MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

Submission Form

Building for Climate Change

1. Contact details (optional)

Name:	Brendan Donnell
Company/organisation	Engineers for Social Responsibility
Email address:	brendan.donnell@gmail.com

2. Are you making this submission on behalf of a business or organisation?

☐ No

☒ Yes (please tell us which Company/Organisation you are making this submission on behalf of)

Engineers for Social Responsibility, Inc.

3. Would you like to:

Remain anonymous in the published consultation summary report	☒ No	☐ Yes
Receive a copy of your own submission	☒ No	☐ Yes
Receive future updates on Building for Climate Change programme	☐ No	☒ Yes

4. Are you willing to be contacted in relation to your submission if MBIE has questions about your response?

☐ No ☒ Yes

5. The best way to describe your role is:

☐ Architect	☐ Building owner	☐ Geotechnical Engineer
☐ Building Consent Authority/Officer	☐ Electrician	☒ Structural Engineer
☐ Builder	☒ Engineer – other	☐ Plumber/Gasfitter/Drainlayer
☐ Building product/material supplier	☐ Fire Engineer	

☒ Other: *Engineering Society*

To submit this form via email:
Once you have completed the form, you can email it to BfCC@mbie.govt.nz, with "Submission" in the subject line.

To submit a print copy of this form:
You can post or courier your submission to:

Via Courier:

Building System Performance
Ministry of Business, Innovation and Employment
Building for Climate Change Submission
15 Stout Street,
Wellington 6011

Via Post:

Building System Performance
Ministry of Business, Innovation and Employment
Building for Climate Change Submission
PO Box 1473
Wellington 6140

Overarching approach of the Building for Climate Change programme

6. Do you agree or disagree that the Building and Construction Sector needs to take action to reduce emissions?

☐ Strongly disagree ☐ Disagree ☐ Neither ☐ Agree ☒ Strongly agree

Please tell us why.

Current scientific advice indicates the key design requirement for the safety of all humanity's infrastructure and the wellbeing and sustainability of natural ecosystems and species is an 80% reduction of fossil fuel production within two decades.

To meet social & economic needs while phasing out this energy source, we will need to consider the consequential issues of a sustained decline in energy supply and material consumption in all sectors of the economy.

7. What support do you think you or your business would need to deliver the changes proposed in the frameworks?

We suggest a three-pronged approach is used, supported by documentation defining appropriate design outcomes & methodologies:

1. Building Code minimums - as per the currently proposed approach, including simplified methods.
2. Building Code Acceptable Solutions, Verification Methods and Alternative Solutions, giving guidance on optional better practice.
3. Government building procurement done as a sustainable building programme that is able to address all phases of the design, materials supply, construction and operation process.

8. Are there any barriers that are currently preventing (or discouraging) you, or your business, taking action to reduce emissions?

☐ No ☒ Yes

Please identify the main challenges.

- Lack of regulatory requirements for consideration of embodied emissions, meaning that it is a relatively low priority for most building developers and clients.
- Limited availability of low-carbon materials in the construction market – meaning that specified low-carbon products tend to be substituted for conventional products at the request of construction contractors due to supply and cost constraints.
- Lack of an established and methodology to account for embodied emissions, with comprehensive embodied emissions data that is specific to the New Zealand context.
- Lack of training and experience in calculating embodied carbon.
- Design being done on an individual building basis as opposed to a programme of buildings, the design fees and timeframes for an individual building are inadequate for product development and step-change improvements. However government building works are well placed for a sustainable building design programme.
- A 'low hanging fruit' is the use of mass timber floors as a substitution for high rise concrete floor but there is inadequate design guidance, NZ manufacturing capability and expertise in its design and construction. However this could be addressed by a programme approach in government procurement of mass timber buildings.

9. Do you think the Building for Climate Change work programme should include the following building classifications?

	No	Yes
Housing	☐	☒
Communal Residential	☐	☒
Communal Non-Residential	☐	☒
Commercial	☐	☒
Industrial	☐	☒

If you have indicated that you believe one, or more, building classifications **should not** be included, please tell us why

Framework: Transforming Operational Efficiency

10. Do you agree or disagree that the Building for Climate Change work programme should include measures to improve the operational efficiency of buildings in New Zealand?

Strongly disagree	Disagree	Neither	Agree	Strongly agree
☐	☐	☐	☐	☒

Please tell us why.

Fossil fuel combustion yields an energy return on energy invested (EROI) that is unparalleled by other energy sources (with the exception of hydroelectricity). To meet social & economic needs while phasing out this energy source, we will need to consider the consequential issues of a sustained decline in energy supply. This increases the future importance of energy efficiency.

Energy efficiency also plays a role in maximising NZ's renewable electricity generation by levelling peak electricity demand on the grid - since supply & demand balancing is more difficult using some forms of renewable generation (e.g. wind) than when burning coal or gas.

11. The Framework proposes that operational efficiency requirements tighten in a series of steps to reduce emissions in the Building and Construction Sector, with the requirements for each step published at the outset and the final step being reached by 2035.

Do you support a gradual introduction of operational efficiency requirements, using a stepped approach?

☐ No ☒ Yes

12. Do you think the timeframe is appropriate?

☒ Yes ☐ No, it's too short ☐ No, it's too long

Please tell us your ideal timeframe if it's not by 2035.

Scientists inform us that the requirements for the safety of all humanity's infrastructure & the well-being and sustainability of all natural ecosystems and species requires 80% reduction of fossil fuel production across the board within 20 years. We support a 2035 timeframe for 80% emissions reduction.

The Montreal Protocol to protect the earth's ozone layer is regarded as one of the world's most successful environmental agreements. The negotiators developed a highly flexible instrument which could increase or decrease controls in response to scientific data. It was only after the initial framework was negotiated that it was discovered that early conclusions about the extent of ozone depletion turned out to be significantly under-estimated. This flexibility meant the protocol could be amended to include stricter controls. Starting out modestly also encouraged a greater confidence in the process. Based on these lessons, we support the idea of incremental control of operational CO2-e emissions. Incremental controls should also be imposed on embodied emissions. However, we recommend that MBIE make provision for the initially published timeframes to be shortened if necessary in response to new scientific information, subject to appropriate notification periods.

From the outset there should be guidance for optional better practice that already meets the 2035 targets for those building developers that wish to be industry leaders.

13. The Framework proposes that a number of building types will be exempt from operational emission reduction requirements.

Do you agree or disagree with the proposal to exclude the following from operational efficiency emission reduction requirements?

	No	Yes
Outbuildings	☐	☒
Ancillary buildings	☐	☒

Please tell us why.

We concede that this is a pragmatic approach, focussing efforts on where the most benefit can be gained. However, we recommend imposing the following limitations for buildings to be considered exempt:

- Outbuildings or ancillary buildings with fossil fuel combustion > 0kgCO_2-e/(m^2.a) are not exempt from operational efficiency reduction requirements.
- Outbuildings or ancillary buildings with electricity use > X kgCO_2-e/(m^2.a) are not exempt from operational efficiency reduction requirements (limit to be determined by MBIE).

Approach

14. The Framework proposes that operational efficiency requirements will only apply to new buildings initially with further work to look at requirements for existing buildings being undertaken at a later date.

Do you support this approach?

☐ No ☒ Yes

Please tell us why.

Recent research in the field of Transition Engineering indicates that regeneration of existing systems is often required in order to achieve 80% emissions reduction targets.

The proposed approach will provide an initial advantage to regenerative solutions (e.g. redevelopment or regeneration of existing systems), since renovation/redevelopment works would be exempt from the emissions controls applied to new buildings.

However, it is important that demolition controls are applied. Existing buildings represent a significant investment of embodied energy, and the associated emissions need to be accounted for prior to demolition if we are to reduce material consumption.

We recommend that upgrades to the operational emissions performance of existing buildings are handled in a similar way to seismic upgrades in existing buildings – i.e. buildings are triaged through an initial evaluation procedure to identify & prioritise upgrades to the worst performing buildings, and upgrades are triggered if substantial alterations are made (i.e. alterations with an estimated value of at least 25% of the building's value and more than $150,000). We suggest that this system could be phased in after 5 years, if it is considered too demanding for inclusion in the initial scope for the framework.

15. Do you support a limit on emissions from fossil fuel combustion to operate buildings (e.g. for space and water heating)?

☐ No ☒ Yes

Please tell us why.

80% reduction in carbon emissions arising from fossil fuel combustion is a key system performance requirement for the economy as a whole. It is unlikely that the small amount of fossil fuel that remains in use would be prioritised for use in heating buildings.

16. Do you think that new Thermal Performance requirements based on heating and cooling demand should be introduced to support increased operational efficiency of buildings?

☐ No ☒ Yes

Please tell us why.

Thermal performance requirements will help reduce peak electricity demand, making it easier to achieve 100% renewable electricity generation. However, care should be taken to express key design requirements in terms of CO2-e, to maintain consistent focus on emissions reductions as an overarching objective.

17. Detailed requirements for the efficiency of fixed services (such as heating and cooling systems, artificial lighting, hot water systems and appliances, ventilation systems etc) are not currently set out in the Building Code.

Do you think that Services Efficiency performance requirements should be introduced to support increased operational efficiency of buildings?

☐ No ☒ Yes

Please tell us why.

Thermal performance requirements will help reduce peak electricity demand, making it easier to achieve 100% renewable electricity generation (since supply & demand balancing is more difficult using renewable generation (e.g. wind) than when burning coal or gas). However, care should be taken to express key design requirements in terms of CO2-e, to maintain consistent focus on emissions reductions as an overarching objective.

To make this rationale more explicit, we recommend that a maximum peak daily electricity demand is imposed for winter space & water heating for new residential buildings, e.g. measured in kWh/m^2. Heating devices must be installed at the time of construction to achieve the desired indoor environmental quality (IEQ) for health and safety, while complying with peak demand limits. These design limits could be applied regardless of any automated demand management measures that may be in place (e.g. ripple control management of hot water heating demand).

18. The framework proposes that there are requirements for the plug loads for large buildings*, but not small buildings. Do you support this approach?

(*Large and small buildings as defined in the framework scope section)

☐ No ☒ Yes

Please tell us why.

We concede that this is a pragmatic approach while introducing the new regulations, but steps must also be taken to reduce peak winter heating demands from all residential buildings (large & small). We recommend:

- That energy metering and management systems be mandatory for all buildings, to allow building occupants to manage peak load.
- That MBIE works with the electricity sector to develop clear strategy & protocols for the use of demand management techniques for buildings, such as ripple control or pilot wire systems for control of hot water heating. Consider opportunities for other non-essential power demand to be controlled during peak times (e.g. plugs loads designated for non-essential use within buildings).
- That a maximum peak daily electricity demand is imposed for winter heating of new residential buildings, e.g. measured in kWh/m^2. Heating devices must be installed at the time of construction to achieve the desired indoor environmental quality (IEQ) for health and safety, while complying with peak demand limits.
- That regulatory powers are retained that would allow plug load controls to be applied to small buildings in future.

19. The Framework proposes that new buildings will not be required to include onsite renewable energy generation or energy storage capacity. Do you agree or disagree with this proposal?

Strongly disagree	Disagree	Neither	Agree	Strongly agree
☐	☐	☐	☒	☐

Please tell us why.

We support this approach, since NZ's national grid is likely to generate electricity with greater efficiency and lower embodied emissions than many on-site generation options (i.e. national grid offers better energy return on energy invested).

Regulations should account for the embodied carbon associated with any on-site generation equipment that is installed (as for other services plant), although this can be offset by the emissions reductions during operation (e.g. offset = electricity generated kWh/(m^2.a) x grid emissions factor kg CO_2/kWh).

We recommend that MBIE consider alternative ways of incentivising solar hot water heating, since this is a particularly efficient technology when properly implemented. To promote efficient hot water heating systems, MBIE should create guidelines and/or regulations to improve hot water heating system performance (e.g. limits on heat radiation to space at night, minimum requirements for service life).

20. The Framework currently proposes to exclude the following elements from the Building for Climate Change work programme. Which do you think should be included or excluded?

	Should be included	Should be excluded
Electrical appliance efficiency	☐	☒

On-site collection and storage of water	☐	☒
On-site waste water treatment	☐	☒

Please tell us why.

Electrical appliance efficiency:

We concede that this is a pragmatic approach while introducing the new regulations, but steps must also be taken to reduce peak winter heating demands from all residential buildings (large & small). We recommend:

- That energy metering and management systems be mandatory for all buildings, to allow building occupants to manage peak load.
- That MBIE works with the electricity sector to develop clear strategy and protocols for the use of demand management techniques for buildings, such as ripple control or pilot wire systems for control of hot water heating. Consider opportunities for other non-essential power demand to be controlled during peak times (e.g. plugs loads designated for non-essential use within buildings).
- That a maximum peak daily electricity demand is imposed for winter heating of new residential buildings, e.g. measured in kWh/m^2. Heating devices must be installed at the time of construction to achieve the desired indoor environmental quality (IEQ) for health and safety, while complying with peak demand limits.
- That regulatory powers are retained that would allow plug load controls to be applied to small buildings in future.

On-site water collection, storage and treatment

Water savings are important aspect of adapting to increased population/demand and increasingly variable climate but belong in a different strategy/framework. When addressing complex problems like climate change, it becomes valuable to maintain clarity on the problem you are working on. In this case, the politically mandated objective is net-zero carbon emissions by 2050. The promotion of water use efficiency should be addressed by a separate resource use cap (not related to CO_2-e emissions), either as a separate section within the current operational efficiency framework, or in a separate document.

21. Buildings need to provide suitable indoor environmental quality (IEQ) for good occupant health and wellbeing outcomes. The Framework identifies the following critical IEQ parameters:

- Air temperature
- Relative or absolute humidity
- Ventilation rates
- Surface temperature
- Hygienic surface temperature (avoidance of mould)
- Daylight provision

If there are any additional elements that you think should be considered, please record them in the comment box below.

No further comments

22. The Framework proposes that the Thermal Performance energy use intensity and services energy use intensity are considered during the consent application process, and when a Code Compliance Certificate is applied for.

Do you think this would impact you or your business/organisation?

☒ No ☒ Yes

Please tell us why.

While ESR will not be directly affected, we anticipate that an increase in design fees would be required to demonstrate compliance with additional design requirements.

23. If there are any additional tools or support that you think you would need to implement this requirement, please tell us in the comment box below.

Development of:

- Acceptable solutions
- Simplified design methods
- Example calculations

Framework: Whole of Life Embodied Carbon Emissions Reduction

24. Do you agree or disagree that the Building for Climate Change work programme should include initiatives to reduce whole-of-life embodied carbon in New Zealand buildings?

Strongly disagree	Disagree	Neither	Agree	Strongly agree
☐	☐	☐	☐	☒

Please tell us why.

Fossil fuel combustion yields an energy return on energy invested (EROI) that is unparalleled by other energy sources (with the exception of hydroelectricity). To meet social & economic needs while phasing out this energy source, we will need to consider the consequential issues of a sustained decline in energy supply and material consumption. Embodied carbon is a useful measure for control of these elements.

To meet our emission reduction goals, a key objective of the framework is to increase building material efficiency, and reduce construction waste.

25. What measures, if any, do you think should be put in place to increase building material efficiency? (Select all that apply)

☒ Update regulatory performance requirements to ensure they are appropriate

☐ Incentivise 'lean design'

☒ Remove barriers to the reuse of construction materials

☒ Other (please specify)

1. Include embodied carbon limits as a requirement for obtaining building consents, including limits on embodied carbon of waste as part of demolition consents (e.g. CO_2-e/m^2.a).

2. Incentivise projects that redevelop or regenerate existing buildings (e.g. by exempting renovation of existing buildings from embodied carbon assessments in the short-term). Later, when redevelopment work becomes subject to embodied emissions assessments, we recommend that the operational embodied emissions performance of existing buildings are handled in a similar way to seismic upgrades in existing buildings – i.e. embodied carbon assessments are triggered if substantial alterations are made (i.e. alterations with an estimated value of at least 25% of the building's value and more than $150,000). This system could be phased in after 5 years.

3. We have encountered anecdotal evidence of builders being reluctant to improve the thermal performance/insulation of buildings beyond minimum standards. We recommend that MBIE considers ways to encourage developers/redevelopers to exceed minimum standards e.g. offering reduced consenting timeframes and/or consenting costs for high performing buildings.

4. Prior to any attempts to incentivise 'lean design', due diligence should be carried out to ensure that this will not reduce the redundancy or resilience of the building stock in the event of earthquakes.

26. What measures, if any, do you think should be put in place to reduce construction waste?

1. Include embodied carbon limits as a requirement for obtaining building consents, including limits on embodied carbon of waste as part of demolition consents (e.g. CO_2-e/m^2.a).

2. Provide proactive support to the materials recycling industry based in New Zealand – including the steel industry. This support should include research & development of standards that address quality control, embodied carbon verification processes etc for recycled materials so that designers have greater confidence to specify these materials. Works with the NZ materials supply industry to ensure that they have (i) adequate certainty about future legal frameworks, and (ii) access to finance, to support ongoing investment in materials recycling plant and technology.

27. Using low carbon construction materials and products is identified as another option to reduce whole-of-life embodied carbon emissions.

How could we encourage the use of low carbon construction materials?

1. Include embodied carbon limits as a requirement for obtaining building consents, with reducing cap through to 2035.

2. The materials with lowest carbon emissions over the next 50 years are those that have already been installed in our building stock, and those that are eliminated from our building designs. To achieve this, demolition works and non-structural elements (e.g. interior partitions) should be included in the initial scope of the framework.

3. Consider reduced costs/timeframe for consenting for projects that exceed minimum code requirements

4. Provide proactive support to the materials recycling industry based in New Zealand – including the steel industry. This support should include research & development of standards that address quality control, embodied carbon verification processes etc for recycled materials so that designers have greater confidence to specify these materials. Works with the NZ materials supply industry to ensure that they have (i) adequate certainty about future legal frameworks, and (ii) access to finance, to support ongoing investment in plant and technology for manufacturing low carbon materials.

5. Have government procurement undertake a programme approach to the design and construction of government buildings using mass timber floors. This programme would select suitable building projects, undertake research and development to optimise design, manufacture and installation and provide guidance to the wider construction construction industry.

The Framework proposes introducing reporting requirements for whole-of-life embodied carbon in buildings, followed by a cap on whole-of-life embodied carbon for new building projects.

28. Would you support a cap on whole-of-life embodied carbon for new building projects?

☒ Yes ☐ No

Please tell us why.

To meet social & economic needs while phasing out fossil fuels as an energy source, we will need to consider the consequential issues of a sustained decline in energy supply and material consumption. Measurement and regulation of embodied carbon is a useful measure for control of these elements.

In the medium-term, we recommend that the operational embodied emissions performance of existing buildings is also considered. These could be handled in a similar way to seismic upgrades in existing buildings – i.e. embodied carbon assessments are triggered if substantial alterations are made (i.e. alterations with an estimated value of at least 25% of the building's value and more than $150,000). This system could be phased in after 5 years.

29. Do you think a data repository of embodied carbon from buildings should be established?

☒ Yes ☐ No

Please tell us why.

Better information about the embodied emissions & operation emissions associated with our building stock, and the speed/progress of any emissions reductions, will allow for informed policy decisions (e.g. reviewing the effectiveness of current regulations).

30. If a data repository was established, do you think this information should be able to be accessed by the public?

☒ Yes ☐ No

Please tell us why.

This could help to engage market forces in support of emissions reductions, i.e. by adding value to buildings with low embodied carbon if this is seen as a being valuable by the market.

31. Which, if any, of the following factors would make it difficult for people to report the whole-of-life embodied carbon of new buildings, and why?

☒ Lack of an agreed methodology

☒ Inadequate data quality and availability

☒ Lack of appropriate tools or software

☐ Administrative burden on businesses

☐ Other (please specify)

1. New Zealand has a significantly different emissions profile from other economies such as the UK, on account of the large transport distances for imported materials, and the low emissions profile from our national electricity supply. It is crucial that high quality, New Zealand-specific embodied emissions data is available for use from day 1 under the proposed framework. It is also crucial the accurate data about demolition recovery & recycling rates are made available as part of the life cycle assessment, and updated as the demolition sector improves its performance over time.

2. Acceptable solutions, alternative solutions, and verification methods for embodied carbon evaluation must be made available through national guidelines and/or standards. These must be supported by appropriate training.

3. Access to NZ-specific design tools and software would significantly reduce the financial burden on designers/developers – thereby reducing the costs passed on to their clients/ customers.

32. What support, if any, do you think will be needed to make reporting embodied carbon a standard part of the design and construction process for every new building project in New Zealand?

1. Acceptable solutions, alternative solutions, and verification methods for embodied carbon evaluation must be made available through national guidelines and/or standards. These must be supported by appropriate training.

2. We recommend the introduction of simplified assessment methods using default material properties that must be assumed for different imported materials (e.g. CO_2-e/kg steel), while allowing specific CO_2-e values to be used in situations where an auditable supply chain can be verified. Simplified methods should be applicable to both large and small buildings. The incentive for carrying out a more detailed assessment for large buildings would be the potential savings from a more accurate assessment of embodied emissions.

3. Training programmes (e.g. short courses, online training) introducing the fundamental concepts and introducing the verification methods used in the new standards/guidelines. The training programme should include real-life case studies of how the methodology has been applied to several different buildings (e.g. based on pilot studies sponsored by MBIE).

4. Access to free NZ-specific design tools and software would significantly reduce the financial burden on designers/developers – thereby reducing the costs passed on to their clients/ customers. Carbon footprint databases should be developed with the ability to be imported/ exported to software with materials quantification capabilities (e.g. Revit or other BIM software).

5. MBIE could work with professional bodies such as ACENZ/Engineering NZ/NZIA to develop guidance for building owners & developers about the anticipated compliance costs associated with life-cycle emissions assessment (e.g. range of fees in $\$/m^2$ for various building types). This will support the consulting industry to balance the assessment quality expectations of Territorial Authorities with the price expectations of clients.

The framework proposes that reporting of whole-of-life embodied carbon for buildings would be carried out as part of the building consent application process.

33. What impact do you think this proposal will have on the Building and Construction sector?

There will be concern from owners/developers about compliance costs.

- Consider providing basic information about the anticipated range of compliance costs compared with business as usual.

There will be anxiety from design consultants about maintaining a level playing field for competitive pricing. To alleviate this concern:

- Provide a well-defined methodology with simplified and specific-assessment options.
- Provide free access to design standards/guidelines, training, emissions databases and software.

There will be significant implications for materials suppliers (both positive and negative). They will have been aware of the potential for embodied carbon regulations to impact their business models for some time and should have plans in place for this.

- Provide clear policy signals and timeframes. Bipartisan support for the general intent of the framework would be preferable.
- Provide support for investment in low-emissions supply & material recovery.

There will be concern from contractors about supply constraints e.g. lack of availability of low-emissions materials specified, fewer material supply options leading to less competitive tendering.

- Create a practical but verifiable system for managing substitution of similar products after building consent has been granted.
- Provide proactive support to the materials supply and recycling industry based in New Zealand. This support should include research & development of standards that address quality control, embodied carbon verification processes etc for recycled materials so that designers have greater confidence to specify these materials. Work with the NZ materials supply industry to ensure that they have (i) adequate certainty about future legal frameworks, and (ii) access to finance, to support ongoing investment in new plant and technology.
- For owner-developers, appropriate government agencies could provide access to finance for capital expenditure on emissions reduction technology by banking on the resulting lifetime cost/energy savings. This might be similar to a commercial Energy Performance Contract, but managed through the rates process, or through lending by a specific govt agency, or a credit guarantee by the state to the market.

34. What additional tools or support would be needed to implement this requirement?

Refer to suggestions in response to Question 32 above.

35. Do you think that requirements for embodied carbon calculations should only include the initial building life cycle stages (product and construction stage)?

☒ No ☐ Yes

Please tell us why.

In a post-fossil fuel economy, we will need a clear focus on energy return-on-energy invested (EROI), in the same way that developers consider returns on financial investments. Existing buildings represent a significant investment of embodied energy, and the associated emissions should be accounted for prior to demolition to reduce our material consumption.

We recommend that demolition is included in the initial scope of the framework. Demolition of existing buildings should be justified before a demolition consent is issued. Requirements for reuse/ recycling of materials must be met, including the submission, approval, and verification of approved waste management plans.

Consideration should be given to imposing caps on the embodied emissions of unrecoverable demolition materials going to waste, i.e. regulations requiring design for specific minimum levels of materials recovery from demolition, measured in CO2-e/(m^2.a).

The effect of building location on the future transport requirements of the occupants is fundamental to understanding the emissions effects of a building. This could be incorporated in a simple way by having territorial authorities provide maps of transport emission by map area.

As a side note related to climate change adaptation, updated building regulations should include consideration of a building's resilience such a susceptibility to increased flooding frequency due to sea level rise. Again, territorial authority maps could provide this information.

36. The Framework proposes limiting the type of building components that would be included in an embodied carbon assessment, excluding components with lower emissions (such as internal fittings).

Do you agree with this proposal?

☒ No ☐ Yes

Please tell us why.

In order to achieve net-zero emissions by 2050, it is clear that all building materials (structure, façade, services, interior fitout) will need to be taken into account.

There are significant potential savings in material consumption when it comes to interior fitout – such as in commercial office buildings where ceilings and partitions can often be deleted to create open plan work spaces.

Steel and concrete require the use of fossil fuel for their manufacture, so often attract the most attention as contributors to embodied CO2-e emissions in buildings. This carbon footprint might change over time (e.g. if steel is recycled using an electric arc furnace powered by renewable electricity), meaning that non-structural elements have a larger relative impact on embodied energy.

Any decision to exclude non-structural elements from embodied carbon assessment bust be based on a robust analysis which demonstrates that 80% reduction in a building's embodied CO2-e can be achieved by reducing emissions from structural materials alone. This analysis must be based on NZ-specific data which includes transport emissions for imported materials.

37. Do you think that reporting on, and ultimately capping, embodied carbon should apply to new building projects only, not refurbishment or demolition projects?

☒ No ☐ Yes

Please tell us why.

Demolition

Existing buildings represent a significant investment of embodied energy, and the associated emissions should be accounted for prior to demolition to reduce our material consumption.

Demolition must be included in the initial scope of the framework. Demolition of existing buildings should be justified before a demolition consent is issued. Requirements for reuse/recycling of materials must be met, including the submission, approval, and verification of approved waste management plans.

Refurbishment

Regeneration of existing systems is often required in order to achieve the emissions reduction targets in the order of 80-100%. This suggests that the proposed application of the framework to new buildings only will be insufficient to achieve the stated objectives, and the framework will also need to address the regeneration of existing building stock.

The proposed approach will provide an initial advantage to regenerative solutions (e.g. redevelopment or regeneration of existing systems), since they are exempt from the controls applied to new buildings. However, in the long-term, refurbishment will also need to be addressed in order to meet objectives.

We recommend that upgrades to the operational emissions performance of existing buildings are handled in a similar way to seismic upgrades in existing buildings – i.e. upgrades are triggered if substantial alterations are made (i.e. alterations with an estimated value of at least 25% of the building's value and more than $150,000). This system could be phased in after 5 years if it is considered too demanding for inclusion in the initial scope for the framework.

38. The Framework proposes that a simplified embodied carbon calculation tool could be used for small buildings but more detailed calculations would need to be provided for large buildings*.

(* Large and small buildings as defined in the framework scope section)

Do you agree with this proposal?

☐ No ☒ Yes

Please tell us why.

We support the introduction of a simplified tool for embodied carbon assessment, but suggest this is based on conservative assumptions and applicable to all buildings (including large buildings).

One benefit of allowing the simplified method to be applied to large buildings is that it can be used to provide confidence of compliance for a large building during the preliminary design stages, before detailed assessments can be carried out.

The incentive for carrying out a more detailed assessment for large buildings would be the potential return on investment by demonstrating lower emissions through a more accurate assessment of embodied emissions.

39. Any other comments on the proposed frameworks?

Design for life-cycle performance

MBIE should develop good practice guidelines for avoiding functional and aesthetic obsolescence in buildings, and there should be some accountability for this as part of the consenting process (similar to the way aesthetic & town planning requirements are considered as part of the current resource consent process).

The importance of this is outlined in Flager, F.E. (2003) "The Design of Building Structures for Life-Cycle Performance", Massachusetts Institute of Technology), as outline below:

Table 1 below indicates that building structures often have a useful design life in excess of 50 years:

Table 1: Durability of the Load-Bearing Frame[9]

Material Description	Useful Structural Lifetime
(1) Stone, brick or reinforced concrete	> 75 years
(2) Structural steel	50-100 years
(3) Timber	30-300 years

However, a 1990 study in the USA revealed that the typical longevity of a building in the USA was only 35 years – and this was not a result of deterioration of the structure.

Particular attention should be paid to demonstrating good life-cycle performance for sites where the land value represents a high proportion of the property value, since this increases the economic drivers for building demolition. An extreme example occurred in Tokyo in the 1980's where the real estate values were so high that high rises were being torn down after 5 years because they had become obsolete (i.e. site value exceeds value of existing property + cost of demolition). The average life of a building in Tokyo was 17 years.

Building design guidelines should be developed to avoid common causes of depreciation, for example the items listed in Table 2 & 3 below:

Table 2: Sources of Building Depreciation: City Offices

Source	Type	Rank
Inefficient floor layout	Functional Obsolescence	1
Inadequate quantity / quality of services	Functional Obsolescence	2
Quality of external design	Aesthetic Obsolescence	3
Deterioration of interior	Physical Deterioration	4
Deterioration of exterior	Physical Deterioration	5
Quality of finishes	Aesthetic Obsolescence	6
Floor to ceiling height	Functional Obsolescence	7

Table 3: Sources of Building Depreciation: Industrials

Source	Type	Rank
State of repair / level of maintenance required	Physical Deterioration	1
Interference from vertical load-bearing elements	Functional Obsolescence	2
Deficient mechanical/electrical services	Functional Obsolescence	3
Inadequate floor loading capacity	Functional Obsolescence	4
Insufficient level of insulation	Functional Obsolescence	5