engineering new zealand
te ao rangahau

PRACTICE NOTE 32
CLIMATE ACTION – THE ROLE OF THE ENGINEER

May 2024

ABOUT THIS PRACTICE NOTE

This Practice Note outlines the roles, responsibilities and core competencies of engineers in mitigating, transitioning and adapting to climate change. It is guided by our Position Statement on climate change. This Practice Note expands upon Engineering New Zealand's interim guidance, Climate Change Practice Guidance for Engineers (2021).

Legal information

Practice Notes offer guidance to practising engineers by exploring issues of importance to the profession and setting out good-practice methodologies. They are written with the support of practitioners and subject to peer review by Engineering New Zealand members.

While every care is taken in their preparation, these documents are not intended to be exhaustive and are not offered as formal advice. Practices, systems and advice may vary depending on individual circumstances, and practitioners must exercise their own professional skill and judgement. Engineering New Zealand accepts no liability arising from their use and nothing in the Practice Note binds Engineering New Zealand in determining the outcome of any future complaint.

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INTRODUCTION

Climate action is taking intentional steps to mitigate and address the reasonably foreseeable impacts of climate change. Engineers are problem solvers and innovators. Throughout history, engineers have provided the technical skills to help society address key challenges (for example, the public health threat of poor wastewater management or the need to provide seismic strengthening to structures in earthquake prone areas).

Today, among other things, society is grappling with the challenges of climate change. Many of the solutions to these challenges require engineers. The solutions require rethinking accepted ways of operating. They also require gaining new competencies and working together across disciplines. The solutions require individual engineers to adapt their practice to a changing world.

Practice Note 32

Engineering New Zealand's practice notes explain practices and procedures across a wide variety of engineering topics, covering subjects as far reaching as ethics, peer review, producer statements, seismic strengthening of pressure equipment and fire safety designs. This practice note, Practice Note 32 Climate Action – the role of the engineer, was developed to explore the role of engineers with regard to climate change and set out accepted practices and competencies.

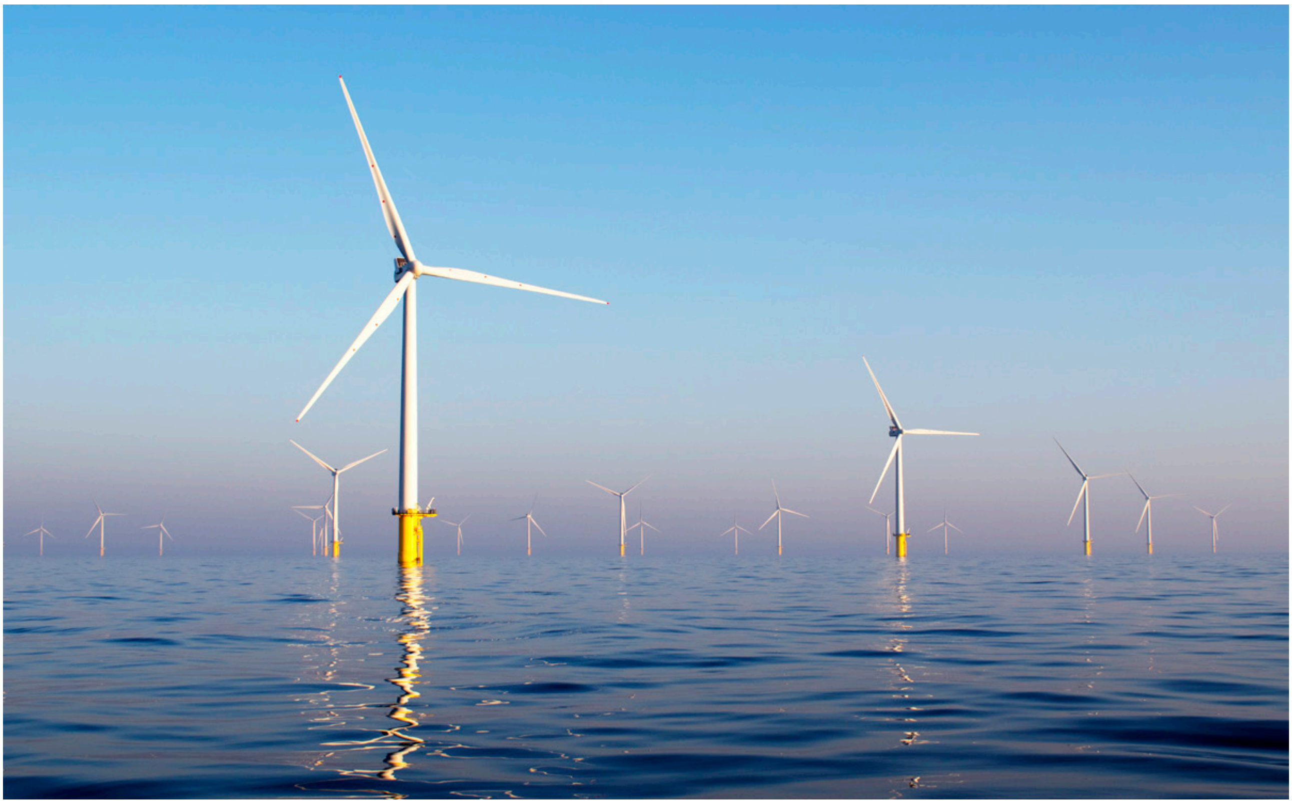
This practice note is structured into the following sections:

1. Background: the wider context of climate change
2. An engineer's responsibility
3. Guidance for engineers
4. Competencies

Included with this practice note are a series of appendices:

A **Appendix A:** Aotearoa New Zealand's climate change commitment

B **Appendix B:** Further information



BACKGROUND

This practice note is intended to help engineers understand their professional responsibility regarding climate change. This section provides background on key climate change concepts as they relate to engineering. For an introductory guide to climate change, please refer to the publication Climate Change 101.

New Zealand is experiencing the effects of anthropogenic climate change, evidenced by the increased frequency and intensity of extreme weather events such as heatwaves, droughts, floods and severe storms.

As we explore the engineer's role regarding climate action, the following concepts are important to introduce:

Anthropogenic climate change
Changes in the climate caused by human activity.

Climate-related hazards
Weather-related events (eg floods, cyclones, droughts, extreme heat and fires), as well as long-term changes such as sea-level rise and shifts in temperature patterns, that can cause harm to humans, property, livelihoods, resources and the environment.

Sustainability
Meeting the needs of present generations without jeopardising future generations.

Planetary boundaries
A framework of nine 'boundaries'[1] or limits on the earth's ability to sustain life.

Circular economy
The reuse or regeneration of materials or products.

Transition engineering
A professional engineering discipline focused on meeting the needs of today, without compromising the ecological, social and economic systems of future generations.

Resilience
The capacity of systems (built, social, economic, and environmental) to cope with hazards by responding or reorganising in ways that maintain the essential function, identity, and structure of the system.

Systems thinking
Reviewing a whole system, breaking it into parts, and determining how those parts interact to understand and make changes in the system.

Adaptation
Changing processes, practices and structures to moderate the potential damages, or to benefit from opportunities associated with climate change.

Greenhouse gases (GHGs)
Gases that absorb and emit radiant energy at thermal infrared wavelengths, causing the greenhouse effect.

Scope emissions
A framework that classifies greenhouse gas emissions into three distinct scopes. Scope 1 for direction emission, Scope 2 for indirect emissions from purchased energy, and Scope 3 for broader indirect emissions throughout the value chain.

Appendix B provides further resources on climate change both within an Aotearoa New Zealand context and a global context.

1 The nine planetary boundaries are climate, biodiversity, stratospheric ozone, ocean acidification, biogeochemical flows of phosphorus and nitrogen, land-system change, freshwater, atmospheric aerosol loading and novel entities.

AN ENGINEER'S RESPONSIBILITY

Engineering New Zealand's Code of Ethical Conduct sets out the shared expectations of ethical practice that engineers have agreed to uphold. This includes having regard to reasonably foreseeable effects on the environment, ensuring their knowledge and skills are up to date and informing others of the consequences of not following advice.

The Code of Ethical Conduct relates to professional practice. In their personal lives, engineers can also undertake climate action. While this Practice Note focuses on professional practice, engineers are encouraged to consider climate action opportunities in all areas of their lives.

Responsibility to uphold the Code of Ethical Conduct

This section outlines an engineer's responsibility to uphold the Code of Ethical Conduct. Engineers have a responsibility to ensure that their work is carried out in a manner that prioritises the safety and wellbeing of society and the environment. This responsibility extends to being a trusted advisor to clients and/or employers and can involve advising on matters surrounding climate change impacts, mitigation, and adaptation. Engineers need to be able to provide advice on the wider implications of their work.

The following Code clauses apply:

Obligations in the public interest
Clause 1 requires engineers to "take reasonable steps to safeguard the health and safety of people". As the climate changes, engineering activities can either increase or decrease exposure to climate hazards. Engineers should take reasonable steps to address these risks. Clause 2 requires engineers to have regard to reasonably foreseeable effects on the environment and the need for sustainable management of the environment. Sustainable management means management that meets the needs of the present without compromising the ability of future generations to meet their own reasonably foreseeable needs.

Obligations relating to personal conduct
Clause 4 requires engineers to act competently, keeping engineering knowledge and skills up to date and to only undertake work within areas of competence. To upskill on climate change and its implications on the practice of engineering, Engineering New Zealand recommends undertaking a variety of continued professional development, including technical, professionalism (ethics, cultural competency, climate, sustainability and others), business/leadership, professional engineering engagement/contribution to the profession (mentoring, etc) and training on fundamental topics such as health and safety.

Inform others of the consequences of not following advice
Clause 6 requires engineers to inform others of the consequences of not following advice, stating "if you become aware that your professional advice may not be followed, and consider that a failure to observe that advice may have adverse consequences, you must inform the recipient of the advice of those adverse consequences". This clause requires engineers to take action. Engineering New Zealand advises engineers to take reasonable steps to communicate the potentially harmful consequences to individuals who choose not to follow advice. The advice should be in writing, with engineers setting out why they are concerned and what the consequences could be. This ensures that they have a record of what action they took if they need it in the future.

What do I do if another member commits a significant breach of the Code?

If you have reasonable grounds to believe that another member or Chartered Professional Engineer has committed a significant breach of the Code of Ethical Conduct, clause 8 of the Code applies and you should report a breach of the Code. See Engineering New Zealand's Practice Note 8: Being Ethical for further guidance on managing situations where professional advice is not followed.

If you have any questions regarding the Code of Ethical Conduct, email us at concerns@engineeringnz.org

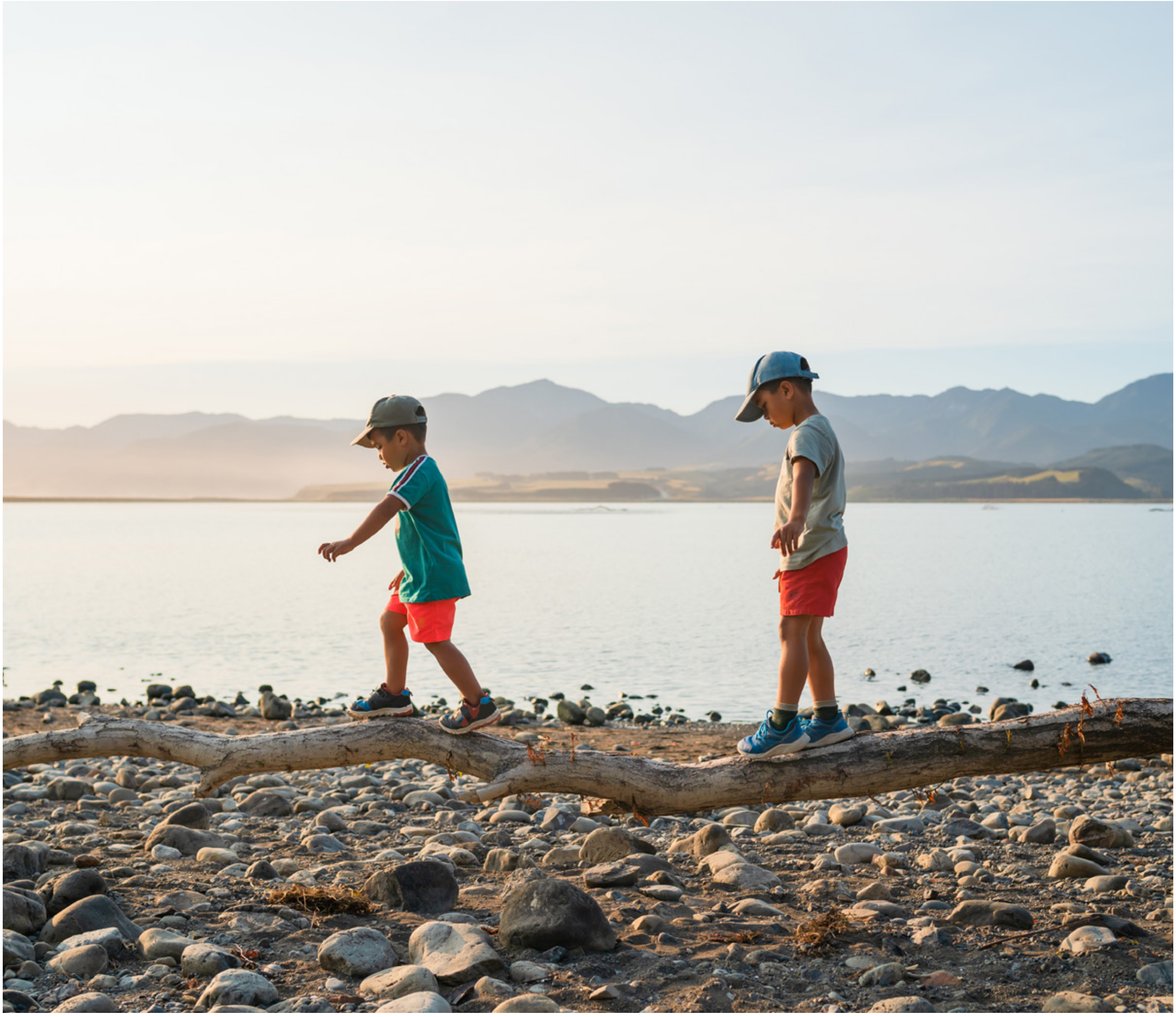
Te Tiriti o Waitangi, mātauranga Māori (Māori knowledge) and Kaitiakitanga (Guardianship and conservation)

Engineers in Aotearoa New Zealand work within a unique bicultural context. This bicultural context must shape how we address the complex challenges posed by climate change.

Māori, as the long-standing kaitiaki (guardian) of Aotearoa New Zealand, have extensive knowledge and experience when it comes to our natural environment and climatic systems. Indigenous and alternative worldviews are critical in rethinking the way we do things, to live within our planetary boundaries[2].

Engineering New Zealand encourages all engineers to work in partnership with tangata whenua (the people of the land), to understand Māori knowledge (mātauranga Māori), guardianship and protection of the natural environment and the resources within it (kaitiakitanga) and apply this to the unique challenges we face in Aotearoa New Zealand.

The next section of this practice note outlines practical guidance for engineers.



2 Engineering New Zealand Climate Change Position Statement. 2021.

GUIDANCE

Engineers are instrumental in the design and management of the built environment and this places the profession in a unique position to both lead and support change. Below is high-level guidance for professionals on responding to climate change. Included in this section is a climate action checklist for engineers (Table 1).

Take a holistic view

The work of engineers lasts for generations. Engineers must consider the wider impact of the projects they are involved in, both in terms of greenhouse gas emissions and adaptive capacity. For example, are there ways in which the embodied carbon (greenhouse gas emissions arising from the manufacturing, transportation, installation, maintenance and disposal of building materials) of a project can be reduced? Or are there ways to reduce the operational carbon (emissions associated with energy used to operate the building or infrastructure) of a project? Or are there ways to strengthen the adaptive capacity and reduce the likelihood of negative impacts of climate-related hazards?

Question status quo

As the world changes, so too does the status quo. Change requires individuals to question how and why things are done and if current operating procedures remain appropriate. If managed productively, this challenge allows for continuous improvement.

Consider your influence on decision making

Engineers should actively consider their influence on decision making and leverage effective communication and collaboration skills to drive positive change towards a more sustainable future.

Engineers can influence project decisions to support better outcomes for the climate by:

Questioning the impact of a project
In the design and planning phases, critically evaluating the project's environmental impact. Ask questions about resource use, energy consumption, and potential for emissions reduction.

Repurposing existing resources
Consider ways to reuse existing structures or materials before opting for new construction. This reduces the embodied carbon and promotes resource efficiency.

Presenting alternative lower carbon options
Explore and propose alternative designs and materials with lower carbon footprints. This can offer decision-makers a broader perspective and encourage conscious choices.

Incorporating and advocating for sustainable design
Integrate sustainable principles throughout the project lifecycle. Integrating renewable energy sources, energy-efficient materials, and responsible waste management practices can significantly reduce a project's environmental impact.

Prioritise sustainability and adaptation in design

Sustainability

Design engineers are encouraged to move beyond mere compliance with legislative mandates to design for future needs. Compliance with regulatory requirements represents only the baseline for legality. Governments, regardless of political affiliation, are increasingly committed to fulfilling national and international climate commitments. Therefore, businesses and organisations must anticipate forthcoming regulations and proactively implement sustainable practices.

Change is inevitable, and those who lead the charge will be better positioned to navigate future regulatory landscapes. We encourage engineers to embrace sustainability and adaptation in their work, fostering innovation, sustainability and forward thinking so that the profession continues to evolve and adapt.

Leaders within firms are encouraged to lead by example and support teams to integrate sustainability into every aspect of design and decision-making, wherever possible. Although most design briefs are limited in scope, there are always opportunities for engineers to brief clients on options for prioritising sustainability beyond current legal obligations.

Adaptation

Design engineers are encouraged to anticipate reasonably foreseeable future challenges and develop solutions that are resilient over time. To incorporate adaption into designs, consider:

- climate data and projections
- risks and vulnerability
- flexibility and modularity, including possible future expansion or reduction in capacity
- circular economy principles, including resource efficiency, recycling and reduced waste
- nature-based solutions
- adaptive management opportunities, including feedback loops for monitoring performance
- consulting with iwi and hapū, and
- incorporating Mātauranga Māori into climate solutions/designs, where possible.

Enable an equitable and just transition

Evidence indicates that existing inequalities within society will be exacerbated by the effects of and responses to climate change[3]. To support a transition that serves society effectively and does not exaggerate inequalities, engineers need to collaborate with marginalised and frontline communities to create solutions that address the needs and concerns of these groups.

In the context of Aotearoa New Zealand, enabling a just transition requires specific consideration of Te Tiriti o Waitangi, the Crown, and iwi partnership. It is essential to engage with iwi and hapū, to ensure solutions that are effective and appropriate.

Know your limits

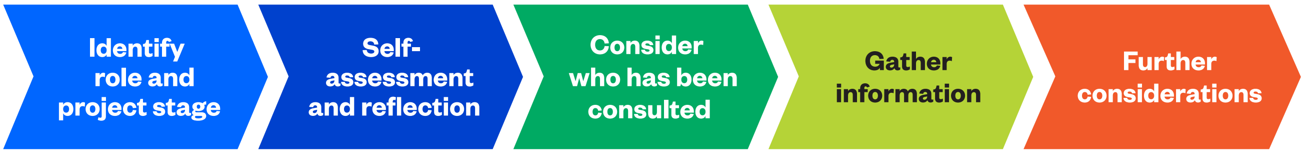
Every role has its limits, and every professional operates within a limited scope and with limited capacity. Engineers are advised to understand the limits of their role and capacity so that they may act within the scope of those limits, to the best of their ability. We encourage the profession to do what you can, where you can.

3 Reisinger, A., Kitching, R., Chiew, F., Hughes, L., Newton, P., Schuster, S., Tait, A., Whetton, P., Barnett, J., Becken, S., Blackett, P., Boulter, S., Campbell, A., Collins, D., Davies, J., Dear, K., Dovers, S., Finlay, K., & Glavovic, B. (2014). Australasia. In Intergovernmental Panel on Climate Change (Ed.), Climate Change 2014 –Impacts, Adaptation and Vulnerability: Part B: Regional Aspects: Working Group II Contribution to the IPCC Fifth Assessment Report: Volume 2: Regional Aspects (Vol. 2, pp. 1371–1438). Cambridge University Press.

Putting it into practice

To support engineers navigating the challenges of climate action in today's projects, we have designed the following checklist (Table 1).

Table 1: Climate action checklist for engineers



Identify role and project stage		**Answer**
1	What is my role in this project and what degree of influence do I have on the project? Am I an advisor, designer, policy maker, investment decision maker, planner, or construction supervisor?	
2	What stage is the project in and what degree of change can be brought through to support climate action?	
Self-assessment and reflection		**Answer**
3	Do I feel comfortable with the environmental/climate impact of the current proposal, project or situation, and why?	
4	Have I clearly outlined and documented my recommendations regarding environmental/climate impact, whether through project meetings, formal advice, or in the design features report, even if the decision maker opted not to implement them?	
Consider who has been consulted		**Answer**
5	Have I considered Te Ao Māori/mātauranga Māori/tikanga Māori in my engineering activities?	
6	Have I engaged responsibly with community, stakeholders, local iwi and hapū to ensure that their perspectives and concerns are addressed in my engineering plans?	
7	Have I discussed with local iwi, hapū and other stakeholders the potential impacts of my engineering activities on local ecosystems and biodiversity, and how can I address their concerns?	
8	Am I balancing present needs with the reasonably foreseeable needs of future generations in my decision-making process?	
9	Have I considered the potential social impacts of my engineering activities, including impacts on vulnerable and/or marginalised communities?	
Gather information		**Answer**
10	Do I have sufficient information to understand the issues and conflicts?	
11	What are my options and what are the potential impacts of each option on the climate and people?	
12	How am I factoring in the reasonably foreseeable long-term needs of future generations while collaborating with local iwi and hapū in my decision-making process?	

Further considerations		Answer
13	Is what I am considering doing consistent with Engineering New Zealand's Code of Ethical Conduct and the law?	
14	Have I considered the potential greenhouse gas emissions associated with what I am engineering and taken steps to reduce them?	
15	Are my engineering activities potentially harmful to the environment? If so, what measures will I recommend or implement to prevent and mitigate negative impacts?	
16	Have I integrated low-carbon and sustainable practices into the project?	
17	Have I considered the potential impacts of climate change on my work? If I perceive potential impact, have I developed plans to adapt to these impacts? Are my plans to address these impacts equitable to communities?	
18	Have I used resources in a sustainable and efficient way while still meeting any resilience objectives? What steps can I take to minimise waste and promote environmentally responsible re-use, recycling, and disposal?	
19	Have I applied engineering practices in a way that fosters the health, safety and wellbeing of the community and the environment?	

COMPETENCIES

To support the profession in understanding the skills, knowledge and attributes needed for engineers to address climate change, we have developed a list of recommended competencies and performance indicators. This is to support structured upskilling. Competencies are grouped into competency groupings that mirror the groupings used by Engineering New Zealand's chartership assessment frameworks.

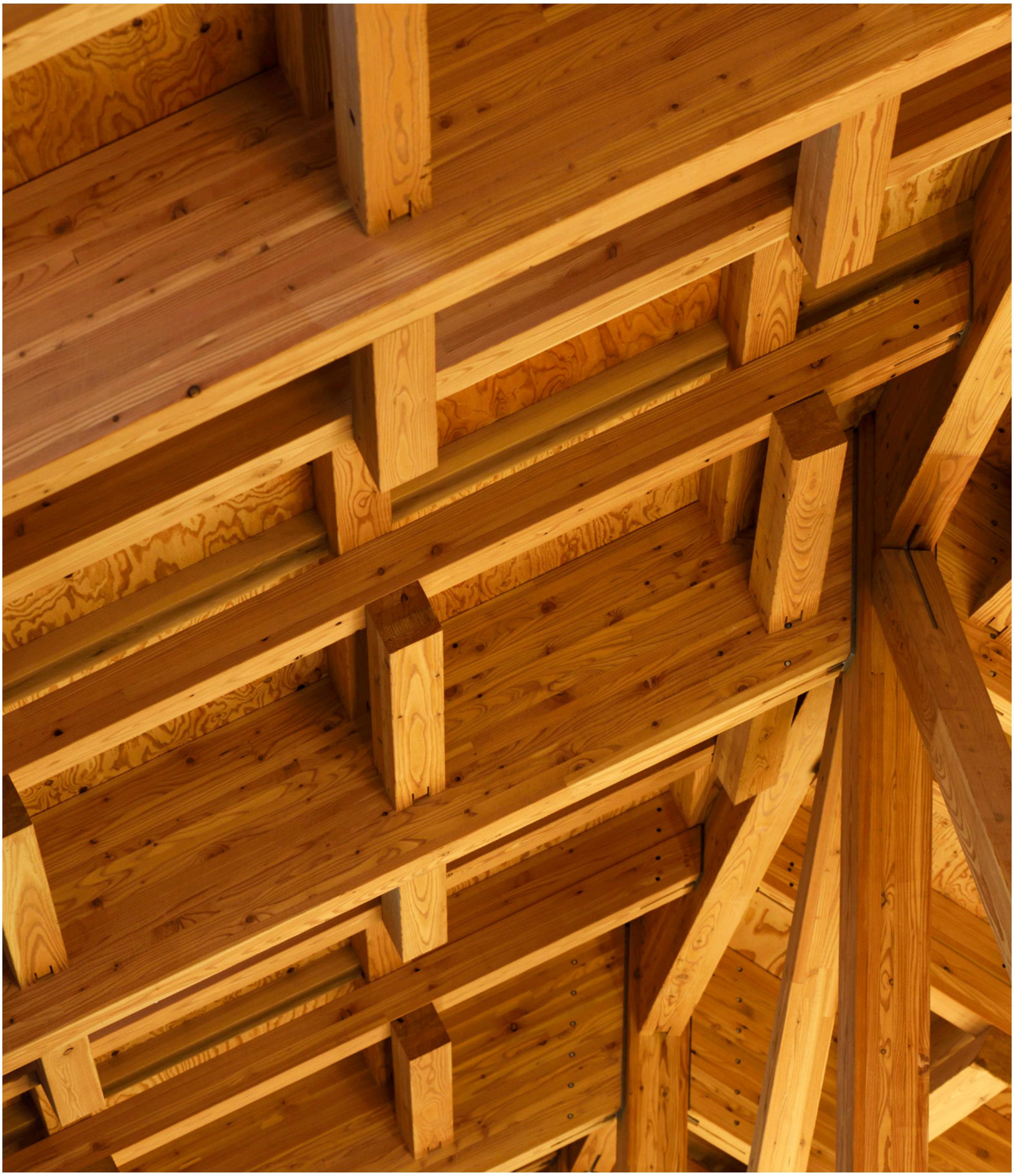
Table 2: Professional engineering competencies to address climate change

Competency group	Competencies	Performance indicators
Engineering knowledge	• Wide understanding of the implications of climate change. • Ability to apply knowledge to projects. • Continually updating knowledge and skills to remain relevant. • Systems thinking.	• Can comprehend and apply knowledge of operational and embodied carbon through carbon calculation tools. • Can comprehend and apply knowledge of what the circular economy means within the relevant industry, designing to conserve resources, eliminate future waste and manage existing material resources. • Can comprehend and apply knowledge of adaptation and resilience. This includes applying an understanding of the possible impacts of extreme weather events and sea level rise on the projects. It also includes designing for the future with changed climate conditions (increased extremes). • Can comprehend and apply nature-based regeneration design solutions to assist in the mitigation of climate change. • Understands and operates within changing legislative, regulatory and policy frameworks. • Knowledge of Te Ao Māori and mātauranga Māori and how these knowledge bases can be applied to projects in Aotearoa New Zealand to support better outcomes. • Demonstrated continued professional development on the impacts of climate change.
Managing engineering work	• Beyond direct operations – wider life cycle considerations.	• Accountable for the longer-term outcomes and impacts of engineering work. Able to identify these outcomes and impacts, articulate where they may have an effect on the climate and outline the mitigation options considered. • Supports collective problem solving with regards to climate change, supporting peers, juniors and seniors to identify the climate challenges and opportunities on projects. • Able to identify alternative options and/or question the long-term feasibility of work in a changing world. • Understands and applies cross disciplinary knowledge on climate change to projects (ie understanding of local ecosystems and how they interact with projects). • Understands local diversity and ecosystems and how they interact with projects. • Advocates for the reduced use of natural resources over the life-cycle of the project (ie decreased water use).

Professional acumen	• Carries out engineering activities to an ethical standard. • Recognises the likely social, cultural and environmental effects of professional engineering activities. • Communicates effectively with engineers and others.	• Understands the Code of Ethical Conduct and behaves in accordance with the Code. • Recognises the impact and long-term effects of engineering activities on the environment. • Considers long-term issues and impact(s) of engineering activities, such as the use of materials, waste during fabrication/construction, energy efficiency during use, and end-of-life issues. • Considers their influence on decision making and leverages effective communication and collaboration skills to drive positive change. • Creates a shared understanding of climate change impacts with clients and works to transition to net zero carbon. • Gives special consideration to Te Tiriti o Waitangi and Te Ao Māori – and the consequent responsibilities. • Seeks to reduce adverse effects. • Communicates the impacts of work and advises where there may be adverse outcomes. • Knowledge of regulations, rules and standards in relation to zero carbon buildings, including proposals for future changes and current best practice. • Knowledge of key policy frameworks, including but not limited to the Emissions Reduction Plan, Whole of Life Embodied Carbon Framework, Transforming Operational Efficiency Framework, etc.
Developing technical solutions	• Defines, investigates and analyses complex engineering problems in line with good practice. • Designs or develops solutions to complex engineering problems in line with good practice.	• Identifies and defines the scope of a problem, using appropriate information and research – including using evidence-based and theoretical principles – including those driven by mātauranga Māori. • Designs for safety and sustainability. • Understands resilience and how natural events will impact designs/builds. • Understands project emission profiles, including scope 3 emissions and the impact of upstream and downstream activities. • Understands what the circular economy means within Aotearoa New Zealand and conserves resources. Designs to eliminate future waste and manages existing material resources so they retain their quality and value (not becoming waste). • Endeavours to ensure industrial symbiosis wherever possible, connecting the by-products of one industrial process to be used in other processes (rather than becoming waste). • Discusses with the client and construction team end-of-life expectations of different parts and elements of builds (Ministry of Environment target is 70 per cent of waste diverted from landfills). • Consults with stakeholders including Mana Whenua and Tangata Whenua. • Develops solutions that are informed by appropriate consideration for societal, climate, environmental, health, safety, legal and cultural issues and the rights of Tangata Whenua.

CONCLUSION

Professional engineers have a role to play in addressing climate change. This practice note outlines the ethical basis for that role and provides guidance and competency considerations. All practising engineers should be familiar with the impact of their work on the climate, as well as the impact of climate change on their work, and utilise this practice note to inform action.



APPENDIX A
AOTEAROA NEW ZEALAND'S CLIMATE CHANGE COMMITMENT

Aotearoa New Zealand has made international and domestic commitments to address climate change by setting targets to lower our greenhouse gas emissions and transition to a low-carbon economy.

Aotearoa New Zealand has committed to reducing its emissions, as a signatory of the Paris Climate Agreement. The Paris Agreement is a legally binding international treaty on climate change. The overarching goal is to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels."

In 2019, the Climate Change Response (Zero Carbon) Amendment Act was passed by Government to set a target for Aotearoa New Zealand to achieve net zero greenhouse gas emissions by 2050. Through this Act, the Climate Change Commission was established to advise on meeting this goal. The Zero Carbon Act also mandates emissions budgets to be set every five years with emission reduction plans outlining government actions to meet each budget period.

In 2022, the National Adaptation Plan was published and considers the impacts of climate change now and into the future and sets out how we will adapt as a nation.

APPENDIX B
FURTHER INFORMATION

Websites accessed 15 April 2024

New Zealand

- Climate Change Commission
- Ministry for the Environment
  - Environmental work programmes
  - Emissions Reduction Plan
- Ministry of Business, Innovation, and Employment
  - Building for climate change
  - Circular economy and bioeconomy
  - Just transitions unit
- National Institute of Water and Atmospheric Research (NIWA)
  - Climate
- The Royal Society of New Zealand
  - Climate change and New Zealand

Relevant professional bodies

- Engineering New Zealand
  - Engineering Climate Action
  - Engineering Climate Action CPD module
  - Sector specific resources
- Water New Zealand
  - Climate Change Group
- Structural Engineering Society New Zealand
  - Sustainable design resources for structural engineers
- The Sustainability Society
- The Institution of Structural Engineers (IStructE)
  - Climate emergency
- Lifecycle Association of New Zealand
  - Case studies
- Carbon and Energy Professionals New Zealand

Other New Zealand organisations

- Building Research Association of New Zealand (BRANZ)
  - Environment and zero-carbon research
- New Zealand Green Building Society
- Sustainable Building Council.

Global

- British Standards Institution
    - PAS2080:2023
- Greenhouse Gas Protocol Initiative
    - The Greenhouse Gas Protocol
- Intergovernmental Panel on Climate Change
- The Institution of Structural Engineers
    - Climate emergency resource
    - Sustainability Resource Map
- United Nations
    - Sustainable Development programme
    - Environment Programme
- World Federation of Engineering Organisations
    - Committee on engineering and the environment
    - Code of Practice for sustainable development and environmental stewardship.

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