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

CC: Engineering New Zealand, c/o hello@engineeringnz.org
Structural Engineering Society of New Zealand, c/o Executive Officer

To the Building for Climate Change team,

As a group of professional engineers, Engineers for Social Responsibility (ESR) strongly endorse MBIE's commitment to meet the government's Carbon Zero targets by 2050, and the implementation of changes to our Building Consent regulations that will improve operational efficiency and reduce lifecycle carbon emissions from New Zealand's building stock.

We endorse most of the proposals made in MBIE's consultation documents titled 'Whole-of-Life Embodied Carbon Emissions Reduction Framework' and 'Transforming Operational Efficiency', and have provided more detailed feedback in the 'Building for Climate Change Submission Form' attached.

More importantly, we would like to draw attention to several insights from the emerging field of **Transition Engineering** which highlight three improvement opportunities associated with the 'Building for Climate Change' framework as currently proposed.

Transition Engineering *provides a methodology and framework to address the problem of substantial reduction in fossil fuel production, and the resulting impacts of sustained decline in energy supply and material consumption.*

ESR are working with the Global Association of Transition Engineering (GATE) and The Sustainability Society (a technical interest group of Engineering New Zealand) to promote and deliver educational opportunities in the field of Transition Engineering.

Improvement opportunities:

1. Maintain focus on ending fossil fuel use.
2. Quantify emissions reduction scenarios to check that policy is likely to meet stated objectives.
3. Consider how the built environment relates to wider activity systems in society and adapt built environment regulations to reduce the overall emissions from human activity.

1. Improvement opportunity - maintain focus on ending fossil fuel use.

When addressing complex problems like climate change, it becomes valuable to maintain clarity on the problem being worked on. In this case, the politically mandated objective is net-zero carbon emissions by 2050. Current scientific advice indicates the key design requirement for the safety of all humanity's infrastructure and the sustainability of natural ecosystems and species is an 80% reduction of fossil fuel production within two decades.

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.

The proposed approach to "Transforming Operational Efficiency" (Section 6) appears to define operational emissions as the sum of (i) fossil fuel combustion (CO_2-e/m^2 per annum), (ii) electricity use (kWh/m^2 per annum), and (iii) water use (litres/person/day). By aggregating these three different performance measures, the framework is at risk of introducing contradictory requirements which distract the sector from addressing the fundamental issue of emissions reduction. For example, a building could continue to burn fossil fuel but remain within the operational emissions cap by reducing its electricity demand – even though electricity generation in New Zealand emits relatively little carbon (and could be close to 100% renewable within the proposed timeframe for this framework). ESR recommends:

*1.1 That all operational emissions caps **must** be expressed in terms of CO_2-e, for example by using the formula presented in Section 3.1.*

1.2 That promotion of water use efficiency as a climate adaptation measure is addressed by a separate resource use cap (i.e. not related to CO_2-e emissions), either as a separate section within the current operational efficiency framework, or in a separate document.

1.3 That MBIE consider rebranding the framework as "Transforming operational emissions" to maintain clarity on its primary objective.

2. Improvement opportunity - quantify emissions reduction scenarios to check that policy is likely to meet stated objectives.

It is not clear from the information provided whether the proposed frameworks will be successful in achieving the stated political objective of net-zero carbon emissions by 2050, and it is crucial that this is quantified from the outset.

The initial steps in the 'Transition Engineering' methodology are to identify what human needs our system meets currently, envision how to meet these needs in a future carbon-neutral economy, and then scientifically evaluate the available options for making it happen in time. Options with demonstrated ability to achieve 80% downshift in fossil energy use are developed into "shift projects" for specific activities and locations. Working through this process has shown that:

(i) many well-intentioned attempts to deploy emissions reduction technology, improve efficiency, or encourage virtuous behaviour fall well short of achieving emissions reductions objectives within the necessary timeframe, when they are mathematically quantified using realistic rates of growth/deployment.

(ii) regeneration of existing systems is often required in order to achieve the 80% emissions reduction targets. 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.

ESR recommends:

2.1 That MBIE considers various emissions-reduction scenarios for implementation of the proposed frameworks (e.g. consider various options for the quantum of $C0_2$-e limits for life cycle emissions, consider options to include demolition and/or existing buildings within the proposed framework), followed by quantitative checks to confirm whether the framework is likely to achieve the stated objective of net-zero carbon emissions by 2050 for each option. This may require some investment in research. The results of this evaluation should be made publicly available.

2.2 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). This system could be phased in after 5 years if it is considered too demanding for inclusion in the initial scope for the framework.

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 material consumption.

ESR recommends:

2.3 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.

2.4 That consideration is given to imposing caps on the embodied emissions of unrecoverable demolition materials going to waste, e.g. measured as CO_2-e/(m^2 per annum).

2.5 That MBIE develop industry guidance on how to improve design for life-cycle performance – to delay deterioration and aesthetic or functional obsolescence as triggers for demolition.

3. Improvement opportunity - consider how the built environment relates to wider activity systems in society and adapt built environment regulations to reduce the overall emissions from human activity.

When engineering a change to a system - in this case changing the built environment to reduce carbon emissions - it is important to define the system and its relationships to other systems. The proposed Frameworks are broad enough to consider the full life cycle of our buildings, but there is also an opportunity to consider the related systems of electricity supply and personal transport.

Materials supply industry – the inclusion of the initial cradle-to-gate stages in the proposed framework creates opportunities to incentivise significant emissions reduction – and the steel supply chain provides a useful example of this. Steel is acknowledged as the world's most recycled material; it can be recycled indefinitely with no degradation in quality, and it is common to recover 85%+ of the steel used in a building when it is demolished. Recycling scrap steel by using renewable energy to power an electric arc furnace creates much lower emissions than producing new steel from iron sand, but Pacific Steel's recycling plant in Otahuhu was decommissioned in recent years due to the significant cost of replacing equipment at the end of its serviceable life. The proposed 'Building for Climate Change' frameworks could have the beneficial outcome of driving the reintroduction of steel recycling, followed eventually by a transition away from the manufacture of new steel. It might also provide a competitive advantage to struggling New Zealand manufacturers if competing steel products arriving from offshore must account for the embodied emissions associated with their manufacture and transport. The Framework proposes that embodied carbon must be accounted for in imported building products, and this is crucial. With this example in mind, ESR recommends:

3.1 That MBIE simplifies the process of accounting for embodied carbon by specifying a range of default embodied emissions 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.

3.2 That MBIE 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 low-emissions technology (such as steel recycling plant).

Related system – the electricity industry: MBIE's vision for "Transforming Operational Efficiency" describes a future where "the efficiencies from the [Building] Sector have made it easier for the grid to become more renewable meaning fewer emissions for the energy we do use". MBIE need to consider the ways in which the built environment can influence the performance of the electricity sector as a related system. For example, there is an opportunity to maximise NZ's renewable electricity generation by levelling peak electricity demand on the grid - since supply & demand balancing is more difficult using renewable generation (e.g. wind) than when burning coal or gas. This fact is identified in Section 7.6, but there is an opportunity to proactively influence load-spreading, particularly with respect to residential winter heating demand. ESR recommends:

3.3 That energy metering and management systems be mandatory for all buildings, to allow building occupants to manage peak load.

3.4 That MBIE and EECA actively promote solar hot water heating. In parallel, 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. designating specific plugs loads for non-essential use within buildings so they can be automatically turned off during periods of peak demand, installation of autonomous demand management devices in buildings that consumers could opt to activate in return for discounted electricity prices).

3.5 That the proposed framework for "transforming operational efficiency" is adjusted to include consideration of when energy is used rather than simply energy efficiency. For example, giving designers the opportunity to adjust the default "grid emissions factor" to reflect the time periods when electricity is reasonably expected to be used and the average carbon emissions from the grid at this time, rather than a simple blended carbon rate regardless of the time that energy is used. Consider other systems, regulations and incentives that will allow dynamic management of when energy is used (e.g. technology that allows retailers to inform consumers when power is cheap due to surplus renewables and share the savings with consumers).

3.6 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.

We also note that "Transforming Operational Efficiency" envisions are future where "people also have more money in their pockets due to lower energy bills." Currently, electricity providers submit regular bids to have their power fed into the grid. The highest bid that is accepted to meet the market demand for a given half hour period sets the price that all the other electricity generators receive. At present, the Huntly power station, which runs on coal and natural gas, is often that highest bidding generator contributing to our North Island power supply. The other companies feeding into the grid like this because they all receive the same price for their electricity that Huntly does, which pushes up their profits. Some companies have even been accused of deliberately spilling water over their hydro dams to keep Huntly in the market.

ESR recommends:

3.7 That MBIE advocate with other government agencies for electricity market reforms that will help them achieve their vision through a lower grid emissions factor (kg CO_2-e/kWh) and reduced electricity costs to consumers within the built environment.

Related system – transport: to meet our emission reduction targets as a country, we will need a holistic approach to the built environment and the human activities that occur within that environment, including our need for mobility. Electric vehicles (EV's) are sometimes envisaged as a solution to the problem of transport emissions - with lifecycle studies indicating they can emit 70% less CO_2 than combustion-fueled vehicles in countries with clean electricity generation. However, further analysis reveals it is not feasible to replace all of our vehicle fleet fast enough to meet our agreed emissions reduction targets, and doing this would create unsustainable waste streams. This forces us to consider that EVs and low-powered vehicles need to be supplemented by major investments in public transport and urban re-form – which affects what types of buildings are constructed, and where. For any given building development, realistic transport emissions to access the nearest schools and public transport networks should be considered as part of the carbon footprint of the building development. ESR recommends:

*3.8 Development of a simple protocol for quantifying transport emissions for a specific building location, and include this in the operation efficiency rating for the development. **For example**: for residential buildings, consider public schools (primary, intermediate & secondary) and public transport stations/interchanges. For commercial buildings, consider distance to public transport stations/interchanges only. Buildings located within 1km walking distance from these facilities would accrue no additional operational emissions. Where these facilities are located more than 1km*

from the proposed building, operational emissions would be calculated as: distance to schools/transport interchange (km) x number of occupants x 400 trips/annum x transport network emissions factor (kg CO_2-e/km). Territorial Authorities could undertake these calculations and provide them in map format making it simple to include them in emissions reporting. As an alternative solution, developers would have the options of preparing a specific transport strategy to justify reduced operational emissions due to transport.

3.9 A review of resource consent regulations and building standards to allow a reduction in the minimum number of carparks required when developing/redeveloping commercial buildings. In parallel with this, advocate for adjustments to fringe benefit taxes that currently provide incentives for private vehicle use.

ESR invites your engagement with the Convergence for a Carbon Transition 2020-2030 which seeks to be a catalyst for the design and development of emissions-reducing shift projects by engineers and business leaders across Aotearoa. We have attached a flyer for our online conference coming up in November 2020 and commend this event to all who are working on this issue within MBIE.

Yours faithfully,

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