

Reference: 20220166

8 June 2022

Dear [REDACTED]

Thank you for your Official Information Act (OIA) request, received on 10 May 2022.
You requested the following:

any research or policy documents (including Word, PowerPoint, and Excel) that the Treasury's Housing and Urban Growth team has on the interaction between housing and climate change, dated 2019 to now. This includes:

- *Analysis or reports on the interaction between housing and climate change,*
- *Analysis or reports on the interaction between government supported housing (KiwiBuild programme, Land for Housing programme, public housing etc) and climate change.*

Information being released

Please find enclosed the following documents:

Item	Date	Document Description	Decision
1.	13 August 2021	Treasury Report: Adding emissions analysis into KiwiBuild briefings T2021/1631	Released in part
2.	16 December 2020	Housing and Climate Change	Released in full
3.	May 2021	Climate change and KiwiBuild	Released in full

I have decided to release the documents listed above, subject to information being withheld under one or more of the following sections of the OIA, as applicable:

- certain sensitive advice, under section 9(2)(g)(i) – to maintain the effective conduct of public affairs through the free and frank expression of opinions,
- advice still under consideration, section 9(2)(f)(iv) – to maintain the current constitutional conventions protecting the confidentiality of advice tendered by Ministers and officials,
- names and contact details of officials, under section 9(2)(g)(ii) – to maintain the effective conduct of public affairs through protecting Ministers, members of government organisations, officers and employees from improper pressure or harassment, and

- direct dial phone numbers of officials, under section 9(2)(k) – to prevent the disclosure of information for improper gain or improper advantage.

Direct dial phone numbers of officials have been redacted under section 9(2)(k) in order to reduce the possibility of staff being exposed to phishing and other scams. This is because information released under the OIA may end up in the public domain, for example, on websites including Treasury's website.

In making my decision, I have considered the public interest considerations in section 9(1) of the OIA.

Please note that this letter (with your personal details removed) and enclosed documents may be published on the Treasury website.

This reply addresses the information you requested. You have the right to ask the Ombudsman to investigate and review my decision.

Yours sincerely

A handwritten signature in black ink, appearing to read 'G Treacher', with a stylized flourish at the end.

Geraldine Treacher
Manager, Housing and Urban Growth

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Treasury Report: Adding emissions analysis into KiwiBuild briefings

Date:	13 August 2021	Report No:	T2021/1631
		File Number:	SH-18-1-2

Action sought

	Action sought	Deadline
Hon Grant Robertson Minister of Finance	<p>Note the contents of this report</p> <p>Agree on an option for emissions analysis in KiwiBuild briefings</p> <p>Refer to the Minister of Housing, Minister for the Environment and Minister of Transport</p>	10 September 2021

Contact for telephone discussion (if required)

Name	Position	Telephone		1st Contact
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Isabel Kelly	Analyst, Housing and Urban Growth	s9(2)(k)	s9(2)(g)(ii)	✓
John Beaglehole	Acting Manager, Housing and Urban Growth			

Minister's Office actions (if required)

Return the signed report to Treasury.

Refer this report to the Minister for Climate Change and the Urban Growth Agenda Ministers (the Minister of Housing, Minister for the Environment, Minister of Local Government, Minister for Building and Construction, Minister of Transport, and Associate Minister for the Environment).

Note any feedback on the quality of the report

Treasury Report: Adding emissions analysis and information into KiwiBuild briefings

Executive Summary

You asked for climate change analysis to be included in agency briefings and Treasury advice on KiwiBuild development deals. This report provides you with three options in response to this request. We have focused on emissions reduction, as flooding and coastal erosion are already considered within KiwiBuild decisions.

Considering the emissions associated with KiwiBuild deals is consistent with the Government's priority to act urgently on climate change. The Government has declared a climate emergency and has committed to urgently reduce emissions. It is statutorily bound to domestic and international climate change targets under the Climate Change Response Act (CCRA) 2002 and Paris Agreement. Achieving targets will require us to reduce average emissions by up to 36% under tight emissions budgets through to 2035. In addition, the Climate Change Commission has recommended that Crown agencies must consider climate change in their investment decision-making (Rec 12.4, *Ināia tonu nei*).

Significant work is already underway to set out priorities and methods for abating and assessing emissions from urban development. This includes the Emissions Reduction Plan (ERP), Resource Management reform, Government Policy Statement on Housing and Urban Development, Hikina Te Kohupara (the Ministry of Transport's report on pathways to net zero emissions), Urban Growth Agenda, Te Waihangā's 30-Year Infrastructure Strategy, and the Building for Climate Change (BfCC) programme. This work will collectively drive changes in the housing and urban development system and establish priorities on emissions reduction through urban development.

For example, in the housing sector, the BfCC programme is the Government's key initiative to address the emissions impacts of building and construction. Under the programme it will be mandatory for developers to report on and meet operational and embodied emission caps for new builds at the resource consent and code compliance stages. We expect, if approved, proposals would be phased in gradually until 2035. This programme will comprehensively address operational and embodied emissions from all buildings once implemented.

The KiwiBuild programme accounts for a very small proportion of new builds and therefore the volume of emissions likely to be avoided from undertaking KiwiBuild climate change analysis is low. This is especially the case given operational and embodied emissions from KiwiBuild homes will ultimately be addressed by the BfCC programme, once implemented. In addition, the KiwiBuild programme already faces delivery challenges. Adding climate change reporting requirements could impose further costs on developers, which may risk fewer KiwiBuild homes being delivered, causing reputational damage to the KiwiBuild programme.

However, the benefits of KiwiBuild climate change analysis go beyond achieving specific emissions reductions for KiwiBuild homes. Undertaking this analysis provides an opportunity for the Government to show some leadership by moving faster than the BfCC and other emissions reduction programmes. In the building and construction sector, this may send a signal that changes to the way that buildings are designed, built and disposed of will be required to drive emissions reductions. It could also steer developers towards low-emissions construction materials and building products, drive efficiency within supply chains, and spark innovation in the sector (demonstrating new ways of building).

The Government could strengthen its influence on the building and construction sector by making climate change analysis mandatory for the Government's entire build programme (as opposed to just KiwiBuild deals, which makes up a fraction of the build programme). The Government's build programme includes Kāinga Ora's Large-Scale Projects, public housing, future Specified Development Projects, transitional housing, KiwiBuild (Buying off the Plans and Land for Housing), future projects delivered under Kāinga Ora's urban development projects, the retrofit programme etc.

Prior to the implementation of emissions reduction programmes such as the BfCC and other ERP initiatives we recommend that officials conduct climate change analysis of KiwiBuild deals using an approach that is commensurate to expected benefits from it.

There are three broad approaches to climate change analysis in KiwiBuild briefings:

- **Approach 1:** High-level analysis of all emissions (transport and building) with reference to a set of principles,
- **Approach 2:** Hybrid approach - high-level analysis of transport emissions and detailed quantitative analysis of building emissions, and
- **Approach 3:** Detailed quantitative analysis of all emissions (transport and building)

At this point, we recommend Approach 1, because it best balances time and resource investments with expected benefits. Detailed quantitative analysis (Approach 3) is high cost, harder to implement, and presents more risk, particularly around duplicating analytical work (underway in programmes listed above) and adding additional barriers to KiwiBuild development. We are continuing to work with the Ministry of Business, Innovation and Employment (MBIE) and industry bodies to evaluate the rigour and suitability of existing tools that quantify building emissions. If such a tool is appropriate and could be easily implemented, it may be possible to move to Approach 2.

Under all approaches, it would be preferable to update the KiwiBuild procurement processes (i.e. the Programme Business Case and Invitation to Partner) to signal to developers how climate change considerations will inform government underwrites. Proposed updates (and an assessment of their impacts on developers) could be incorporated in a forthcoming Cabinet paper on KiwiBuild price caps.

Given the limited emissions impact of KiwiBuild climate change analysis, we also outline other areas where there is potential for greater abatement opportunities in the housing sector. These areas coincide with existing reform programmes and investments:

- **Resource Management reform:** Officials are currently working on the design of the new Spatial Planning Act. This legislation presents an opportunity to make room for growth and support more competitive urban land markets (land and floor space) while reducing greenhouse gas (GHG) emissions and protecting environmentally and culturally sensitive areas and greenspace. Aspects of this legislation could significantly impact emissions. An options paper on the spatial planning process will be discussed at the Infrastructure Subgroup of the Resource Management Ministerial Oversight Group on 8 September.
- **National Policy Statement on Urban Development (NPS-UD) implementation:** The NPS-UD puts requirements on councils to plan for growth in ways that will help to lower household emissions by supporting shorter travel distances and mode-shift.

s9(2)(f)(iv)

- **Public and active transport (PAT) investment:** Increased investment in PAT, especially when paired with measures that enable greater densification of areas near PAT infrastructure, can also help lower household emissions through shorter travel distances and mode shift. Increased PAT investment could be achieved through, or in addition to, the National Land Transport Programme (NLTP), via increasing funding into the programme, maximising existing funding and financing levers, introducing new levers (e.g. grants, value capture, congestion pricing, Emissions Trading Scheme hypothecation) and mobilising private capital. We will continue working with officials from the Ministry for the Environment on the joint work programme on funding and financing the transition to a low-emissions economy and will advise you later this month on addressing the NLTP21 investment gap.

Recommended Action

We recommend that you:

- a. **note** that there are three broad approaches to climate change analysis in agency briefings and Treasury advice on KiwiBuild development deals:
 - **Approach 1:** High-level analysis of all emissions (transport and building) with reference to a set of principles,
 - **Approach 2:** Hybrid approach - high-level analysis of transport emissions and detailed quantitative analysis of building emissions, and
 - **Approach 3:** Detailed quantitative analysis of all emissions (transport and building)
- b. **note** that any approach would require the Ministry of Housing and Urban Development (HUD) and Kāinga Ora officials to do additional assessment of KiwiBuild deals
- c. **note** that it would also be preferable for HUD officials to update the KiwiBuild procurement processes in order to signal to developers how climate change considerations will inform government partnered development
- d. **discuss** the outlined approaches with the Minister of Housing

EITHER

- e. **agree to Approach 1 (Treasury recommended option):** officials conduct high-level analysis with reference to a set of principles

Agree/disagree.

OR

- f. **indicate** your preferred approach (either **Approach 2** or **Approach 3**).
- g. **direct** Treasury to work with officials from HUD and Kāinga Ora to report back on the implementation of your preferred approach.
- h. **note** that there are other areas where there is potential for greater abatement in the housing sector (Spatial Planning Act, NPS-UD implementation and public and active transport investment)

- i. **note** that Treasury officials will engage with officials from HUD and the Ministry for the Environment to explore whether there are further options to strengthen the implementation of the NPS-UD
- j. **refer** this report to the Minister of Housing, Minister for the Environment and Minister of Transport

Refer/not referred.

John Beaglehole
Acting Manager, Housing and Urban Growth

Hon Grant Robertson
Minister of Finance

Treasury Report: Adding emissions analysis and information into KiwiBuild briefings

Purpose of Report

1. You asked for climate change analysis to be included in agency briefings and Treasury advice on KiwiBuild development deals.
2. This report provides you with three different approaches to analysis, and assesses the benefits, costs and risks of each approach. We recommend a high-level approach to climate change analysis with reference to a set of principles. This analysis would focus on building (operational and embodied) and transport emissions from KiwiBuild homes.
3. The report also outlines other areas where there is potential for greater abatement in the housing sector (Resource Management reform, particularly the design of the Spatial Planning Act, NPS-UD implementation, and public and active transport investment).

Background

KiwiBuild climate change analysis aligns with the Government's broader climate change priorities

4. On 2 December 2020, the Government declared a climate emergency and committed to urgently reducing emissions. New Zealand is statutorily bound to domestic and international climate change targets under the Climate Change Response Act (CCRA) 2002 and the Paris Agreement, including net zero long-lived greenhouse gas (GHG) emissions by 2050. Achieving these targets will require us to meet tight emissions budgets including average emissions reductions of up to 36% per year (vs. 2019, from 2031-2035).
5. He Pou a Rangi also recommended that Crown agencies must consider climate change in their investment decision-making in its final advice to Government (Rec 12.4, *Ināia tonu nei*). Considering emissions associated with KiwiBuild deals is therefore in line with the Government's climate change commitments and He Pou a Rangi's advice.
6. Significant work is already underway to set out a strategic direction and set of priorities for emissions reduction through urban development. This includes the Emissions Reduction Plan (ERP), Resource Management reform, Government Policy Statement on Housing and Urban Development, Hikina Te Kohupara (the Ministry of Transport's report on pathways to net zero emissions), Urban Growth Agenda, Te Waihangā 30-Year Infrastructure Strategy, and the Building for Climate Change (BfCC) programme. While the resulting climate change mitigation will not be realised for some time, relative to the currently delivery of the KiwiBuild programme, this work will collectively drive changes to the housing and urban development system, including to settings that underpin the Government's build programme.

Most emissions associated with KiwiBuild deals will be addressed through the Building for Climate Change Programme, ETS and Emissions Reduction Plan

7. The housing sector contributes to GHG emissions directly and indirectly:
 - **Direct:** Operational and embodied emissions arise from the construction, use, maintenance and disposal of buildings. These emissions are not broken out in the New Zealand GHG Inventory but contribute in part to emissions from public electricity and heat production (5.1% of our total gross emissions in 2019) and manufacturing and construction (9.3% - although only 1-3% of gross emissions is attributable to the built environment, which includes commercial builds/roads).
 - **Indirect:** Household transport emissions are influenced by urban form factors (e.g. access to jobs and amenity). Transport emissions from households and industry accounted for 19.7% of our total gross emissions in 2019.
8. Most emissions from KiwiBuild homes and the wider housing sector will be addressed through the BfCC, ERP and ETS. This means that the overall abatement opportunity from KiwiBuild climate change analysis is small.
9. The BfCC programme is the Government's key initiative to mitigate direct emissions from building and construction. This programme proposes to make it mandatory for developers to report on and meet operational and embodied emission caps for new builds at the resource consent and code compliance stages. The programme will complement the ETS by targeting emissions excluded under that scheme (e.g. imported construction materials) and overcoming market dynamics and signals that prevent participants from responding to the ETS price (e.g. high and rising house prices, information asymmetry). If approved, we expect BfCC proposals to be phased in gradually until 2035.
10. The magnitude of transport emissions abated from KiwiBuild climate change analysis is limited because KiwiBuild homes make up a small proportion of the total new build stock. The ERP (not yet approved by Cabinet) is likely to propose policies and strategies to drive a reduction in household transport emissions.
11. KiwiBuild developments often have superior emissions profiles when compared with the average existing house. This is because of the overlap between KiwiBuild settings and climate change considerations. For example, to minimise Crown and developer risk, the Programme targets locations with good access to jobs, amenity, transport networks, and public transport where possible (considering constraints such as the price of land and the KiwiBuild price caps). Household transport emissions are typically lower in locations that are close to the CBD. In addition, as KiwiBuild price caps have and continue to depart from the market price, developers look to capitalise on land by building small and medium-to high-density homes. Smaller more dense homes typically have lower operational emissions.

But there are broader benefits to undertaking KiwiBuild climate change analysis

12. The benefits of KiwiBuild climate change analysis are much broader than emissions reduction. First, as discussed above, undertaking this analysis aligns strongly with the Government's climate change commitments, priorities and work programmes, and the advice of the Climate Change Commission.

13. Undertaking analysis at the KiwiBuild level provides some opportunity for the Government to show leadership by moving faster than the market to adopt changes under the Building for Climate Change Programme and Emissions Reduction Plan. This will send a strong signal to the Building and Construction sector that major changes in how buildings are designed, built and disposed of will be required in order to drive significant emissions reductions. It could also steer developers towards low-emissions construction materials and building products, drive efficiency within supply chains, and spark innovation within the sector (new ways of building).

Detailed quantitative analysis of some emissions will face implementation challenges and may not be accurate

14. There are implementation challenges associated with undertaking a detailed quantitative analysis of the impact of KiwiBuild development deals on all emissions.
15. Officials from MBIE note that good tools exist to assess the whole-of-life operational and embodied emissions from buildings (e.g. the BRANZ life cycle assessment tool). We have not had an opportunity to assess what would be required to use them. If tools to assess building emissions are suitable, low cost, and easily implemented, then the greater challenge lies in quantifying the transport emissions impacts that result from the combination of urban form factors that underpin a KiwiBuild development (e.g. density, proximity to public and active transport infrastructure, and land use zoning).
16. We have a good understanding of the correlation between individual urban form factors and vehicle kilometres travelled and/or transport emissions. However, we lack a strong evidence base in a New Zealand context of how urban form factors operate in conjunction to influence emissions. We also do not have a consistent approach (i.e. robust methodology and tool) to quantifying the emissions impacts of urban development decisions.
17. For these reasons, He Pou a Rangi, the Climate Change Commission, recommended in its final advice that the Government commit to both strengthening the evidence base and developing a consistent quantification approach (Recommendations 16.3 and 16.4). The Emissions Reduction Plan will likely require transport emissions impact assessments of urban developments. This means in the medium term, stronger methodologies and tools will likely be available. Until then, officials and developers can begin to develop or scale processes for the collection and sharing of transport emissions data, which will be a necessary input into any future quantification approach.

Broad approaches to KiwiBuild climate change analysis

18. There are three broad approaches we have identified that could be used to incorporate climate change analysis into KiwiBuild briefings:
 - **Approach 1:** High-level analysis of all emissions (transport and building) with reference to a set of principles,
 - **Approach 2:** Hybrid approach - high-level analysis of transport emissions and detailed quantitative analysis of building emissions, and
 - **Approach 3:** Detailed quantitative analysis of all emissions (transport and building)

19. We have qualitatively assessed the costs, benefits and risks of each approach, below. In addition, we briefly discuss the risks associated with the status quo. A more detailed explanation of the approaches can be found in the table overleaf.
20. To assess the costs and benefits of each approach we have used the status quo as the counterfactual. As such, there are no costs or benefits associated with the status quo – but there are risks. For example, lack of emissions monitoring and analysis for Government supported housing development creates some reputational risk.
21. **Approach 1:** High-level analysis of all emissions (transport and building) with reference to a set of principles

Costs: This approach incurs low costs to agencies and developers as most of the information in Column 1 (see table overleaf) is currently collected and is observable rather than estimated or calculated. For example, HUD and Kāinga Ora KiwiBuild briefings currently include information on access to employment, amenity, and public transport; typology; size; and occasionally design features, fittings and appliances.

Benefits: A formalised set of principles provides evidence of emissions consideration, allowing the Government to send a signal and provide some leadership in the Building and Construction sector and mitigate some reputational risk. In addition, you and officials can easily identify relatively high-risk deals at a low cost.

Risks: There is a low-to-negligible risk of dampening interest in delivering KiwiBuild homes as this option presents few barriers (time and cost) to developers and agencies. However, some stakeholders may deem this response insufficient as it is not a significant departure from the status quo.

- **We recommend Approach 1, because it best balances time/resource investments with expected benefits.**
 - Although the analysis is ‘high-level’, it is based on empirical findings and relationships between development characteristics and emissions. For example, developments have higher indirect emissions risks if they are far from employment, amenities, and public transport options. Developments tend to have higher direct emissions if they are large and/or stand-alone homes; or are constructed using high-emission materials (i.e. concrete). Some development characteristics, like location, will contribute more to emissions than others, like building materials.
 - Kāinga Ora and HUD (with support and information from developers) would be responsible for completing this high-level analysis.
 - For deals that are large, in the public interest, or present a relatively high emissions risk you may want more detailed analysis. Officials could provide customised analysis for such deals when required.

22. **Approach 2:** Hybrid approach – high-level analysis of transport emissions and detailed quantitative analysis of building emissions

Costs: This approach presents low costs for Kāinga Ora and HUD as no detailed analysis of transport emissions impact is required. As stated above, high-level information on access to jobs and amenity is already collected.

If developers are able to use existing tools to estimate building emissions free of charge and at the level of sophistication required, then developers face low costs. However, costs would be greater than under Approach 1, as incorporating these tools into developers’ processes would require time.

Benefits: This approach displays strong, quantitative evidence of building emissions considerations, but only some evidence of transport emissions consideration and these are the greater proportion of housing-related emissions. It allows the Government to send a signal and provide leadership in the Building and Construction sector and mitigate some reputational risk. It would lead to better data collection for only direct emissions.

Risks: Depending on what level of cost developers face under this approach, there is a moderate risk that fewer KiwiBuild homes will be delivered. This risk is higher than Approach 1, but lower than Approach 3.

- If this were the preferred approach, then as a part of implementation advice officials would need to properly assess whether existing tools are practicable to use.

23. **Approach 3:** Detailed quantitative analysis of all emissions (transport and building)

Costs: This approach is high cost as it will require developing new and robust tools and methodologies to quantify transport emissions for KiwiBuild deals. Our view is that developing these tools and methodologies, to an appropriate quality, would be a substantial and time-consuming exercise (requiring FTE and/or consulting fees). We could provide more detailed commentary on this in further advice on implementation, if Approach 3 is your preferred option. Analysis of building emissions would be the same as Approach 2.

Benefits: This approach displays strong evidence of emissions consideration, and the use of innovative quantification methods, allowing the Government to display strong leadership and credibility in the Building & Construction sector and mitigate reputational risk. It would lead to better data collection for both direct and indirect emissions.

Risks: Adding detailed climate change reporting requirements will significantly raise costs (time and resources), creating a moderate to high risk that fewer KiwiBuild homes are delivered. This could cause reputational damage to the KiwiBuild programme. This approach also risks officials doing analytical work twice. We note that significant time and cost has already been allocated to climate change mitigation via the ERP, Resource Management reform and MBIE BfCC.

- This is the most comprehensive option and presents high costs and risks relative to benefits. It is also more challenging to implement.
- Kāinga Ora, HUD and developers would be responsible for completing this detailed-level analysis. It is likely that agencies will bear the costs for analysis related to transport emissions (vehicle kilometres travelled, and access); and the developer will bear the costs of analysis related to embodied and operational emissions.

Updating the procurement processes

24. Under all options, it would be preferable to update the KiwiBuild procurement processes (i.e. the Programme Business Case and Invitation to Partner) to signal to developers how climate change considerations will inform government underwrites. Doing this will indicate a preference for partnering with developers willing to develop housing with lower emissions profiles because of location, size, quality, connectivity to active and public transport, etc. It will also avoid developers investing time and money on negotiations and redesign work, only to have KiwiBuild homes rejected at the final stage. It is likely that the market will expect the Crown to bear the cost of these additional requirements.

Table 1: Further information on approaches to analysing emissions from KiwiBuild developments						
Key: Information is currently collected and in KiwiBuild deal briefings		Yes	Partially/Sometimes	No		
Principles		High-level analysis (Approach 1)			Detailed analysis (Approach 3)	
TRANSPORT: Minimise transport emissions by prioritising areas that are close to employment, amenities and public transport (The four categories below may require setting a benchmark or counterfactual for comparison)						
Access to employment		Comment on time to nearest employment hub via private vehicle, public transport, and if applicable active modes		“Methodology for strategic assessment of the wider costs and benefits of urban growth” (PwC 2020), using Effective Job Density and Adjusted Effective Job Density measures.		
Access to amenity		Comment on time to proximal amenities i.e. schools, parks, retail, sports centres, maraes etc		Use spatial analysis to identify common amenities (i.e. schools) and compare the Site to a counterfactual.		
Access to public transport		Select a reasonable ‘catchment’ around the Site and outline time to public transport station/s, and type of public transport. Include information on carparking options if applicable.		Use 2018 Census main means of travel to work at the SA2 level to determine what proportion of people in a particular location use PT to get to work.		
Vehicle kilometres travelled (VKT) <i>(for detailed analysis)</i>		N/a		Opportunity to build on the Transport Model in “Methodology for strategic assessment of the wider costs and benefits of urban growth” (PwC 2020) Compare findings to a counterfactual.		
OPERATIONAL AND EMBODIED: Minimise operational and embodied emissions by prioritising denser typologies and ‘eco-friendly’ materials, fittings and design features						
Design and features including fittings and appliances		Comment on design features or appliances i.e. solar panel, homestar, greenstar, fitted with energy efficient appliances.		Calculate the marginal difference in operational emissions between the ‘counterfactual’ home and the KB new build.		
Materials		Comment on building materials etc. May run into issues with buildings being made with concrete, which is high in emissions compared to wood or steel (but cheaper).		Calculate the marginal difference in embodied emissions (per dwelling) between the ‘counterfactual’ home and KB new build.		
Construction						
Typology (stand-alone, terraced, townhouse, or apartment)		Use current insights that higher density typologies and home with less floor area typically emits less from an operational emissions perspective. We are unsure about an embodied perspective.		Sum the two cells above for the counterfactual vs. KiwiBuild dwelling or conduct new research/ analysis into the relationship between emissions and typology.		
Size of home				Similar to above.		
OTHER						
Developer track record		Developer to provide.		N/a		
LSF component		To be developed.		N/a		
Existing infrastructure		Comment on the Site’s capacity regarding infrastructure and service lines (water, electricity, internet, road/ transport etc).		Calculate the embodied emissions (construction, materials, energy for machinery etc) associated with infrastructure provision.		

Implementation considerations

Currently, the counterfactual to a development is often thought of as no development – but this is not the case. As such, we need to establish a reasonable comparator.

25. Accommodating for growth and responding to the current housing shortage is a necessity – people have to live somewhere. If we do not make room for growth, we will continue to experience increases in house prices and rents, homelessness, and overcrowding. It is important to recognise that growth, irrespective of what type, will likely increase emissions. As such, if a KiwiBuild development did not occur, the counterfactual would be people living in an existing home, or a new build delivered by the private market.
26. To produce climate change analysis (at a high or detailed level) we need to establish a suitable counterfactual to a KiwiBuild development. Our working method is to benchmark household characteristics and behaviours to either:
 - the average household at the national level,
 - the average new build at the national level, or
 - either of the above options for Auckland only (as a vast majority of KiwiBuild developments occur in this location).
27. Setting the counterfactual depends on how we view KiwiBuild. If KiwiBuild creates homes that would not have otherwise been built, then the counterexample should be the average existing home (likely with overcrowding and housing unaffordability implications). If KiwiBuild creates homes that displace the development of 'different' homes i.e. more expensive and less dense typologies, then the counter example should be the average new build. Considering that current price caps are at a significant discount to the market price, we believe KiwiBuild delivers homes that would not have otherwise been built.
28. Agencies do not yet agree on which counterfactual should be used. We will continue to discuss this with agencies and ensure that it is covered off in the further advice on implementation.

Other areas with potential for greater abatement in the housing sector

29. As the KiwiBuild programme accounts for a small proportion of new builds, this section considers other areas with greater abatement potential in the housing sector.
30. While the ETS is an important lever for emissions reduction, it is not sufficient alone to meet our emissions targets. This is especially the case in the housing and urban development sector, where market, government and behavioural failures make it challenging for participants to respond to the ETS price.
31. Further government intervention is therefore justified where it will drive additional abatement beyond the ETS or overcome market, government and behavioural failures, and offers good value for money, with any distributional effects accounted for.

32. Typically, we recommend interventions that target decisions made at a high-level over a long time horizon regarding a significant volume of emissions. These types of interventions allow decision-makers to take a 'bird's eye view' of the long-term potential for abatement, and balance trade-offs between climate change and other long-term objectives like housing affordability.

33. Three areas of abatement potential in the housing sector are:

- **Resource Management reform, particularly the design of the Spatial Planning Act**

Officials are currently working on the design of the new Spatial Planning Act. This legislation presents an opportunity to make room for growth and support more competitive urban land markets (land and floor space) while reducing GHG emissions and protecting environmentally and culturally sensitive areas and greenspace. We will continue to advocate for the creation of bold spatial plans that require local authorities to forecast population growth, plan where housing demand will be met under a range of scenarios, require density in certain areas, and identify and protect land underpinning key infrastructure corridors and sites upfront, taking into account the emissions impacts of these decisions over the long term. An options paper on the spatial planning process will be discussed at the Infrastructure Subgroup of the Resource Management Ministerial Oversight Group on 8 September.

- **Strengthen the implementation of the NPS-UD**

The NPS-UD puts requirements on councils to plan for growth, with specific requirements around density in locations close to the city/metropolitan centre and access to rapid transit stops. The effective implementation of the NPS-UD will mean that cities can grow in ways that support shorter travel distances and mode-shift, enabling households to have lower emissions.

Implementation is now underway, with councils having to publicly notify intensification plan changes from 2022. In addition, Cabinet has agreed measures to speed up and strengthen the NPS-UD and introduce new mandatory medium density residential zones in certain areas. Implementation of these changes will further support emissions reduction in housing.

s9(2)(g)(i)

We will engage with HUD and Ministry for the Environment officials to ensure that councils have sufficient guidance and support to implement new measures agreed by Cabinet. s9(2)(f)(iv)

s9(2)(f)(iv)

- **Invest further in public and active transport (PAT)**

Increased investment in PAT, especially when paired with land use regulations that enable greater densification near PAT infrastructure, can also help lower household emissions through shorter travel distances and mode shift. It will be important for delivering the level of abatement in the Transport sector required by the Emissions Reduction Plan and referenced in Hikina te Kohupara.

Investment in PAT projects already occurs through the National Land Transport Programme (NLTP), funded by hypothecated land transport revenue, with investment decisions made by the Board of Waka Kotahi NZ Transport Agency. However, where the Crown desires faster or greater progress than is being achieved under the current system, it would need to explore:

- Increasing revenue into the National Land Transport Fund (NLTF), for instance via increases to the Fuel Excise Duty or Road User Charges,
- Maximising existing funding and financing levers (e.g. reorienting or increasing Crown direct investment in PAT, the IFF Act 2020, council and developer co-contributions),
- Using new funding and financing levers (e.g. pricing tools such as congestion charging, value capture, recycling revenue from the ETS into PAT infrastructure), and
- Mobilising the flow of private capital towards PAT infrastructure.

We will provide you with further advice on the NLTP21 investment gap in the coming month, including funding and financing options to increase investment in PAT. You will also be aware that the Treasury and the Ministry for the Environment are undertaking a joint work programme on funding and financing Aotearoa's transition to a low-emissions economy. Initial decisions are expected by October 2021 to inform Budget 2022 and the Emissions Reduction Plan.

Next Steps

34. We will work with officials at HUD and Kāinga Ora to provide implementation advice on your preferred approach to KiwiBuild climate change analysis. This includes advice on updating the KiwiBuild procurement processes and an assessment of the impact of the additional requirements. HUD officials have suggested that this be included with advice on KiwiBuild price caps if this goes to Cabinet.

Consultation

35. We have consulted with the Ministry of Housing and Urban Development, Ministry for the Environment, Ministry of Transport, Ministry of Business Innovation and Employment, and Kāinga Ora on this report.



Housing and Climate Change

HUG CHEW session

16 December 2020

1

Problem statement

The government has goals to address both climate change and the housing crisis – we want to know how these interact

The New Zealand Government is committed to addressing both climate change and the housing crisis.

- Parliament has set into law a target of net zero emissions of all greenhouse gases, other than biogenic methane, by 2050.
- Labour is committed to making sure every New Zealander has a warm, dry, safe place to call home – whether they rent or own.

The Housing and Urban Growth Team want to know how these competing interests interact so that we can identify trade-offs and consider them when providing advice. We should aim to:

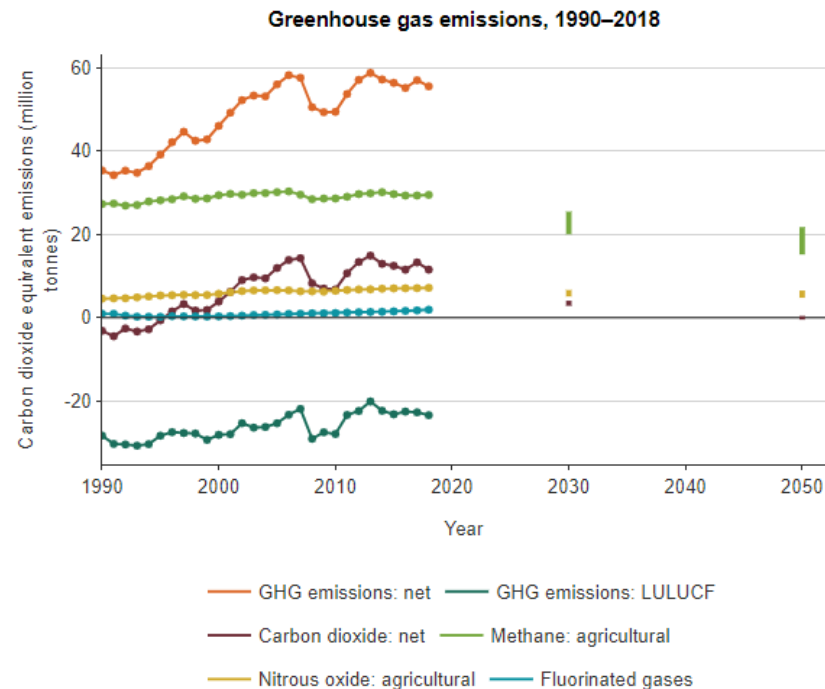
- influence the development of environmental policy in a way that does not exacerbate issues in the housing market, and;
- give housing policy advice that considers the intervention/s effects on the Four Capitals, including the environment.

Today we are going to discuss these potential trade-offs

2 Context

To reach our GHG reduction targets we must focus on carbon dioxide, which largely a product of the energy sector

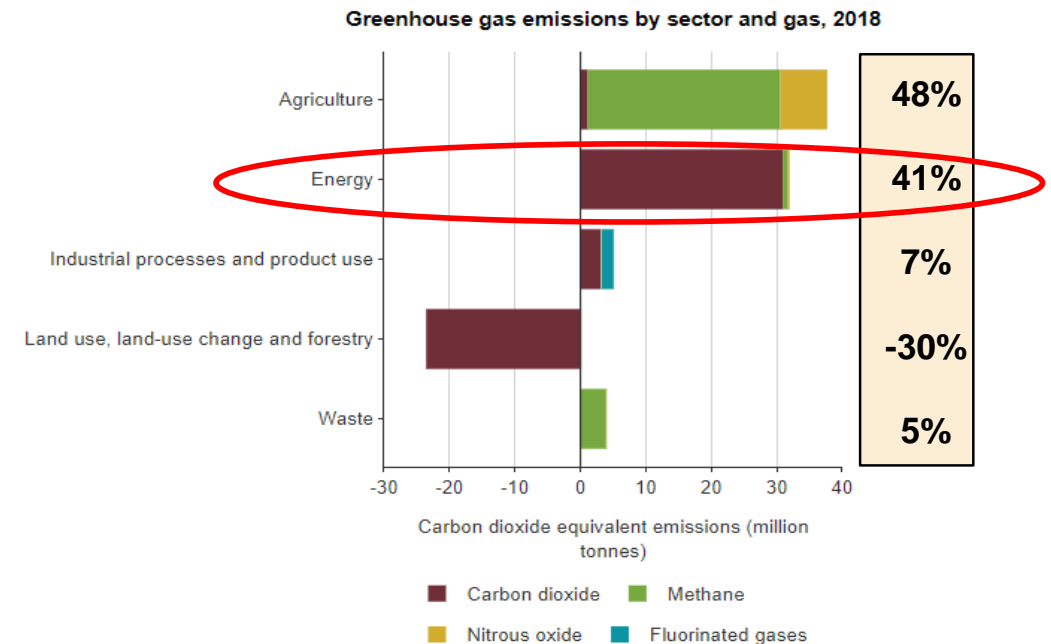
The trend of net GHG emissions are driven by carbon dioxide, evidenced by all other gases having a stagnant pattern



2018

- Carbon dioxide emissions 44.5%
- Methane 43.5%
- Nitrous Oxide 9.6%

Methane in New Zealand is largely biogenic, meaning our substantive reductions must come from carbon dioxide

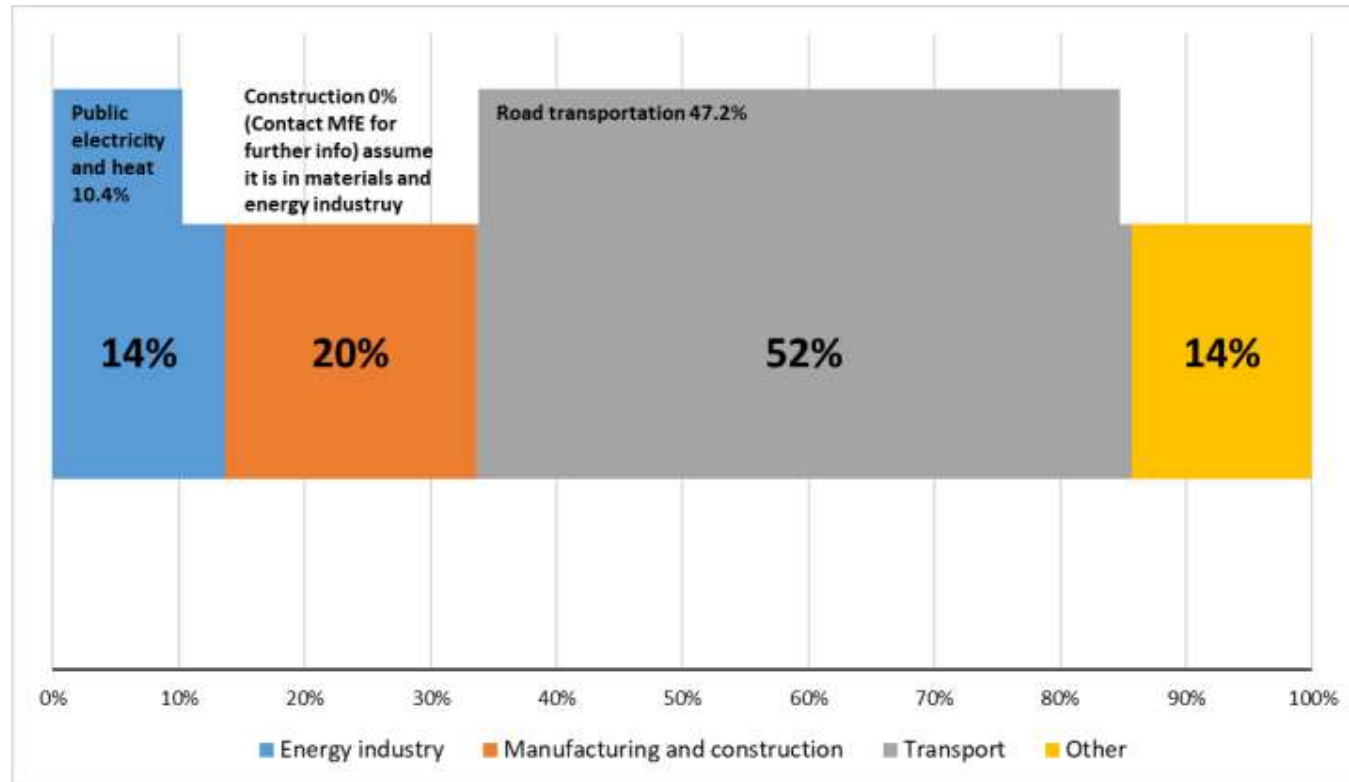


The **energy sector** includes emissions most relevant to housing including:

- Transport (road transportation)
- Energy industry (public energy and heat)
- Manufacturing and construction

The energy industry, manufacturing and construction, and transport make up 86% of the energy sector's emissions

GHG emissions from the energy sector (2018)



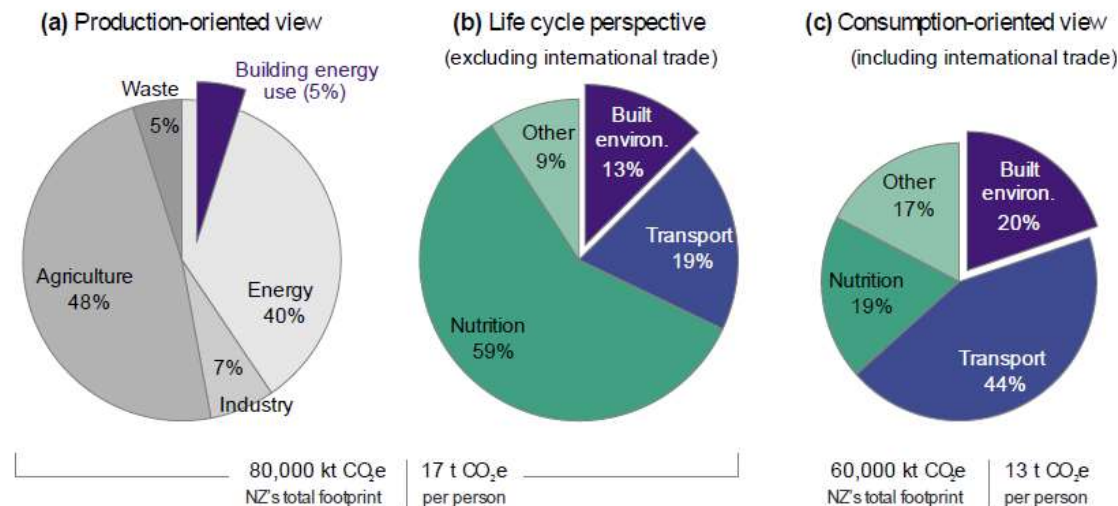
- Emissions from public electricity and heat production were down 8.4 percent from 2017, down 63.3 percent from 2005, and down 5.5 percent from 1990. This reflects our high proportion of electricity generation from renewable sources. In 2018, the share of electricity generated from renewable energy sources in New Zealand was 84 percent.
- Emissions from manufacturing industries and construction were down 9.9 percent from 2017 and up 34.2 percent from 1990. They made up 17.9 percent of all carbon dioxide emissions in 2018 and 20% of all emissions from the energy sector.

(Emissions from the construction industry increased by 66 percent in the decade from 2007 – 2017)

- Road transportation emissions in 2018 were up 2.0 percent from 2017 and up 101.6 percent from 1990. They made up 42.6 percent of all carbon dioxide emissions in 2018 and 47.2% of all emissions from the energy sector.

Transport and the built environment are main targets for reducing GHG emissions. Both categories are related to housing

New Zealand's carbon footprint (2015)



Methodological limitations (key assumptions for the built environment calculation)

Building and construction: All metals and minerals were included

Usage: 56% of all public electricity production, fugitive emissions produced during electricity generation, and all fuel combusted for direct use in heating residential and commercial buildings were included

End of life: Emissions associated with

We would need to look into this more to understand it.

Building & Construction

- In New Zealand, the built environment contributes 13% of emissions from a life cycle perspective, which includes construction, use and end-of-life.^{1,2}

Transport

- Transport makes up 19% of New Zealand's total emissions from a life cycle perspective, which is all from direct combustion emissions (no manufacturing or end-of-life).²
- 91% of transport emissions are from road transport (road freight, passenger vehicles).³

Housing drives both types of emissions

3

How does housing
drive emissions

The life-cycle of housing has direct and indirect effects on GHG emissions

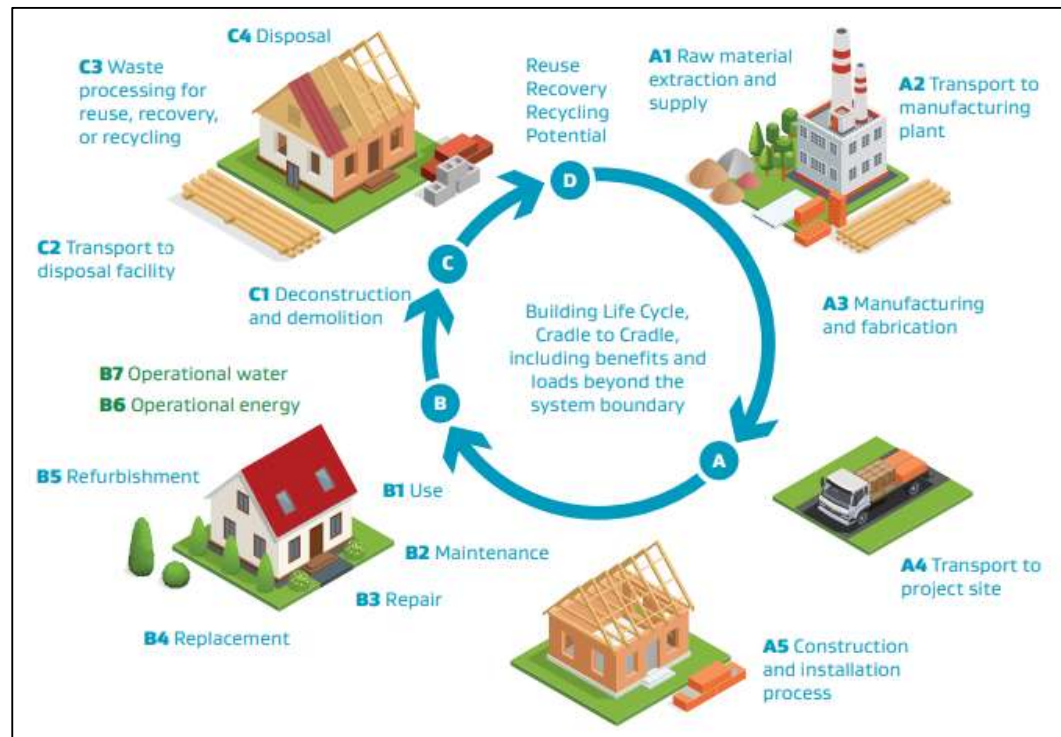
Category		Emissions from...
Direct		
<i>Materials and construction</i>	Product	embodied emissions of the materials, extraction, refinement, transformation etc.
	Construction process	transportation of materials, assembly, energy for construction machinery and wastage at the construction site
<i>Use</i>	Maintenance	repainting etc.
	Replacement	replacing materials ie the roof
	Operational use - energy	heating, cooking, appliances that use electrical outlets, water heating etc.
	Operational use - water	pumping and treating water
	End-of-life	demolition activities
Indirect		
	Transport externalities	road transport emissions
	Construction of new infrastructure networks	if current infrastructure is at or above capacity, new infrastructure is required to service households (road networks, three waters etc.)
	Marginal differences in decision making	Differences in density, topologies and location

3.a

Direct effects

The two major forms of Built Environment emissions are operational and embodied

MBIE “Life cycle stages of a building”

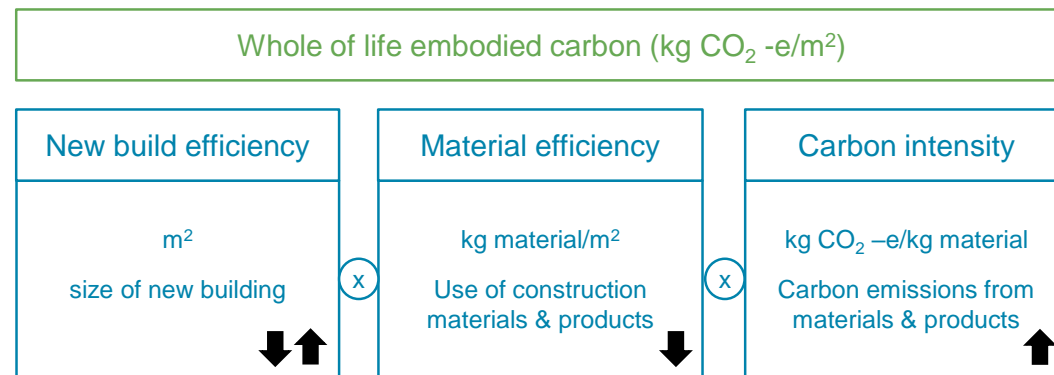


- **Operational emissions:** Emissions directly and indirectly attributable to the operation of buildings. Includes use of energy (heating, cooling, hot water, lighting, appliances) and water.
- **‘Whole-of-Life’ embodied emissions:** Emissions attributable to the building itself. Includes construction materials and products across the lifecycle of building (product manufacture, building construction, renovation, disposal).

New Zealand has been focused on reducing operational emissions. This is only one part of the housing’s contribution to emissions.

Significant emissions are created throughout the building products supply chain...

Decarbonisation opportunity



- 1 **Maximise new build efficiency:** Ensure size and quantity of new builds are proportional to need; upgrade existing buildings; increase longevity of new buildings and their components
- 2 **Increase material efficiency:** Use less material in new buildings - reduce waste and minimise replacement over building lifecycle
- 3 **Reduce carbon intensity of materials:** Use low-carbon materials, and/or reduce the embodied carbon of construction materials

INDEX

↑ Likely increase construction costs ↓ Likely decrease construction costs

Existing policy work



MBIE leading Building & Construction sector's contribution to National Emission Reduction Plan ("NERP").

Proposed framework to reduce embodied carbon emissions in August 2020:

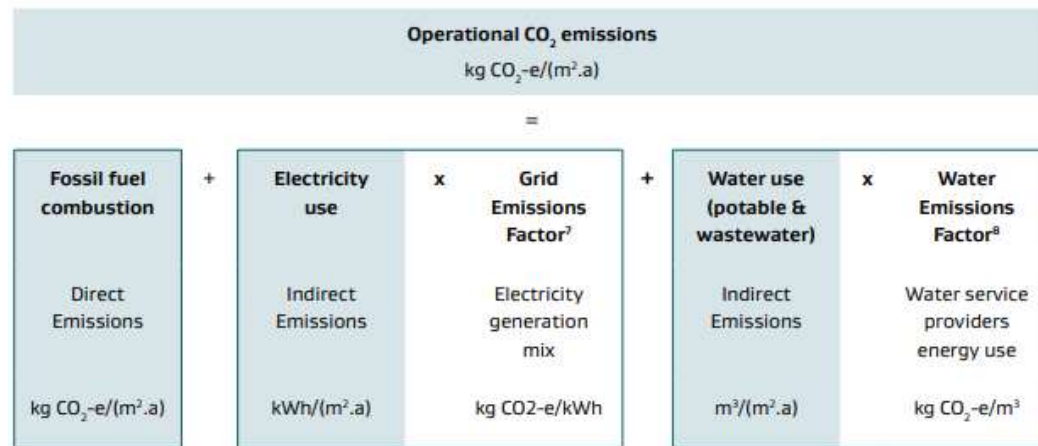
- **Mandatory reporting** of embodied carbon in buildings as part of consent process
- **Mandatory cap that tightens over time** imposed on embodied carbon of buildings; must meet cap to obtain consent

However MBIE framework has constraints:

- **Limited scope:** Only applies to new builds, initially only public sector
- **Difficult to implement in practise:** Hard to quantify/verify emissions of foreign import building materials

...we can reduce operational emissions with good design

Decarbonisation opportunity



Reduce operational emissions: Construct and retrofit buildings with low operational emissions (low fossil fuel combustion, electricity and water use), with reference to the below factors:

- **Architecture:** Shape and orientation of building, solar protections
- **Building envelope:** Insulation, high performance glazing and windows
- **Systems:** Ventilation, heating and air conditioning, appliances, etc.

Note: NZ's electricity generation mix impacts size of emissions reduction opportunity

Existing policy work



MBIE has also proposed framework to reduce operational carbon emissions in August 2020:

- **Mandatory reporting** of operational emissions at consent and code compliance stages
- **Mandatory cap that tightens over time** imposed on operational commissions
- **Limited scope:** New builds only

Government has also introduced Healthy Homes standards and mandatory insulation

Implications for housing market



Average house prices and rents may increase with an imposition of new standards



However this is partially offset by reduced household energy costs, driven by more energy efficient housing design and appliances

3.b

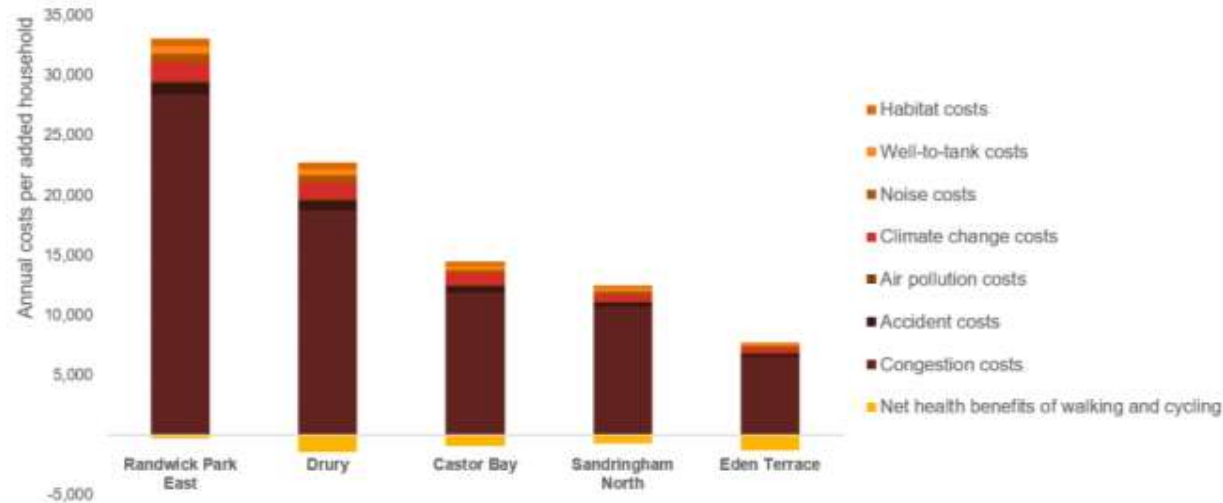
Indirect effects

The transport externalities of housing development go beyond greenhouse gas emissions

Transport externalities of housing development	
Climate change (GHG emissions)	Transport results in emissions of CO ₂ , N ₂ O and CH ₄ (methane), all of which are greenhouse gases contributing to climate change.
Air Pollution (PM₁₀, PM_{2.5}, SO₂, NO_x, NH₃, VOC)	The emission of air pollutants can lead to different types of damages. Most relevant are the health effects due to air pollutants. However, other damages are also relevant, such as building and material damages, crop losses and biodiversity loss.
Well-to-tank emissions	<p>Emissions due to energy production, often also called well-to-tank emissions and includes the production of all different type of energy sources which leads to emissions and other externalities.</p> <p>The extraction of energy sources, the processing (e.g. refining or electricity production), the transport and transmission, the building of energy plants and other infrastructures: all these processes lead to emission of air pollutants, greenhouse gases and other substances.</p>
Habitat damage	Transport has different effects on nature, landscape and natural habitats. The main effects reported in literature are habitat loss (ecosystem loss), habitat fragmentation and negative effects on ecosystems due to the emission of air pollutants (e.g. biodiversity loss/ habitat degradation).
Accident	Accidents occur in all forms of traffic and result in substantial costs, consisting of two types of components: material costs (e.g. damages to vehicles, administrative costs and medical costs) and immaterial costs (e.g. shorter lifetimes, suffering, pain and sorrow).
Noise	Traffic noise is generally experienced as a disutility and is accompanied by significant costs.
Congestion	Congestion is defined as a condition where vehicles are delayed when travelling. In particular, a congestion cost arises when an additional vehicle reduces the speed of the other vehicles of the flow and hence increases their travel time.
Other	Cost of soil and water pollution, up-and downstream emissions of vehicles and infrastructure, external costs in sensitive areas ie mountainous regions, separation costs in urban areas etc.

Dwellings closer to CBDs incur less transport externality costs & People living closer to CBDs typically travel less kilometres (VKT)

Estimated transport externalities per added household by category & Daily added VKT per household by mode



	Eden Terrace	Drury	Randwick Park East	Castor Bay	Sandringham North
Daily added VKT per dwelling by mode (kms):					
Car	26.1	97.5	116.0	61.0	42.7
Bus	6.6	5.9	2.7	12.0	8.4
Train	3.2	5.9	5.3	-	4.4
Cycle	3.1	7.3	3.3	5.1	4.3
Walk	13.6	13.7	5.8	9.0	7.1
Ferry	-	-	-	-	-

- Although congestion costs constitute the majority of transport externalities, there is a trend showing that climate change costs, well-to-tank costs and air pollution costs all increase with distance to the CBD.
- People who live closer to the CBD are more likely to use an active mode of transport and are more likely to use public transport (2018 Census Main means of travel to work by Statistical Area 2).
- Choosing where to develop has important implications on VKT
- Adding a development in Drury as opposed to Eden Terrace results in an extra 71.4 VKT per household per day.

Research from the US suggests that denser and smaller housing emits less carbon

Variable	Effect	Strength of finding (R value and p-value)
Urban	A household in an urban area emits 5.7% less carbon than a non-urban household	(R² = 0.69, p<0.001)
Household size	The total effect of household size is a 20% reduction in per capita emissions	(R² = 0.69, p<0.001)
Dwelling has gas heat	A dwelling with gas heat emits 11.6% less carbon than other types of heating	(R ² = 0.60, p<0.001)
Detached dwelling	A detached dwelling emits 17.5% more carbon than other types of dwellings	(R² = 0.67, p<0.001)
Owner-occupied	An owner-occupied household emits 3.6% more carbon than renting	(R ² = 0.69, p<0.001)

Information about the regression

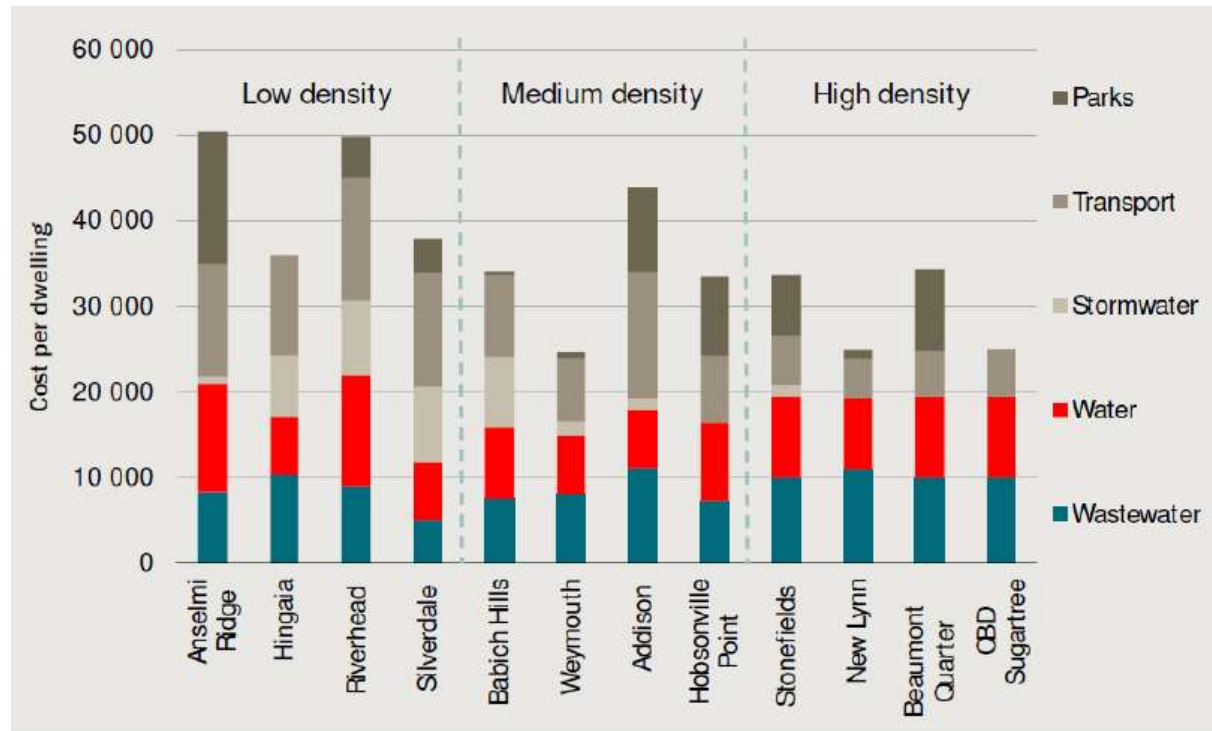
- Log linear regression (Direct effects: RECS regression. Indirect effects: ACS regression.)
- Dependent variable: natural log of household kg CO₂ emissions per capita
- Independent variables: many more (please see appendix)

Limitations

The authors used a scale for the household size variable

Assuming there is a correlation between the cost of infrastructure and 'work done' it is likely that low density and greenfield have larger levels of emissions from infrastructure development

Summary of infrastructure costs by density and asset type (CIE and Arup, 2015)



- This research assessed per-dwelling costs to new infrastructure for twelve new developments in various locations. The composition of costs varied significantly between locations.
- The high degree of variation between sites in turn means that it is difficult to extrapolate these results to other developments.
- **Consistent with international studies, new infrastructure costs tend to be higher for 'greenfield' compared to 'brownfield' development.** This reflects the fact that existing urban areas often, but not always, have existing infrastructure with spare capacity or the ability to be adapted or expanded.
- **On average, infrastructure costs are lower for higher-density developments.** This reflects economies of scale in provision of some types of infrastructure. For instance, when distances between dwellings are lower, less water and sewer pipes are required per dwelling.
- **Notwithstanding these trends, infrastructure costs can vary significantly between sites.** Some low-density greenfield developments will be cheaper to serve than some higher-density brownfield developments.

6

Emissions Trading Scheme (ETS)

We must consider decarbonisation policy in context of ETS

- New Zealand has an ETS that sets a cap on total emissions
- Under a 'pure' ETS, introducing a complimentary decarbonisation policy will not increase total emissions abatement, it will only change which sectors abate (the '*waterbed effect*')¹
- When designing complimentary decarbonisation policy, we should consider:
 - Reducing the supply of emission permits in tandem to compensate for the 'waterbed effect'; and
 - What market failures we are trying to address over and above what the ETS delivers via the price mechanism (e.g. information asymmetry, principal-agent); and
 - Whether complimentary policy is otherwise justified in order to (a) drive shorter term reductions; or (b) serve as an 'enabling action' to start addressing longer-term reductions in hard to abate sectors
- Given our ETS by design finds emissions where they are most cost efficient, it is also important to assess the value for money of different decarbonisation policies

Note: (1) We do not currently have a 'pure' ETS, given we exclude Agriculture, offer generous subsidies and set the cap at a level that arguably generates a price point not significant enough to drive significant behaviour change.
Source: Ministry for the Environment website; Consultation with Treasury TRED team

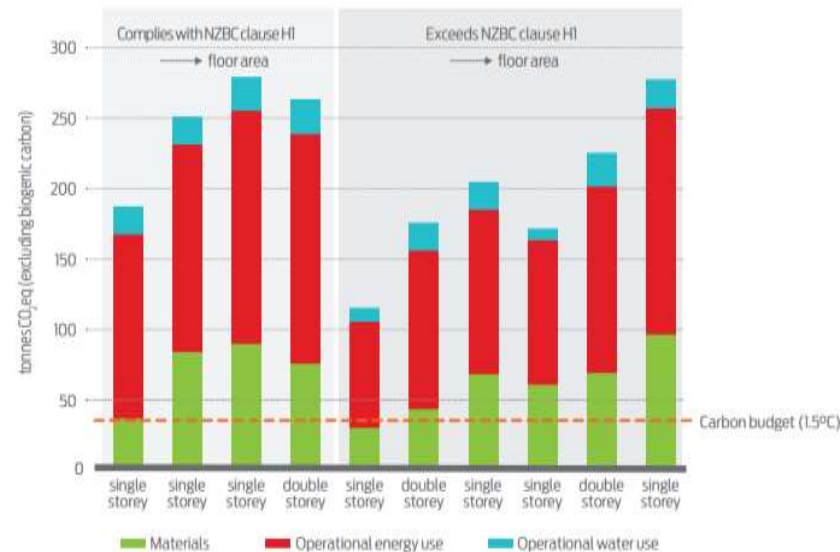
4

BRANZ and
Massey University
research

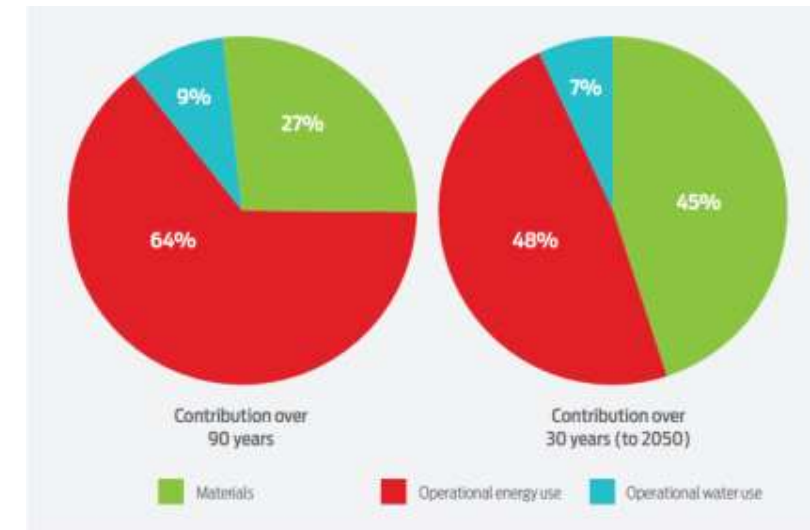
To meet our emissions target the budget for a newly-built detached house is 35 tonnes CO2 equivalent

- There has been little work to calculate the amount of greenhouse gases that a New Zealand house could allowably emit while still moving towards New Zealand's 2050 net-zero carbon goal.
- The BRANZ and Massey method takes a top-down approach that assigns a share of the global carbon budget for 2018–2050 to a country, then to its construction sector and finally to a building. This results in a carbon budget for new buildings in New Zealand until 2050.
- The project also found that the emissions from typically-sized new-build detached houses today exceeds the carbon budget by several multiples.

Total global warming potential (tonnes CO2 equivalent) over 90 years calculated for 10 stand-alone houses



The contribution of materials, energy use and water consumption to a new house's greenhouse gas emissions over different periods of time



The typical house was taken as 198 m2 floor area, based on June 2019 Stats NZ data. With energy use, new houses were simulated to maintain a healthy indoors temperature no lower than 18°C or higher than 25°C

5

Living Standards Framework and He Ara Waiora

LSF analysis indicates decarbonisation policy is not a simple trade-off between natural and financial capital

LSF: Short term vs. long term view



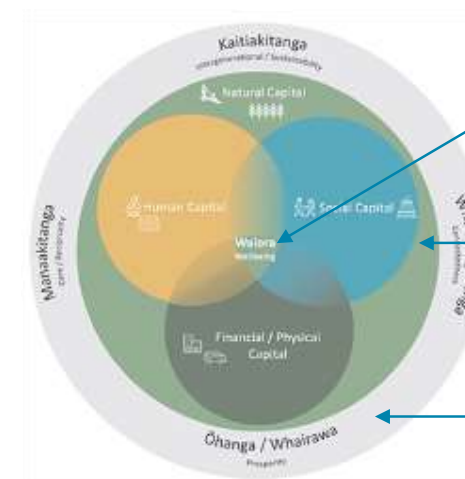
In short term, decarbonisation policies may...

- Draw down financial capital, by imposing additional costs (increased house prices, rents and other expenses) on households and firms¹
- Improve natural capital, by reducing GHG emissions in environment
- Impact social and human capital less directly
- Cause stakeholders to perceive a trade-off between the capitals

However, in the long term...

- Climate change is an existential threat
- Other capitals become increasingly reliant on natural capital to be sustained
- Relationship between capitals changes from trade-off to dependency

He Ara Waiora



Waiora² not human-centric – wellbeing of Te Taiao³ is paramount

Reflected in fact that natural capital underpins other capitals (closer to LSF long-term view)

Tikanga values are means by which we sustain Waiora and Te Taiao

Applying the He Ara Waiora framework

- Would favour a stronger decarbonisation response sooner, given centrality of Te Taiao and our obligations to it
- Calls for decarbonisation approach to reflect manaakitanga and ohanga
 - Must consider distributional impacts of decarbonisation
 - Must ensure that targets are feasible and impacted stakeholders are supported
 - Must seek opportunities to create economic prosperity
- ...and facilitate kaitiakitanga (Māori/Crown stewardship)

Note: (1) Net financial impact dependent on policy design (e.g. a subsidy such as an EV tax credit could be cost-neutral or even positive); (2) Waiora = wellbeing; (3) Te Taiao = the natural world, or the environment

Source: Living Standards Framework (Treasury), He Ara Waiora (Tax Working Group), He Kāhui Waiora (Treasury)

7

How can our team
make an impact?



1. Go to **www.menti.com** on your phone or laptop
2. Type in code: **47 13 4**
3. Answer the above question



Appendix

(Boring stuff that no one will want to read)

Table 4
Results for mediation model of urban and non-urban housing CO₂ emissions: RECS regression and indirect effects from ACS regressions.

Dependent variable: natural log of household kg CO ₂ emissions per capita									
variable	RECS Data				RECS & ACS Data				
	marginal effect ^a	std err	p-val	direct effect (δ and β)	indirect effect rooms (αβ)	indirect effect detached (αβ)	indirect effect age (αβ)	indirect effect gas (αβ)	total effect (β + Σ αβ)
Constant	8.050	0.088	0.000	8.050					
Census urban classification (δ)	-0.057	0.014	0.000	-0.057	na	na	na	na	-0.057
Natural log of population density(indirect)				na	-0.002	-0.006	0.001	-0.008	-0.013
Dwelling rooms per occupant	0.110	0.005	0.000	0.110					
Detached dwelling	0.175	0.018	0.000	0.175					
House age, years	0.001	0.000	0.010	0.001					
Dwelling has gas heat	-0.116	0.014	0.000	-0.116					
Household income \$10-\$15k	0.008	0.034	0.810	ns	0.001	0.000	0.000	0.000	0.001
Household income \$15-\$25k	-0.028	0.020	0.162	ns	0.001	0.000	0.000	0.000	0.001
Household income \$25-\$35k	-0.030	0.019	0.109	ns	0.001	0.000	0.000	0.000	0.001
Household income \$35-\$50k	-0.006	0.019	0.732	ns	0.001	0.000	0.000	0.000	0.001
Household income \$50-\$75k	0.022	0.019	0.254	ns	0.001	0.001	ns	0.000	0.001
Household income \$75-\$100k	0.059	0.020	0.005	0.059	0.001	0.001	0.000	0.000	0.060
Household income > \$100k	0.197	0.020	0.000	0.197	0.002	0.001	0.000	-0.001	0.199
Highest degree: high school	0.005	0.016	0.765	ns	ns	0.000	ns	0.000	0.000
Highest degree: associate's	0.030	0.018	0.113	ns	0.000	ns	0.000	0.000	0.000
Highest degree: undergraduate	0.004	0.019	0.827	ns	0.000	-0.001	0.000	0.000	-0.001
Highest degree: graduate	0.008	0.018	0.670	ns	0.000	0.000	0.000	ns	0.000
Hispanic	-0.129	0.015	0.000	-0.129	-0.024	-0.023	-0.004	0.008	-0.173
Race: black	0.033	0.013	0.013	0.033	-0.012	-0.018	0.001	-0.005	0.000
Race: Asian	-0.116	0.020	0.000	-0.116	-0.090	-0.055	-0.008	0.024	-0.244
Race: other	0.014	0.017	0.409	ns	-0.032	-0.032	0.004	0.006	-0.054
household size	-0.172	0.005	0.000	-0.172	-0.040	0.016	-0.002	-0.005	-0.204
Householder is employed	0.005	0.009	0.539	ns	-0.001	0.000	ns	0.000	-0.001
Householder works at home	0.059	0.009	0.000	0.059	0.000	0.000	0.000	0.000	0.000
Heating degree days, thousand	0.043	0.008	0.000	0.043	na	na	na	na	0.043
Cooling degree days, thousand	0.102	0.014	0.000	0.102	na	na	na	na	0.102
Owner-occupied	0.036	0.016	0.029	0.036	na	na	na	na	0.036
Price per kWh of energy, dollars	-4.801	0.352	0.000	-4.801	na	na	na	na	-4.801
Occupants do not pay for heat	0.036	0.018	0.053	0.036	na	na	na	na	0.036
Household has clothes washer	0.194	0.021	0.000	0.194	na	na	na	na	0.194
Hot meals cooked per week	0.001	0.001	0.145	ns	na	na	na	na	0.000

na = not applicable. ns = not significant at the $p \leq 0.10$ level.

RECS regression : $n = 12,083$, $R^2 = 0.69$, $F = 492$ ($p < 0.001$)
 ACS regressions: rooms : $n = 64,297$, $R^2 = 0.77$, $F = 4,143$ ($p < 0.001$)
 detached : $n = 64,831$, $R^2 = 0.67$, $F = 2,763$ ($p < 0.001$)
 houseage : $n = 64,831$, $R^2 = 0.54$, $F = 1,350$ ($p < 0.001$)
 gas heat : $n = 64,831$, $R^2 = 0.60$, $F = 2,697$ ($p < 0.001$)

^a The marginal effect is the coefficient b for scale variables, and is $(e^b)-1$ for binary variables.



TE TAI ŌHANGA
THE TREASURY

Climate change and KiwiBuild

Direction by the Minister of Finance to include climate change information/ analysis in KiwiBuild briefings and advice

May 2021

MoF has asked for climate change information to be included in KiwiBuild briefings and advice

The New Zealand Government is committed to addressing both climate change and the housing crisis.

- Parliament has set into law a target of net zero emissions of all greenhouse gases, other than biogenic methane, by 2050.
- One of the Government's overarching housing objectives is to “Ensure every New Zealander has a safe, warm, dry, and affordable home to call their own – whether they are renters or owners.”

Accommodating for growth is a necessity - people will live somewhere. The choice is where people are accommodated (rural or urban, CBD or fringe, large house/small house/no house/crowding). Growth and significantly reducing emissions often have competing interests.

- It is important to identify where climate change interventions are the most efficient and effective

The Minister of Finance would like to identify when the *emissions cost to housing benefit ratio* of a KiwiBuild development is relatively higher than other developments (private and public).

Deals that are identified as high relative cost may require a more detailed investigation or warrant some mitigations.

This instruction covers both the direct and indirect emissions associated with housing.

Today we will discuss and plan our response to MoF's request

During this meeting we plan to discuss:

- The DRAFT outline of the report (*below*)
- KiwiBuild characteristics and related information that may be suitable for high-level or detailed analysis (*brainstorm later in the meeting*)
- The options we will provide to MoF (*brainstorm later in the meeting*) + Recommendation/s
- If our response is a Treasury Report or a Joint Treasury and MHUD Report (*MHUD, do you have a preference*)

We are planning on drafting a Treasury Report (or Joint Treasury and MHUD report) in response to MoF's request. The report will include (rough outline, open to change):

- **Background** - the built-environment and emissions, trade-offs between housing and climate change, where climate change intervention is the most effective (i.e. ETS, sector or regional specific, project specific), New Zealand's current climate change framework and plans
- **KiwiBuild** - outline the different levels in KiwiBuild (deal, terms and conditions, programme etc) where changes can be made to consider emissions
- **Benefits vs costs of analysis** – Why the costs of considering climate change will likely outweigh the insight benefits (preference for high-level analysis to minimise costs and risks)
- **Options** – Outline options, explaining what information each option provides and how much work is involved to produce the information
- **Recommendation/s** – Select a high-level or principles based option, with room for more analysis if the deal is very large, in an 'inferior' location, or has other 'high emission-risk' factors

Questions
or
Comments

How does housing drive emissions

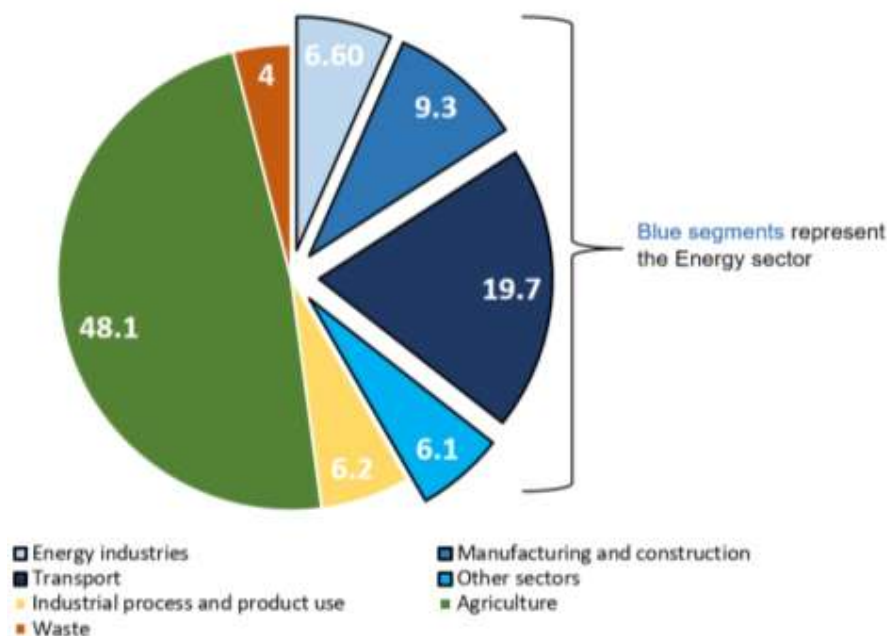
The life-cycle of housing has direct and indirect effects on GHG emissions

Category	Emissions from...
Direct	
Product	embodied emissions of the materials, extraction, refinement, transformation etc.
Construction process	transportation of materials, assembly, energy for construction machinery and wastage at the construction site
Maintenance	repainting etc.
Replacement	replacing materials ie the roof
Operational use - energy	heating, cooking, appliances that use electrical outlets, water heating etc.
Operational use - water	pumping and treating water
End-of-life	demolition activities
Indirect	
Transport externalities	road transport emissions
Construction of new infrastructure networks	if current infrastructure is at or above capacity, new infrastructure is required to service households (road networks, three waters etc.)
Marginal differences in urban form decision making	Differences in density, typologies and location

Although transportation is an indirect emitter in housing – it is the largest emitter in the energy sector

New Zealand CO₂ equivalent by sector 2019 (percentage)

Source: MFE New Zealand's Interactive Emissions Tracker, production orientated view



All statistics below are from 2019

The **energy sector** accounted for 41.6% of gross emissions.

Road transportation accounted for 17.8% of gross emissions, with:

- **Cars and motorbikes** making up 11.4% of gross emissions
- **Light duty trucks** making up 4.6% of gross emissions; and
- **Heavy duty trucks and buses** making up 1.9% of gross emissions.

Public electricity and heat accounted for 5.1% of gross emissions.

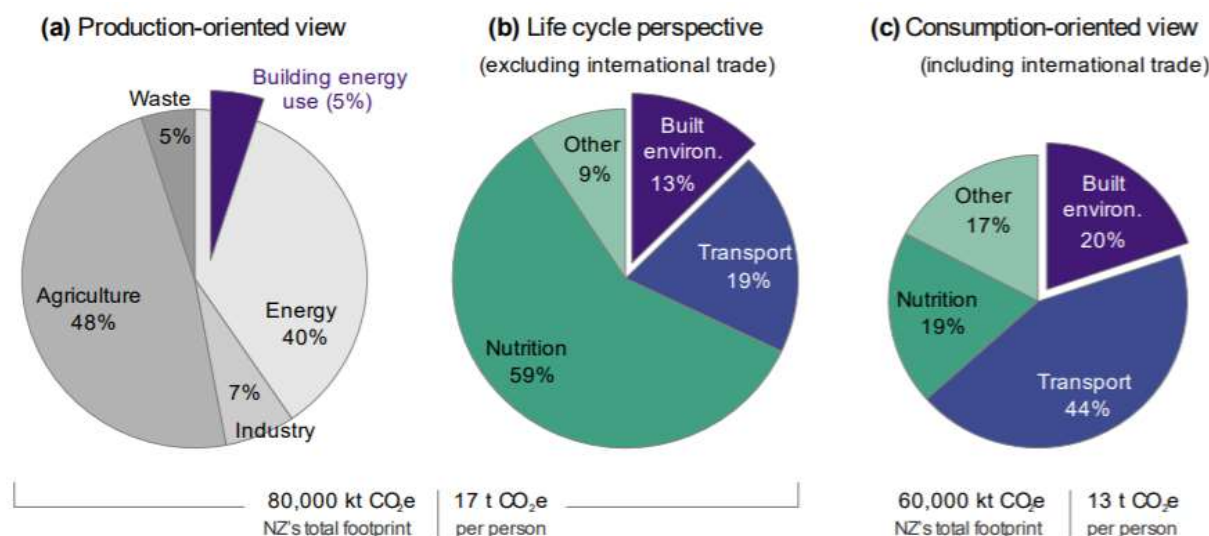
Manufacturing Industries for relevant materials accounted for 1% to 2.5% of gross emissions. **Construction emissions** are recorded as nil, as the emissions are included in transport, materials and manufacturing.

The 'built-environment' includes embodied and operational emissions – it is difficult to separate between housing and other built structures

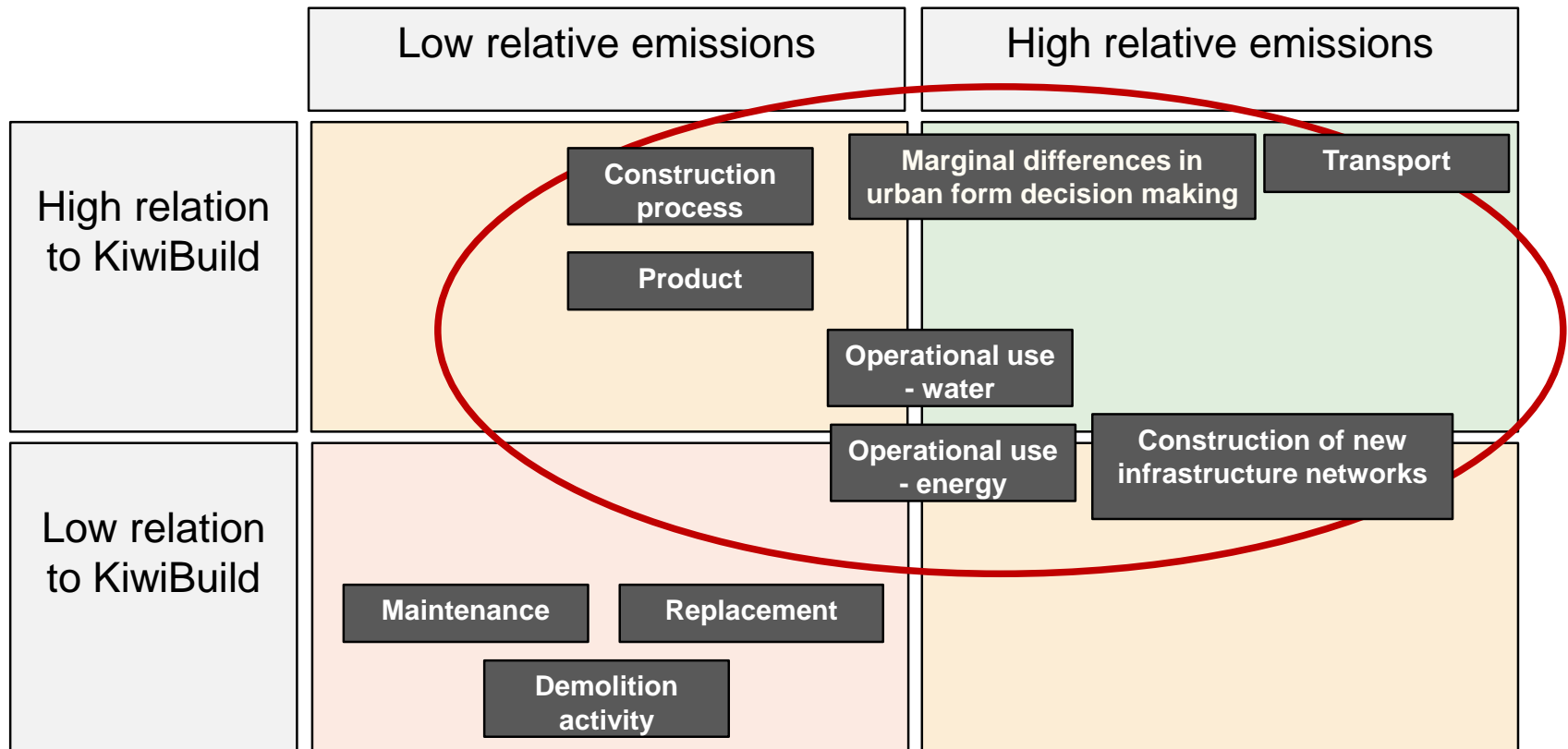
If we consider the full life cycle (construction, use and end-of-life), the contribution of the built environment increases to approximately 13% of New Zealand's gross carbon footprint. If we then adjust for the carbon footprint embodied in our exports (dairy, meat, etc.) and our imports (cars, trucks, clothes, etc.), this share climbs to 20%.

In this context the consumption-orientated view is less important as we cannot reasonably expect New Zealanders who are eligible for KiwiBuild to influence climate change through their home purchasing decisions.

A breakdown of New Zealand's carbon footprint in 2015 from (a) a production perspective, (b) a life cycle perspective, and (c) a life cycle consumption perspective



We are proposing categories that are related to KiwiBuild activities and are significant emitters should be considered



We should consider the efficiency and outcomes related to the level of climate change intervention

1

Emissions Trading Scheme

- Central policy lever (cap, cost-efficiency)
- But also imperfect (non-comprehensive, does not account for certain market failures)

2

Sector and/or regional-specific interventions

- May be justified, especially where they reinforce the ETS
- Requires careful assessment for impact and value for money

3

Project-specific interventions

- Typically less justified (low marginal impact, better levers)
- Can present opportunities (e.g. data capture)

Example framework

Additional abatement		Will the policy drive additional abatement beyond what the ETS can deliver? How much?
Reinforce ETS		Will the policy reinforce the ETS by overcoming a government or market failure preventing a response to the ETS price signal?
Value for money	Economic impact	What is the economic impact of the policy? Does it impose additional cost at a firm or household level?
	Fiscal impact	What is the fiscal impact of the policy?
	Co-benefits	What is the value of co-benefits from the policy?
Distributional impacts		What are the distributional impacts of the policy?

Climate policy should not artificially constrain urban growth

1

Theory

- Urban containment policies prevent competitive urban expansion at the urban-rural fringe
- This constrains the supply of land and artificially drives up urban land prices, in turn putting pressure on house prices

2

Analysis

- We have conducted simple analysis estimating the marginal abatement cost (MAC) through land-use change (urban to farm). **The results indicate that the cost of abating one tonne of carbon equivalent is between \$1,700 and \$1,900.**
- MAC for land use change from farm to forestry ranges from the negatives to \$250. this Implies limiting up-zoning of rural land is one of the most costly ways of abating carbon emissions

3

Practise

A recently study on urban growth, led by Shlomo Angel, found:

- Only 25% of the total population added to 200 cities in 1990-2014 was accommodated within 1990 urban footprints...
- ...despite 129 (66%) of these cities saying containing expansion was an explicit goal in their zoning and land use plan

Therefore we should aim to...

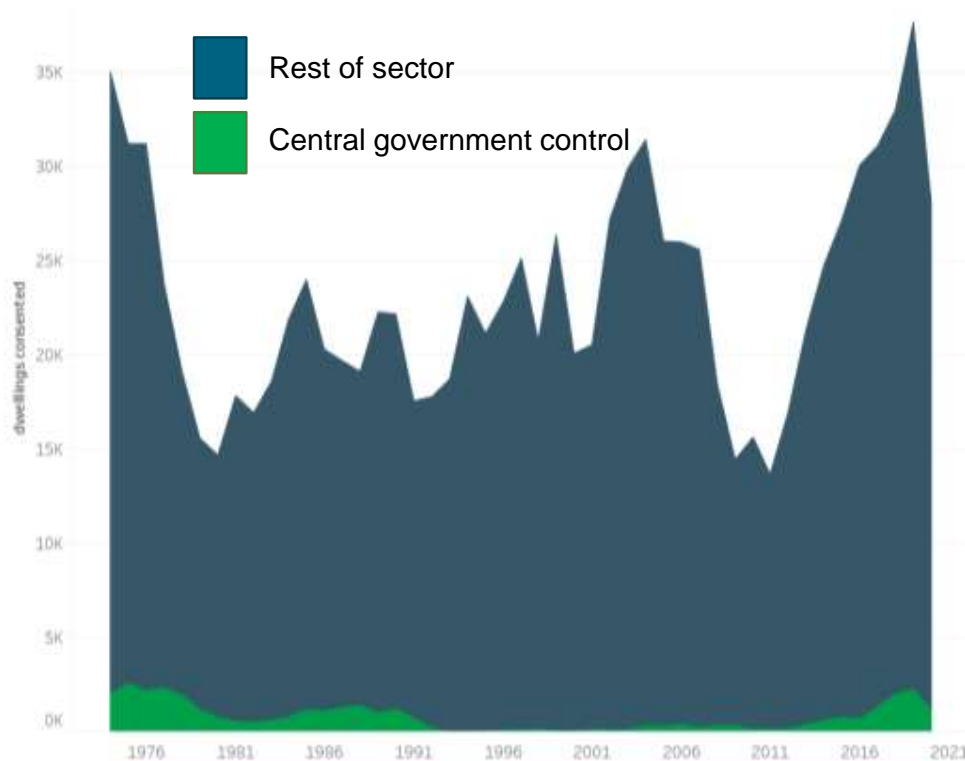
1. Incentivise intensification,
2. without imposing additional barriers to expansion, and
3. support decision-making that lowers the relative emissions profile of green-fields

KiwiBuild and the new build market

KiwiBuild homes account for a small proportion of new housing stock

Building consents by institution

source: Stats NZ



From 2018 to January 2021 2,184 KiwiBuild homes (including public housing) have been contracted nationally.

Over the same time period around 113,000 homes have been consented.

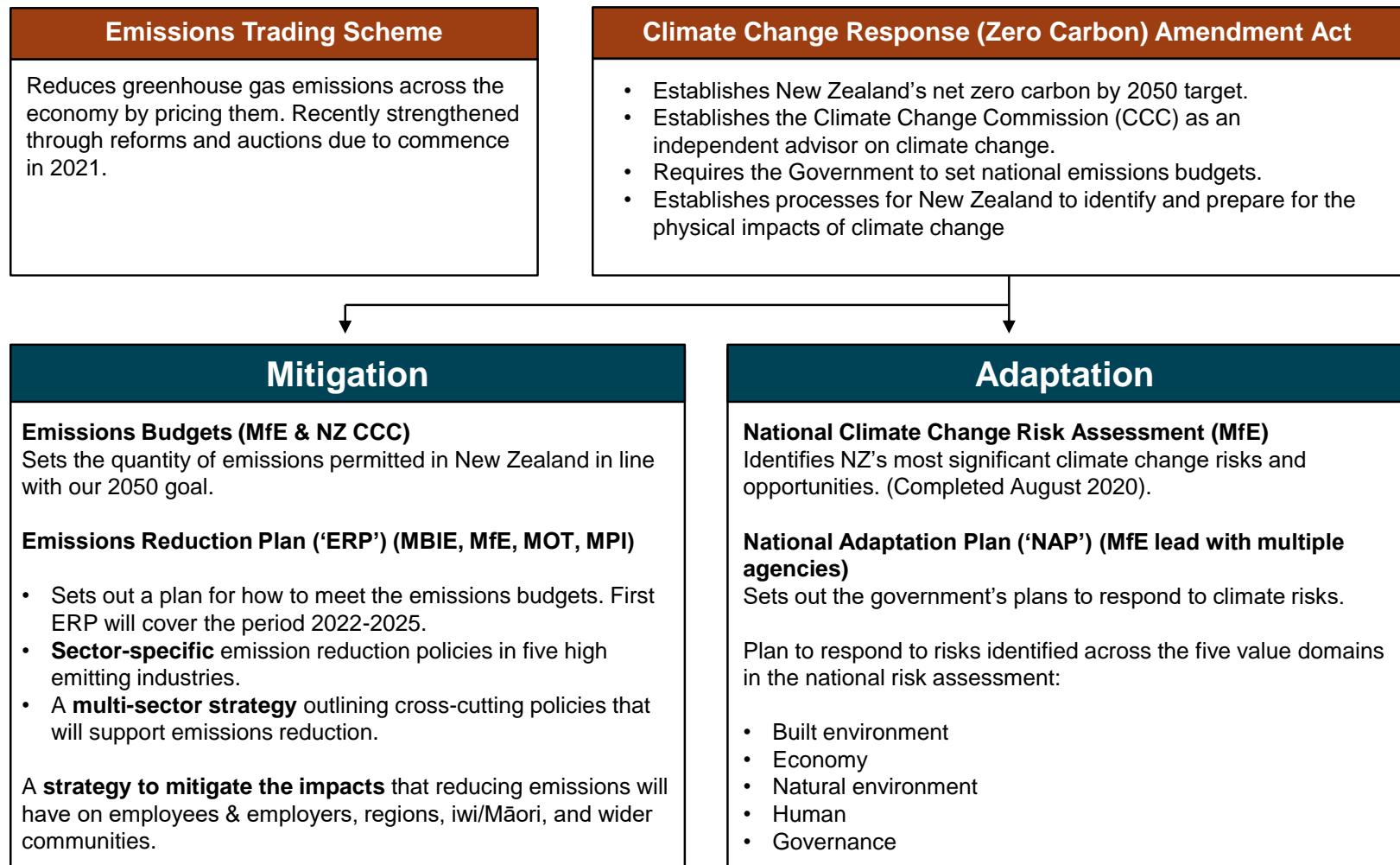
KiwiBuild homes have accounted for around 2% of new housing yield. It is unclear whether KiwiBuild timeframes or market timeframes are slower to deliver housing after consent or contracts have been given.

If KiwiBuild timeframes are slower then it is likely that the estimate above would be smaller.

The costs of considering climate impacts at this level, in a detailed way, may outweigh any benefits.

Climate Change: Work in progress

New Zealand has a working framework to address climate change



MBIE and MOT are already leading climate change work in this space under the ERP & NAP

The government's emissions reduction plan will be developed by a cross-government group of agencies (MBIE, MfE, MOT, MPI).



MBIE

Emissions from building and construction

MoT

Transport emissions

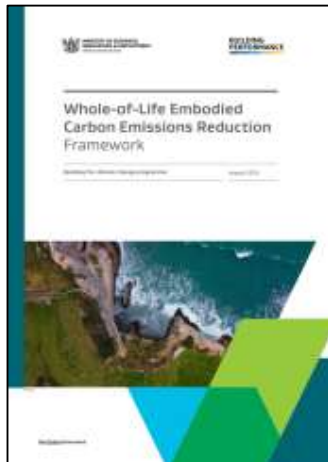
MFE

MFE is looking at the broader planning/urban system and infrastructure, amongst other things.

MBIE is working on mandatory reporting and caps for embodied and operational emissions

Are there any other workstreams underway?

Existing policy work



Proposed framework to reduce **embodied carbon emissions** in August 2020:

- **Mandatory reporting** of embodied carbon in buildings as part of consent process
- **Mandatory cap that tightens over time** imposed on embodied carbon of buildings; must meet cap to obtain consent



Proposed framework to reduce **operational carbon emissions** in August 2020:

- **Mandatory reporting** of operational emissions at consent and code compliance stages
- **Mandatory cap that tightens over time** imposed on operational emissions

Government has also introduced Healthy Homes standards and mandatory insulation.

However MBIE's framework has constraints:

- **Limited scope:** Only applies to new builds, initially only public sector
- **Difficult to implement in practise:** Hard to quantify/verify emissions of foreign import building materials

Question for MBIE:

What is the timeframe for both new frameworks to apply to KiwiBuild?

MOT recently released “Transport Emissions: Pathways to Net Zero by 2050”

Are there any other workstreams underway?

Existing work: discussion paper

Hikina te Kohupara identifies opportunities to reduce emissions across three themes, based on the ‘Avoid, Shift, Improve’ framework.

- 1) **Changing the way we travel**
- 2) Improving our passenger vehicles
- 3) Supporting a more efficient freight system

Theme 1 is most relevant to KiwiBuild developments. Below are key points related to Theme 1. MOT note that we can reduce emissions by:

- Promoting compact urban form (including mixed-use zoning)
- Invest in PT and other ‘low-emissions’ infrastructure i.e. walkways and reconsider planned investments into highways and roads
- Designing and managing streets to be more inclusive and encourage PT and active modes by applying multi-modal street layouts, lower speed limits
- Placemaking to support higher density development
- Transport demand management, including transport pricing



Options

We currently have three options (open to more ideas) to provide to MoF

1) **Do nothing**

- The current government framework including the ETS, Zero Carbon Amendment Act, Emissions Reduction Plan and National Adaptation Plan is sufficient.
- KiwiBuild homes account for 2% of new housing stock, therefore

2) Have regard to a set of principles (outlined on the following slide) acting as a high-level indication of relative emissions between KB developments and the **counterfactual**. There are potentially sub-options here, whereby some categories are excluded i.e. indirect emissions.

3) Detailed quantitative analysis (against a counterfactual) across relevant emissions related to housing including transport (VKT), PT use, embodied and operational emissions of the development. Accompanied by qualitative analysis into other categories such as developer track record.

The HUG team have drafted the following principles, we are keen to get your thoughts

Principles	Non-detailed analysis	Current analytic frameworks and methodologies (detailed assessment)	Info currently in briefings
Aim to minimise transport emissions by prioritising areas that are close to jobs, amenity and public transport			
Vehicle kilometres travelled (VKT)	Use 'narrative' that larger distances from a CBD or an employment hub leads to larger VKT.	A methodology for strategic assessment of the wider costs and benefits of urban growth (PwC 2020, commissioned by MHUD) and compare to the counterfactual	No
Access to employment (not directly related to emissions, could remove)	Comment on distance to nearest employment hub (via private vehicle and PT)	“ – using EJD and AEJD measures	No
Access to public transport	Select a reasonable 'catchment' based on distance (meters) or walking distance and comment on time to the nearest employment hub as well as CBD	Use 2018 Census main means of travel to work at the SA2 level to determine what proportion of people use PT to get to work in the area.	Yes, in a high-level manner
Aim to minimise operational and embodied emissions by prioritising denser typologies and 'eco-friendly' materials, fittings and design features			
Design and features including fittings and appliances	Comment on design features or appliances i.e. solar panel, homestar, greenstar, fitted with energy efficient appliances	Calculate the marginal difference in operational emissions between the 'counterfactual' home/ appliance and the KB new build	partially
Materials	Comment on building materials etc. May run into issues with buildings being made with concrete, which is high in emissions compared to wood or steel (but much cheaper)	Calculate the marginal difference in embodied emissions (per dwelling) between the 'counterfactual' home and KB new build	No
Construction			No
Typology (density)	Use current insights that denser and smaller housing typically emits less than stand-alone houses from a operational perspective. Unsure about a embodied perspective.	Sum the two cells above for the counterfactual vs KB dwelling OR conduct new research/ analysis into the relationship between emissions and typology	Yes
Size of home		Similar to the above	Yes
Other			
Developer track record with climate change	Developer to provide	N/a	No
LSF component	To be developed	N/a	No

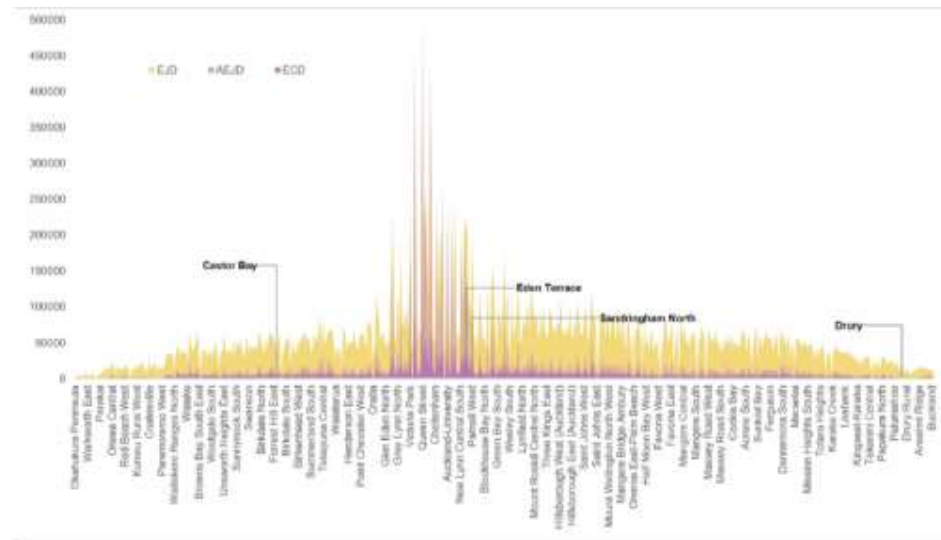
Analysis suggests that as distance to the CDB increases added VKT increases and EJD decreases

Added travel distance per added dwelling - Auckland

	Eden Terrace	Drury	Randwick Park East	Castor Bay	Sandringham North
Daily added VKT per dwelling by mode (kms):					
Car	26.1	97.5	116.0	61.0	42.7
Bus	6.6	5.9	2.7	12.0	8.4
Train	3.2	5.9	5.3	-	4.4
Cycle	3.1	7.3	3.3	5.1	4.3
Walk	13.6	13.7	5.8	9.0	7.1
Ferry	-	-	-	-	-

Based on 2018 commute patterns (national census survey), the average added vehicle and passenger kilometres per added household is estimated.

Access to employment and agglomeration raw scores by SA2 - Auckland



The 'raw score' indicates the count of 'effective jobs' accessible from each SA2, determined by the sum of jobs, with an adjustment for distance, for each SA2 where census data shows a commuting flow either to or from the SA2 in question.

The current counterfactual to a KB development is **no** development – so we need a reasonable comparator

Our working method is to benchmark development and household behaviour to the average household at the national level

- For example, the average existing household is:
 - stand-alone
 - 156 sqm (2019)
 - is made from wood etc (include household behaviour like average VKT)

However, we still have the following questions of \what the counterexample should look like including:

- Should the counterexample be set to the average existing home or the average new build
 - This depends on how we view KiwiBuild. If KiwiBuild creates homes that would NOT have been built otherwise, then the counterexample should be the average existing home (likely with overcrowding implications).
 - If KiwiBuild creates homes that displace the development of 'different' homes i.e. more expensive and less dense, then the counter example should be the average new build.
- Seeing that a majority of deals are in Auckland, should the counterexample for KB developments be at the national or Auckland level.

Our initial view is to recommend the ‘do nothing’ or ‘to have regard to principles’ option

For ‘high relative emission risk’ deals or particularly large deals MoF may want the opportunity for detailed analysis OR would be keen to introduce mitigation factors to the deal to help offset emissions. However, any detailed analysis comes with costs, barriers to development and risk.

Other questions:

- Are there other options that we should consider?
- Are people comfortable with our tentative lead options?

Brainstorm

If we recommend the 'to have regard to principles' option

- what information would this provide
- who would do this work
- how much work is involved to produce this information

Costs, barriers and risks as a result of providing detailed analysis

Detailed analysis comes with costs, barriers to development and risk

- Increase in FTE required to conduct detailed analysis (may need to hire new people)
- The detailed analysis work is quite technical and would require high skilled workers (existing capabilities gap)
- Risk of creating further barriers for developers and driving them away or slowing down negotiations
- Risk of creating cottage industry (irrelevant or unhelpful analysis, over analysis)
- The size of the problem (around 2% of new housing stock) is small, and any insights and subsequent changes/ mitigations to a deal are unlikely to drive change
- Risk of 'doing the work twice' - Work at a higher-level is already being done and KiwiBuild will operate under those 'new rules' i.e. the ERP and NAP as well as MBIE's operational and embodied emissions monitoring and caps
- Difficulty of establishing a stable counterfactual
- **OTHER**