zero carbon. The interventions that must occur need to have long term support and commitment from the key parties. Aotearoa cannot be paralysed by thinking that the "next" Government will change targets (either up or down). We need a consistent and steady approach to achieve the ambitions on net-zero carbon.

The draft advice recommends that cross-party support be obtained, and each party's position made a matter of record. This clear line in the sand will allow the Climate Change Commission to hold the parties to account and hold them to the carbon reduction path that has been agreed.

Consultation question 6

Coordinate efforts to address climate change across Government

Do you support enabling recommendation 2? Is there anything we should change, and why?

We support this recommendation. We are aware of many parts of the Government (and different groups within the Ministries) are working towards climate change action, but do not see a cohesive workplan (or sometimes even a

coordinated effort). There needs to be clarity for the lead organisation and the mandate to enable and foster coordination. They need to be supported by the other interested agencies at the highest levels in the organisations.

For the building and construction industry we see coordination led by the Ministry of Business, Innovation and Employment (the building section). Players key to delivery include Ministry of Housing and Urban Development, Kāinga Ora, Energy Efficiency and Conservation Authority and the Ministry for the Environment.

These agencies are responsible for key legislation and enabling activities, including: Building Act and Building Code; Resource Management Act; National Policy Statements on Urban Development.

There is opportunity that as this material is refreshed/revised to "hard code" carbon reduction targets and activity into them.

Engagement with our Stakeholders has identified that the National Policy Statement on Urban Development 2020 – policy 6(e) requires local authorities to look at the "likely current and future effects of climate change". From our perspective what seems to be missing is how different bits of legislation interact which can lead to inconsistencies and confusion. This is a good example why a coordinated effort is important.

The enabling recommendation 2, is designed to coordinate the required efforts. BRANZ has nothing further to add to this.

We feel the progress indicators are appropriate to measure and report progress. The first key accountability point is for the Climate Change Commission to hold the Government to account for delivery of process indicators a. and b.

Consultation question 7

Genuine, active, and enduring partnership with iwi/Māori

Do you support enabling recommendation 3? Is there anything we should change, and why?

BRANZ supports enabling recommendation 3. Iwi/Māori take a multi-generational, long term view of Aotearoa. With this longevity this group will be important for guiding the long term plans and supporting delivery of them. We feel the progress indicators are appropriate.

Consultation question 8

Central and local government working in partnership

Do you support enabling recommendation 4? Is there anything we should change, and why?

BRANZ supports this recommendation.

We believe it is critical for central and local government to work in partnership to focus on updating zoning and building regulations to support climate readiness. BRANZ recommends that Central and Local Government work hard to enact and operationalise legislation consistently across the country. We are aware that different Councils have different ways in which they interpret and apply (for example) requirements of the Building Code. A house consented in one jurisdiction can be declined in another – both Councils are using the same Building Code.

Working in partnership needs to extend to the private sector as well. We are aware that delivering public good outcomes needs investment from the private sector. Without the buy-in and support, generated through partnerships with the private sector, it is likely that barriers will form and progress towards transition will be slowed.

Aligned to our response to Consultation question 6, we recommend that advice to Government includes ensuring that the recommendations outlined in MfE's "New Directions for Resource Management in New Zealand" are adopted. In particular the Climate Change Adaption Act and to ensure this is interoperable with other key Government legislation and statements. This includes the Building Act and Building Code, and National Policy Statements on Urban Development. We hear stories of the inconsistencies between them, this creates confusion which can be addressed through partnership and coordination. Linked to this, work is required to understand how (and if) legislation like the Local Government Act is driving behaviours to support Aotearoa's climate ambitions.

We feel the progress indicators are appropriate.
We recommend adding a review of key legislation to uncover inconsistencies aimed at unlocking barriers.

Consultation question 9

Establish processes for incorporating the views of all New Zealanders

Do you support enabling recommendation 5? Is there anything we should change, and why?

BRANZ supports recommendation 5. The challenge will be to develop a process for listening and responding but making sure that it does not devolved to lowest common denominator and the latest "pet fad". The Government will need wide buy-in to achieve the reduction targets. It will also have to show leadership to bring people along, and make the hard calls that Government's typically avoid due to the 3-year election cycle. This is why Consultation question 5 (above) is so important to success.

We feel that the process indicator is not ambitious enough. Government needs to act now to build momentum for action. 2030 is "only" nine years away and waiting for another 18 months for a process to be published, let alone enabled feels like missing a big opportunity to get our citizens involved early.

The target date should be 31 December 2021. If the Climate Change Commission is aware of public engagement mechanisms that have worked, then we suggest you name them in your final report.

Consultation questions 10 & 11

Locking in net zero

Do you support our approach to focus on decarbonising sources of long-lived gas emissions where possible? Is there anything we should change?

Do you support our approach to focus on growing new native forests to create a long-lived source of carbon removals? Is there anything we should change, and why?

BRANZ supports decarbonising sources of long-lived gas emissions. We support the Climate Change Commission's position "We take the approach of reducing gross emissions where it is feasible and leave carbon removals to offset the hard-to-abate sectors."

BRANZ supports the commitment to increasing native forests, however, believes this needs to be done in a way that enables economic activity to be generated

from and within the new native forests. This will reduce the impact to rural communities of transitioning land use from pastoral farming and/or plantation pine forestry. Research is required to identify how best to develop plantation-style native forests for long-lived carbon removal. This needs to allow economic activity such as selective logging for high-value wood processing, tourism and recreation, and other forms of harvesting. See Consultation question 17 for further information.

We note that with rising temperatures and more forests being planted, as identified in the draft advice, there is an increased risk of fire.

Key opportunities for the building regulatory system that the Climate Change Commission can advise Government on include the following:

- Areas prone to forest fires need to be identified so that the Resource Management Act (or its successor) and planning regulations can interact with building regulations.
- Analysis of costs and benefits of incorporating fireproof materials into forest fire-prone areas is required.
- Other jurisdictions are addressing the increased risk of forest fires. Recent changes to the Australian National Construction Code in May 2019 are an example. From this work, there is an opportunity to explore what forest fire strategies, processes and regulations would be useful for the Aotearoa context.

Consultation questions 12

Our path to meeting the budgets

Do you support the overall path that we have proposed to meet the first three budgets? Is there anything we should change, and why?

BRANZ supports the overall path across the first three budget periods.

The targets for buildings can be more ambitious. All Government and public buildings (including schools and hospitals) should have all fossil fuel heating (including coal and diesel) phased out during Budget 1 (not across Budget 2). Fossil fuel heating of homes and commercial buildings should be included in table 3.1 and phased out across Budget 2.

As our research (see response to Principle 2) shows, operational energy use of a building creates a larger carbon impact than its construction and materials. This primarily is determined by the building's thermal efficiency. MBIE is currently working on improvements to thermal efficiency clauses of the Building Code, the

consultation on that has not yet taken place. BRANZ's position will be to push hard for all new built homes and renovations/retrofits to have improved thermal efficiency by 2025 – over Budget period 1.

Towards lifecycle assessment

The Climate Change Commission draft advice appears to show that phasing out reticulated gas and increasing energy efficiency is enough for buildings. Research undertaken in partnership between BRANZ and Massey University shows this is not the case. The draft advice and the accompanying evidence report appears not to reference this.

We are researching an absolute sustainability assessment framework to calculate carbon budgets (in line with a 1.5ºC warming threshold) for Aotearoa's buildings. This is with the aim of giving designers and architects a meaningful target for individual buildings.

This work has been internationally peer reviewed, has contributed to International Energy Agency's Energy in Buildings & Communities (IEA EBC) Annex 72 research (involving research organisations from 20+ countries). The work won best paper awards at both the Sustainable Built Environment conference in Graz, Austria in 2019[4] and the World Sustainable Built Environment conference in 2020[5], out of almost 200 papers at each conference. However, this research has not influenced the Commission's evidence base.

We illustrate key points from this research:

- Estimated (consumption-based) greenhouse gas emissions from residential buildings to 2050 is 170 $MtCO_2eq$.
- Emissions from existing buildings is approximately two-thirds (63%), and new build approximately one-third (37%).
- Most emissions (new and existing) to 2050 arise from detached housing.
- Whilst the majority of emissions in existing housing over its life-cycle are from energy use (operational energy), the sum of materials-related impacts

[4] Chandrakumar C, McLaren S, Dowdell D & Jaques R; *A top-down approach for setting climate targets for buildings: the case of a New Zealand detached house;* Sustainable Built Environment Conference 2019 (SBE19 Graz), IOP Conference Series: Earth and Environmental Science 323, Graz, Austria, 11 – 14 September 2019, doi:10.1088/1755-1315/323/1/012183

[5] McLaren SJ, Chandrakumar C, Dowdell D, Bullen L and Jaques R; *Application of absolute sustainability assessment to New Zealand residential dwellings;* BEYOND 2020 – World Sustainable Built Environment Conference (November 2020); IOP Conference Series: Earth and Environmental Science 588 (2020); doi:10.1088/1755-1315/588/2/022064

(products, construction phase, maintenance, and replacement) in new building's is greater than emissions from energy use.

Furthermore, the work illustrates the current discrepancy between the carbon footprint of the new residential buildings we are constructing and using, and the available carbon budget.

The carbon budgets have been developed for residential and commercial buildings are now embedded into BRANZ's LCAQuick v3.4.3 www.branz.co.nz/lcaquick (which calculates whole-of-life carbon and other environmental impacts). We are finishing research around the sensitivity of the calculated carbon budgets to a range of variables. We anticipate this will be published in April 2021.

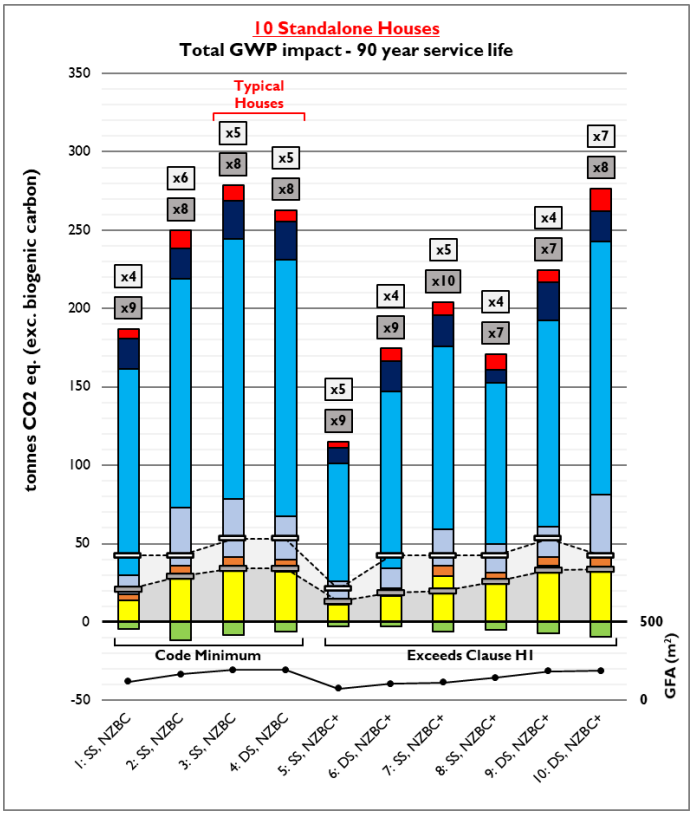
Further examples have been published and presented by BRANZ and Massey University[6],[7],[8],[9].

[6] Dowdell, D. MacGregor, C. Jaques, R. Berg, B. & J. Butler (2021) 'The greenhouse gas emissions of stand-alone residential houses in New Zealand: challenges and opportunities' in L. Grant, H. Viggers & P. Howden Chapman Eds Improving Buildings, Cutting Carbon. Steele Roberts Aotearoa, pp 39-48

[7] Chandrakumar, C., McLaren, S.J., Dowdell, D. and Jaques, R. (2020) A science-based approach to setting climate targets for buildings: The case of a New Zealand detached house. Building and Environment,169, p.106560

[8] McLaren SJ, Chandrakumar C, Dowdell D, Bullen L and Jaques R (2020) Application of absolute sustainability assessment to New Zealand residential dwellings; BEYOND 2020 – World Sustainable Built Environment Conference (November); IOP Conference Series: Earth and Environmental Science 588 (2020); doi:10.1088/1755-1315/588/2/022064

[9] Chandrakumar C, McLaren S, Dowdell D & Jaques R (2019) A top-down approach for setting climate targets for buildings: the case of a New Zealand detached house; Sustainable Built Environment Conference 2019 (SBE19 Graz), IOP Conference Series: Earth and Environmental Science 323, Graz, Austria, 11 – 14 September, doi:10.1088/1755-1315/323/1/012183



Carbon footprint of ten residential stand-alone houses

The six houses on the right are all high-performance houses designed to be more energy efficient than current New Zealand Building Code clause H1 'Energy Efficiency' settings. Despite this, all houses are significantly higher than the calculated carbon budget. To meet carbon reduction targets a standalone home (198m^2) needs to emit no more than 35 tonnes of CO_2 equivalent over its 90 year lifetime. This is represented by the bottom grey collar on each house in the figure above. The selection of building materials high in embodied carbon, carbon intensive practices, high operational carbon from the use of plug loads and water heating pushes houses above the carbon budget **before** they are occupied.

Improved energy efficiency in Aotearoa buildings is important and should not come at any embodied carbon cost. Operational emissions occur incrementally over decades and will be expected to decline over time with decarbonising of grid electricity supply. Most embodied emissions occur immediately (with manufacture of materials). Consideration of embodied and operational carbon is important to ensure we are not achieving longer term energy-related emissions gains at the expense of short-term embodied emissions. This can happen using a production-based carbon accounting approach. Considering embodied carbon is important for retrofitting existing buildings as well.

Effective, site-sensitive design that incorporates good passive solar design principles and careful selection of materials is critical in reducing both embodied and operational carbon. Whilst this is acknowledged in the Climate Change Commission evidence base, it does not appear in the draft advice.

BRANZ acknowledges that we need to improve the performance of Aotearoa's houses. There is a view that better-informed consumers could help by demanding better-performing houses. Therefore, BRANZ has undertaken research that examines the information currently available to consumers about house building: www.branz.co.nz/pubs/research-now/changing-behaviour/2-mapping.

We **recommend** that the Climate Change Commission's advice to Government should include the following key mitigation strategies:

- Improve building energy efficiency through retrofitting *existing* detached housing to address operational energy reduction.
- Require that during the design phase of a *new* build, consideration of materials selection to reduce carbon emissions is undertaken.
- Develop a roadmap to enable consumers to make informed choices which are based on consideration of low carbon buildings.

To measure the of progress the Government could require all buildings to have a lifecycle analysis conducted. Overtime, as thermal efficiency (as well as new products and building techniques) improve, the calculated carbon footprint will reduce. The Climate Change Commission would be able to collect and report this data.

There are tools, including BRANZ's LCAQuick which can perform this task. This free tool is available for download on the BRANZ website: https://www.branz.co.nz/environment-zero-carbon-research/framework/lcaquick/

A further contribution that buildings can make that will reduce carbon is around waste management. BRANZ research has shown that with good recycling and reuse infrastructure in place, there are many opportunities to divert building construction and demolition waste from landfill. See Consultation question 18 for more detail.

We would support the Climate Change Commission advice to Government to develop and operationalise a waste management strategy.

Consultation questions 13

An equitable, inclusive and well-planned climate transition

Do you support the package of recommendations and actions we have proposed to increase the likelihood of an equitable, inclusive and well-planned climate transition? Is there anything we should change, and why?

BRANZ supports an equitable, inclusive, and well planned climate transition to a thriving, climate-resilient and low emissions future.

- We acknowledge that low income and vulnerable people are likely to be impacted (by increasing costs) and will need additional support through the transition
- We know that the building and construction work force will need to gain new skills through training to accelerate and support the transition. We do not know what these are yet, BRANZ is currently undertaking a research project aimed at determining these.
- There are likely to be building and construction workers who may lose their jobs due to the shift from high emissions (e.g., concrete and steel industry). More work is required to understand the impacts.
- We feel that the large building and construction firms and group home builders would be able to commit to and transition faster than the thousands of small building companies that exist in Aotearoa. Work needs to be done to understand the impact on small companies and support required for their transition.
- We have stated above that we support the Government improving the standards for energy efficiency through the Building Code. Our response to the upcoming consultation is to implement these improvements "hard and fast".
- We support the concept of the Warm-up New Zealand scheme, but also support the advice to assess its scale and pace. We think the scale should be extended and potentially made mandatory for all homes, especially as they undergo renovation. BRANZ research into the benefits of "better than code" insulation clearly shows the link between better insulation and better health. Homes still need to be heated, but we have found through improved insulation that internal temperatures are closer to the World Health Organisation's recommended 18°C. The focus therefore should be transition to low carbon, efficient heating solutions.
- We support the need for better information/data of the co-benefits of climate policy. BRANZ would be able to support work in this area in its relation to building and construction.
- BRANZ is completing a piece of research on Marginal Abatement Cost Curves (MACC). A MACC provides a simple visualisation of the cost

effectiveness of a range of interventions aimed at reducing greenhouse gas emissions in terms of cost per tonne of carbon dioxide ($/tCO$_2$e) equivalent saved. It provides a clear comparison of the range of interventions available, based on their relative cost per tonne of carbon saved, by grouping intervention options from least to highest cost per tonne. This work could guide the choices that the building and construction sector make and will be available later in 2021.

Consultation question 14

Transport

Do you support the package of recommendations and actions for the transport sector? Is there anything we should change, and why?

BRANZ supports the recommendations for the transport sector.
We recommend that Government consider changes to the Building Code to reflect the shift to an electrified fleet, for example requiring fire-safe charging points to be included in new buildings.

COVID-19 has shown how adaptable Aotearoa is to working differently, particularly remote working. The vast investment in internet fibre infrastructure has paid off. However, we consider that more emphasis needs to be placed on remote working approaches to reduce transport volumes and carbon emissions. More work may be required to understand what the difference could be and how to incentivise this practice.

Consultation question 15

Heat, industry and power sectors

Do you support the package of recommendations and actions for the heat, industry and power sectors? Is there anything we should change, and why?

BRANZ makes the following suggestions regarding the necessary action points:

- The Climate Change Commission should include in necessary action 5 that the Government decide how to incentivise uptake of micro-generation systems, e.g., solar photo-voltaic power generation. This should include better strategies and prices for micro-generators selling back surplus power to the grid.

- Under necessary action 5, point d – this should be strengthened from "assess" to "support electricity distributors to be equipped, resourced…".
- Under necessary action 8. We know that in Aotearoa some of the hard-to-abate industries, like steel and aluminium production, are amongst the lowest carbon emitting processes globally. A risk, not cover in the draft advice, is that cheaper, dirtier off-shore products are imported to Aotearoa to off-set the potential cost increases due to the transition. Climate Change Commission should recommend to Government that imported materials are treated transparently in terms of their carbon footprint and not adversely impact the efforts Aotearoa is undertaking.
- As covered previously, we support Necessary action 9 – and will be calling on Government to make the standard changes "hard and fast".

Consultation question 16

Agriculture

Do you support the package of recommendations and actions for the agriculture sector? Is there anything we should change, and why?

BRANZ has nothing to add to this question.

Consultation question 17

Forestry

Do you support the package of recommendations and actions for the forestry sector? Is there anything we should change, and why?

BRANZ has commented on forests in Consultation question 10 & 11.

Use of native timber in buildings is encouraged if it can be produced economically and sustainably. It is long-lived and durable and therefore is an ideal product. Its use would decrease the need for timber treatment (required for pine timber products) and reduce the need for imported engineered wood products. It does take longer to reach maturity, so there is work to be performed to understand the full benefit of using native timbers as a long term carbon sink.

Consultation question 18

Waste

Do you support the package of recommendations and actions for the waste sector? Is there anything we should change, and why?

BRANZ supports the recommendations for Consultation question 18.

We recommend that the Climate Change Commission advise Government to develop a building and construction waste management roadmap aimed at reducing, reusing and recycling building and construction waste. Waste is a particular concern for the building and construction industry. It has been estimated that construction and demolition waste may represent up to "50% of all waste generated in New Zealand" – Greater Wellington Regional Council. BRANZ research has identified the industry willingness to support waste reduction but is this often impacted by the lack of cost effective infrastructure.

BRANZ has resources available that can assist industry to address construction and demolition waste, such as Resource Efficiency in the Building and Related Industries or REBRI (https://www.branz.co.nz/sustainable-building/reducing-building-waste/rebri/).

Consultation question 19

Multisector strategy

Do you support the package of recommendations and actions to create a multisector strategy? Is there anything we should change, and why?

BRANZ supports the package of recommendations and actions to create a multisector strategy.

For the building and construction sector, we recommend the Climate Change Commission advises Government to focus on behavioural changes to:

- Design carbon "out" of new buildings – residential and commercial.
- Consider what options there are to incentivise the consumer to choose the low carbon option, not the lowest cost option.
- Improve building practices that are focussed on high performance details and construction.

- Develop and consistently use Government procurement guidelines that have an emphasis on reducing climate impacts and not on reducing building cost.
- Enable understanding and engagement with a circular economy. BRANZ sees that more work to understand the circular economy as it relates to the building and construction sector is needed.
- Make visible and transparent the emissions profiles of all materials used in Aotearoa. Government could ban the use of materials without such a published public profile.

Consultation question 20

Rules for measuring progress

Do you agree with Budget recommendation 5? Is there anything we should change, and why?

We support the planetary boundaries approach taken in addressing climate change mitigation. We acknowledge that the Climate Change Commission has primarily focused on the calculation of a production-based carbon emissions accounting methodology as it is outlined in the Climate Change Response (Zero Carbon) Amendment Act 2019. Furthermore, this approach is also undertaken by other international organizations.

However, we believe the Climate Change Commission should provide a more ambitious response than what the draft advice suggests. This is to be more reflective of the recent, compelling building-related climate science. We advocate for building-related emissions reduction budgets to be examined from both a consumption-based approach as well as a production-based approach.

The draft advice appears to miss existing peer reviewed, Aotearoa specific research from literature and conferences proceedings. The Chandrakumar *et al* (2019)[10] paper provides opportunity to draw on insights obtained through a different lens of consumption-based accounting that can be used to help emission reduction strategies. Key comments are:

- The work by Chandrakumar is more refined and does not have the gross approximation of the Statistics New Zealand work. There work has assumed that imports have the same emissions content as outputs of the

[10] Chandrakumar C, McLaren SJ, Malik A, Ramilan T & Lenzen M (2019); Understanding New Zealand's consumption-baesd greenhouse gas emissions: an application of multi-regional input-output analysis; The Int J of LCA; https://doi.org/10.1007/s11367-019-01673-z

same industry in New Zealand. Respecting the limitations of consumption (and production-based accounting) the work concluded that *both approaches should be used in a complementary way when developing climate policies.*

- Respecting the Commission's preference to use a production-based approach, where good quality, New Zealand-relevant research exists in peer reviewed sources, this should be taken into account.
- Chandrakumar illustrates that the construction sector is a significant importer of carbon due to demand and supply of materials manufactured overseas. Only a consumption-based approach can quantify embodied emissions in international trade and is therefore able to provide a more equitable (and therefore more responsible) reaction for NZ Inc. on the world stage.

We recommend that the Climate Change Commission advise Government to develop an understanding of the impact of buildings, and to implement approaches, from a *production* and *consumption* based approach.

Consultation question 21

Nationally Determined Contribution (NDC)

Do you support our assessment of the country's NDC? Do you support our NDC recommendation?

BRANZ supports the NDC recommendation to strengthen reductions in line with the 1.5°C target.

We have nothing further to add to this discussion.

Consultation question 22

Form of the NDC

Do you support our recommendation on the form of the NDC?

BRANZ has nothing to add to this question.

Consultation question 23

Reporting on and meeting the NDC

Do you support our recommendations on reporting on and meeting the NDC? Is there anything we should change, and why?

We agree that the NDC needs to be aligned with international practice and that of the IPCC's Fifth Assessment report. This will make Aotearoa's efforts internationally transparent.

Consultation question 24

Biogenic methane

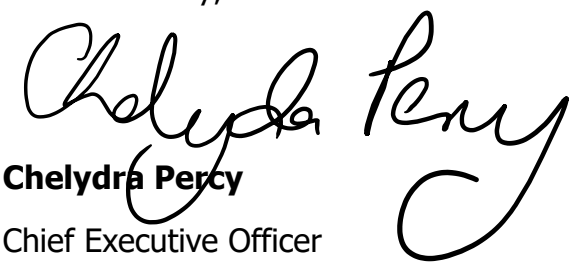
Do you support our assessment of the possible required reductions in biogenic methane emissions?

BRANZ has nothing to add to this question.

If you have any questions about this submission or wish to seek further advice, please do not hesitate to get in touch with BRANZ. We have a wealth of knowledge and experience in this area, and we are an organization that offers independent and impartial scientific advice.

Thank you for the opportunity to comment and contribute to this discussion.

Yours faithfully,



Chelydra Percy

Chief Executive Officer