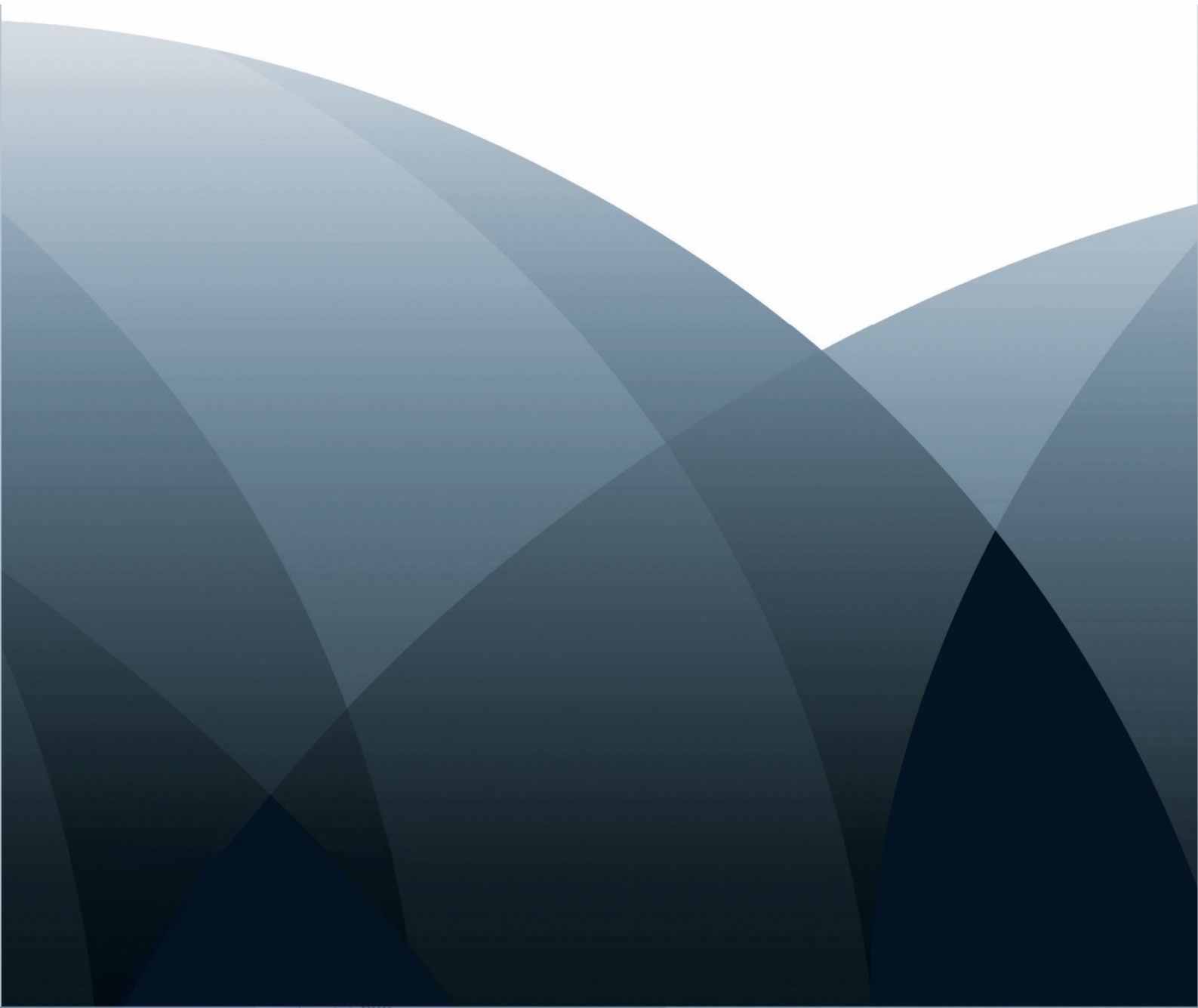
He Pou a Rangi
Climate Change Commission

Discussion document

Review on whether emissions from international shipping and aviation should be included in the 2050 target, and if so how

April 2024



Haere mai – welcome

Disclosure statement

As anticipated by the appointment criteria, the Climate Change Commissioners come from varying fields such as adaptation, agriculture, economics, te ao Māori and the Māori–Crown relationship. While a number of board members continue to hold roles within these fields, our advice is independent and evidence based. The Commission operates under its Interests Policy, which is derived from the Crown Entities Act 2004. You can read more about our board members on the Climate Change Commission website. The Commission regularly updates and publishes on its website a register of relevant board interests.

Contents

Takamua

E tono ana mātou ki Aotearoa New Zealand ki o whakaaro mō ētahi mahi rerekē e toru nei otiia, hono tonu ana, kia tautoko mai i a mātou ki te whakawhanake he tohutohu mā te Kāwanatanga. Ka whai pānga āu kōrero mai kia whakamātauhia tā mātau arotakenga me a mātau kitenga anō hoki. I tēnei e tautoko ai te whakatūturutanga o ā mātou tohutohu e whai take nei ka whai mōhiotanga ai i āu hiahia, tirohanga, āwangawanga anō hoki. Whakamahia ai e te Kāwanatanga i ēnei tohutohu e toru kia whai whakatau me pēhea rā te whenua nei e whakamimiti i ngā haurehu tūkino taiao.

Āu whakahoki kōrero

He mea hira koe ki tā mātou tukanga, ā, kei te hiahia rongo mātou i o whakaaro.

Nā te whakarongo, titiro me te whakaaro ka puta mai i te kōrero.

He mea nui ia, ko a mātou tohutohu e whai reo ai i ngā whakaaro maha kē atu me ngā whakaarotau puta noa i te motu. Ko te whakawhitinga atu ki tētahi ao tukuwaro iti, ki tētahi ao manawaroa hoki e hua ai he angitūtanga, he hua, he wero, he utu anō hoki. Ko ngā pānga – pai mai, kino mai – e rongo ai i a tātou katoa atu.
E kimi ana mātou i ngā taunakitanga, ngā whakaaro kē, ngā whakamōhiotanga me ētahi pārongo kē atu e whakamātautia ai tā mātou ara mahi arotakenga hoki, ā, ka tautoko mai i a mātou kia tomo i ngā whiringa kē. Nā konei e whakapai ake ai ā mātou tohutohu whakamutunga ki te Kāwanatanga me ahu pēhea atu te whenua, ā, ka pēhea rā te āhua o te ao mō ngā uri o inamata, ā, anamata ake nei.

He aha rā tēnei uiuinga e kapi nei?

Koia tēnei tētahi anake o ngā puka uiui e toru, ko tēnā me tēnā he tohutohu e whakawhanakehia ana e mātou. Ko ngā tohutohu e toru nei, he noho wehe otiia, ka whai hononga (**whika 1**). He hira ēnei katoa kia whakamahere tā Aotearoa New Zealand kokenga kia whakatutukitia ai te whāinga tukuwaro whakamimititanga i mua mai i te tau 2050, ā, ki tua atu.

He whakawhanaketanga tēnei puka uiui i ngā mahi i mua, tae ake ki tā mātou rīpoata 2021 *Ināia tonu nei*, ā, ko ngā *Tohutohu 2023 mō te ahunga atu o te kaupapa here mā te Kāwanatanga whakamimititanga tukwaro mahere tuarua*. I whai mōhiotanga mai anō hoki nā tā mātou karanga ki te tūmatanui mō ngā taunakitanga i te tau 2023.

Koia kei ēnei puka:

- **Ngā puka matapakina e rua** – ko tētahi o tā mātou arotakenga o tā Aotearoa New Zealand whāinga whakamimititanga tukuwaro; ā, ko tērā atu i tā mātou arotakenga mēnā rānei me whai wāhi mai ki tēnei whāinga anō hoki ko ngā tukuwaro nā te kawe ō ā-ao mā te poti, mā rererangi rānei, ā, mēnā rānei āe, me pēhea hoki.
- **Ko tētahi tohutohu hukihuki** – mō te tahua tukuwaro tuawhā (2036-40), ā, mēnā rānei ko ngā tahua tukuwaro tahi, rua me te toru me whakahou.

Ko te whāinga whakamimititanga tukuwaro 2050 (**whika 2**) he mea whakatakoto nā te Paremata kia aro ai a Aotearoa New Zealand ki ngā hohenga manaaki taiao. Ka whakaratohia he tohu toitū ki te kāwanatanga me ngā hapori e taea ai e rātou te whakamahere hohenga pae tawhiti, haumitanga anō hoki. Kua herea te Kōmihana kia tātaringia ai te whāinga i ia rima tau ki ētahi paearu, ā, ka whakarato tohutohu mēnā rānei me panoni e noho tonu ai te whenua ki te ara tika.

Kei te rangahau hoki mātou i ngā tukuwaro o te ao waka rererangi, poti anō hoki i Aotearoa New Zealand, ki Aotearoa nei hoki, ā, mēnā rānei me whai wāhi mai ki te whāinga whakamimititanga tukuwaro – mēnā āe, me pēhea hoki.

Ko ngā arotakenga e rua tahi nei e whai whakaaro ana mēnā rānei me whai panonitanga mai te whāinga nei.

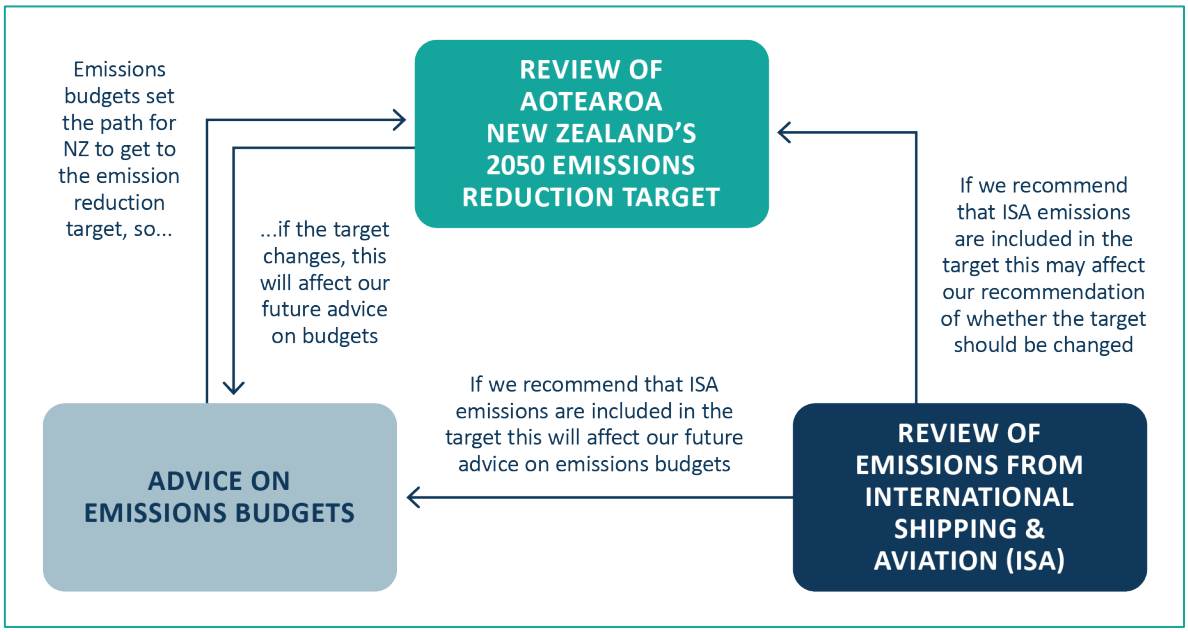
Ko ngā tahua tukuwaro he wāhanga pakupaku kau iho o tā Aotearoa New Zealand whāinga nui. Ka whakatakoto mai te nui o ngātukuwaro haurehua kati mahana e whakaaetia ana a i ia wāhanga rima tau te roa, ā, ka paku iho i ia tahua, o tō mua mai, e whakamimiti ai ngā haurehu Tūkino taiao takahanga o te wā. Ko tā te tahua tukuwaro hukihuki tohutohu he whakarato mai i tā te ināia nei whāinga tukuwaro 2050.

Ko ngā whakatau a te Kāwanatanga mō ā mātou tohutohu whakamutunga me panoni rānei te whāinga, ā, kei te tuawhā o ngā tahua tukuwaro e whakatakoto ai he terenga mō ngā kaupapa here taiao mō ngā tekau tau te taka mai nei. Me tere tika ai ā te Kāwanatanga kaupapa here ki ngā hiahia e whakatutuki ai a Aotearoa New Zealand i tōna oati whakamimiti tukuwaro (**whika 3**). Mā tēnei mahi e whakarato ai ngā taunakitanga ki te Kāwanatanga e hiahiatia ana kia mahi whakatau tika. He mea whakaatu mārama nei, e taea ai e te tūmatanui te whakaheretia te Kāwanatanga. Ko te ara whakawhiti tōkeke ki ngā tukuwaro iti me āta whakahaere puta i ngā tari kāwanatanga maha, waihoki ki ngā iwi me te Māori anō hoki.

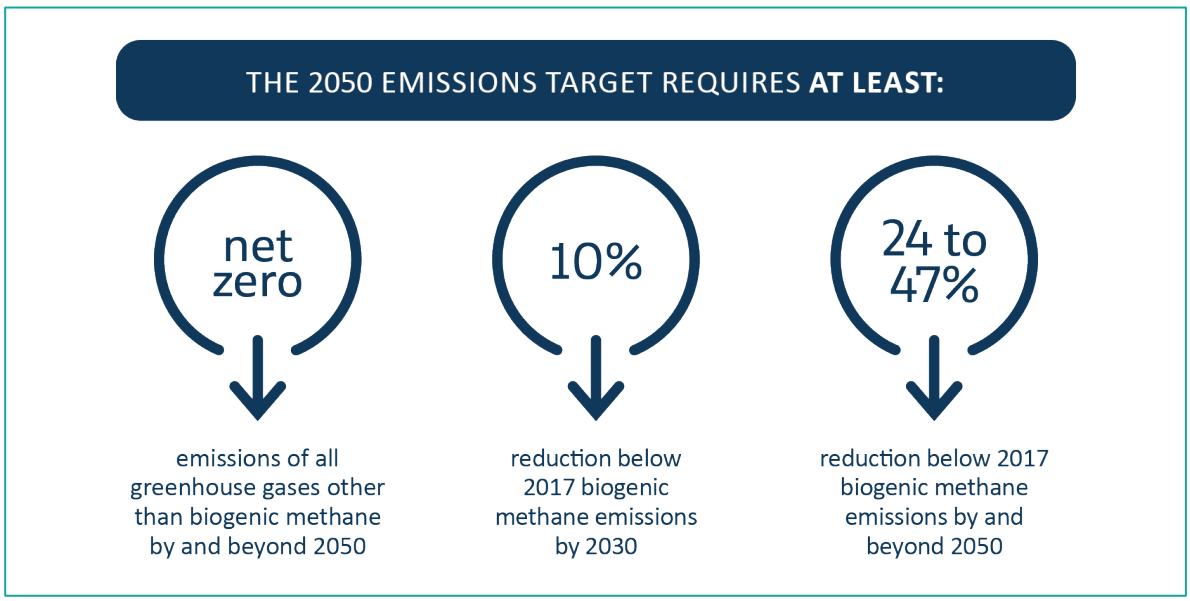
Ko tā mātou he whakatakoto tohutohu motuhake, tōkeke anō hoki. Ko tā mātou he tiro ki ngā pūtaiao, ka mahi kia whai māramatanga o te oranga wheako, ā, ka whakawhitiwhiti whakaaro ki ngā tāngata e whai mōhiotanga ai ki a mātou tohutohu.

He whiringa kei te Kāwanatanga ka aha rā. Ko a mātou tohutohu he whakarato māramatanga ki ngā whiringa rerekē, ā, ka pēhea te whai pānga. Ehara i te mea me manaaki mai te Kāwanatanga a mātou tohutohu otiia, ki te kore, ka kōrero pea ka aha kē rā. Ko te taunga o tēnei waka he mea hira – waihoki, te pēheatanga e ū ai ki reira.

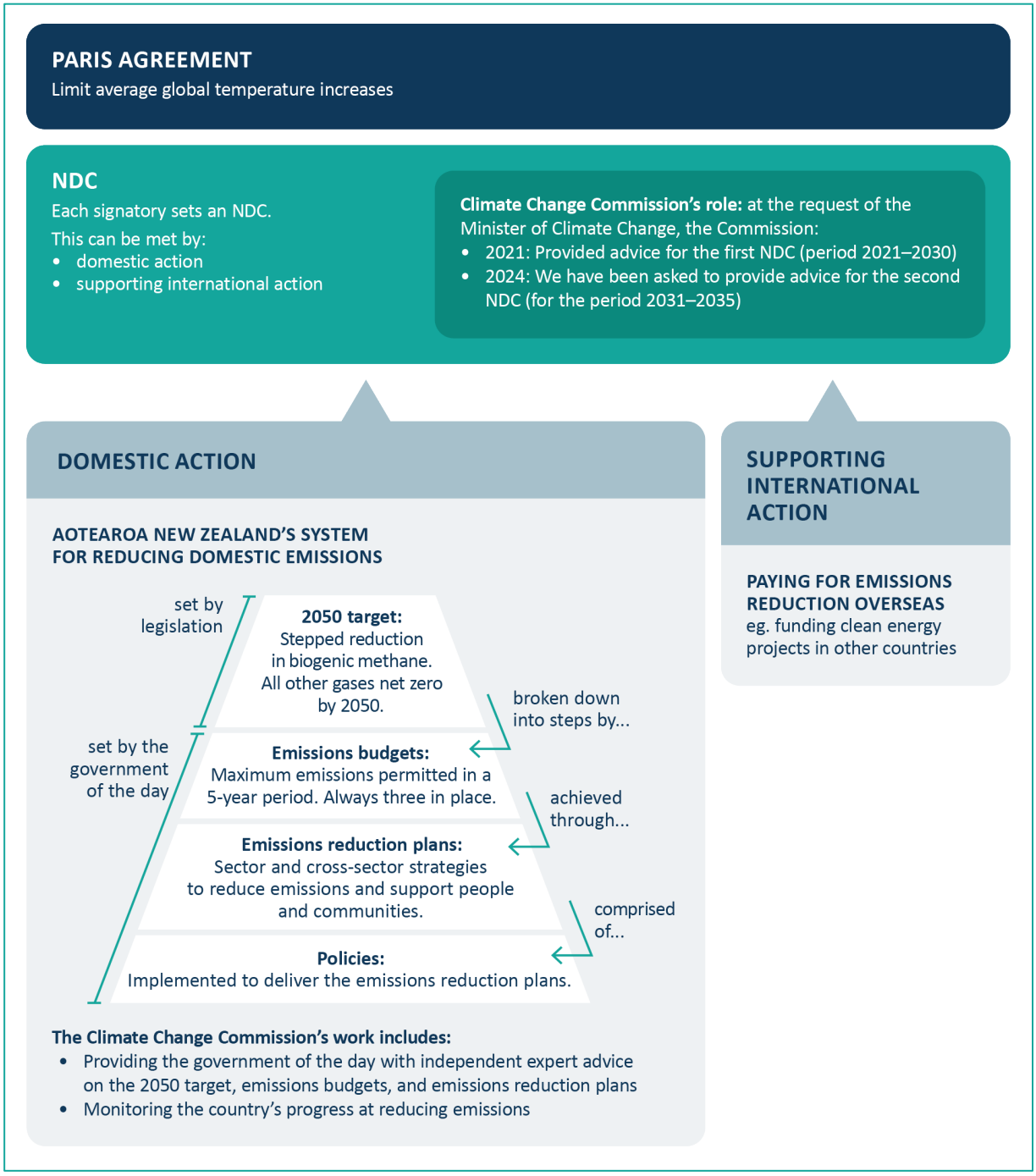
Whika 1. Te honotanga o ēnei mahi e toru. *Ko te whāinga whakamimititanga tukuwaro 2050 tērā e arongia ana e te motu. Ko ngā tahua tukuwaro ka whakaritea mai te ara – tēnā, ki te panoni te whāinga, ka whai pānga tērā ki ngā tohutohu anamata ka tukuna e mātou mō ngā tahua tukuwaro. Mehemea ka whaikuputia e mātou kia whai wāhi atu anō ngā tukuwaro ngā kawenga ō poti me ngā rererangi ā-ao ki te whāinga 2050, tēnā pea ka whai pānga tēnei ki tā mātou whaikupu mēnā rānei me panoni te whāinga, ā, ka whai pānga ki a mātou whaikupu anamata mō ngā tahua tukuwaro.*



Whika 2. Te whāinga whakamimititanga tukuwaro 2050. *He whāinga 'wehenga haurehu' tā Aotearoa New Zealand mō ngā tukuwaro ā-whenua nei, ā, koia tēnei he whakawehe mewaro rauropi ora i ērā atu haurehu kati mahana. Ka whakaaturia tēnei ngā pānga rerekē o tērā tā te mewaro ki ētahi haurehu kati mahana kē atu pēnā me te hauhā. E toru ngā wāhanga o te whāinga. Tuatahi ake, he whakamimiti i ngā haurehu kati mahana (hāunga te mewaro rauropi ora) kia heke ki te kore heke iho rānei i mua i te 2050 ki tua haere ake. Ko ngā toenga wāhanga nei e rua e arongia ana kia whakaheketia ngā mewaro rauropi ora kia 10% te itinga iho i ngā taumata o te tau 2017 i mua mai i te 2030; ā, 24-47% i raro iho i ngā taumata 2017 i mua mai i te tau 2050 ki tua haere ake.*



Whika 3. Ko ngā oati whakamimititanga tukuwaro me te pūnaha e whakatutukihia ai ēnei.
Nā te waitohu i te Whakaaetanga Pārihi, kua ngākau titikaha a Aotearoa New Zealand kia pupuri "te toharite o te pikinga mahana ki rawa raro i te 2°C nui ake i tērā o ngā taumata i mua mai i te whānautanga ahumahitanga" me whai atu i te "herea te pikinga mahana kia 1.5°C nui ake i tērā o ngā taumata i mua mai i te whānautanga ahumahitanga." Tā ia waitohu me whakarite mai he rouroutanga ā-whenua (NDC) e haere ai i te tekau tau mai i te 2021-2030. Ko ngā NDC ka whai ake e kapi ai kia rima tau te roa, ā, me poto ake ai haere nei te wā. Ka whakatutukihia atu ngā NDC mā te whakamimiti haeretanga o ngā tukuwaro ā-whenua, waihoki mā te utu tukuwaro i rāwāhi – ina koa mā roto mai i te haupūtanga atu i ngā hinonga i whenua kē atu. Ko te whāinga 2050 me te tahua whakamimiti (tahi nei me ngā mehere whakamimiti tukuwaro) he wāhanga o tā Aotearoa New Zealand pūnaha mō te whakamimiti tukuwaro ā-whenua nei.



Tā mātou tūranga

Ko ngā kāwanatanga kē o te wā i oati nei kia whakamimiti i ngā haurehu tūkino taiao o Aotearoa New Zealand. Ko tā mātou mahi nei he whakarato tohutohu motuhake, tōkeke hoki mō ngā whiringa kei te kāwanatanga o te rā kia uruparehia te whakamahanatanga o te ao. Ko tā mātou motuhaketanga he whakaūtanga ki Aotearoa – ā-ao anō hoki – mō te kaha o tā Aotearoa New Zealand hohenga mō te whakamahanatanga o te ao.

Tā te Ture Urupare Whakamahanatanga Ao e whakatakoto ai he aha ia ngā mea tā te Kōmihana me tuku tohutohu, ā, me whai whakaaro anō mātou nō mātou e mahi nei i tēnei mahi. He mea whakatakoto paearu me whai ai e a mātou tahua tukuwaro, ā, he whakarite mai anō te whānuitanga o a mātou arotakenga e rua o te whāinga 2050 me ngā tukuwaro i ngā poti ā-ao me ngā rererangi.

Ka herea anōtia e te Ture kia āta whai wāhi ki a mātou tohutohu. Ko te rongo i ngā whakaaro o te hunga whaipānga pēnā i a koe tonu he hira tonu mā mātou hei whakawhanake tohutohu e whai pānga ana ki te ao tūturu, ngā wheakotanga o ngā whānau, ngā hapori me ngā pakihi puta atu i te motu. Ko te whai wāhitanga he mana nui ki a mātou mahi. Mā āu whakahoki kōrero mai me ngā whakamōhiotanga mai e pakari ake anō ai a mātou tohutohu.

Ko āu whakaaro mai ki tēnei uiui e tautoko ai i a mātou ki te whakamātau i te āhua o tā mātou i tātaringia ai ngā taunakitanga, ka whakamātau anō a mātou kitenga, waihoki he whakaatu tauira mō te āhua o urupare e panoni ki tētahi, ki ngā arotakenga e rua rānei.

He aha e take nui ai a mātou mahi

Ko Aotearoa New Zealand, ki te taha o ētahi anō whenua 195, kua oati atu ki te ao kia tautoko te here whakamanatanga ao. E whakawhiti ana te ao ki tētahi anamata tukuwaro iti, me te aha, e hua mai ai he angitūtanga ohaoha hou me ētahi mahi hou kē atu. Me tīmata mai a Aotearoa New Zealand kia whai hua i ēnei angitūtanga, waihoki kei noho hei kaitukuwaro nunui. He tokomaha ngā kiritaki i te ao e tirohia ana te 'whakaritenga tukuwaro' i a rātou ake hanganga me ā rātou kaiwhakarato. Ko ngā hohenga e mahia ana e Aotearoa New Zealand aia nei me ngā whakatau hira te hou mai nei, he mea nui tonu mō tō tātou rongonuitanga i te ao, ā, tā tātou tomo ki ngā mākete o te ao.

Ko te tikanga o tēnei mahi he whakaū e whakawhiti tere ai a Aotearoa me ngā panga iti e taea ana ā-ohaoha, ā-hapori, ā-taiao, ā-ahurea anō hoki – ka mutu, ka whai hua nui ai ngā angitūtanga i aua mea anō rā i runga i te tōkeke mā te hunga katoa o Aotearoa. Ina koa, ko a mātou tohutohu hukihuki ki te tahua tukuwaro tuawhā e whakaaturia ana ko te whakawhitinga ki ngā waka hiko me te whakamimiti i te hautū wakatanga, kei te takiwā o te $23 miriona e penapenatia ai i mua i te 2040 mā te whakamimiti i ngā utu Hauora tūmatanui me te whakapaipaia ake i ngā mahi whakaputaputa. Waihoki, he whakapai ake i oranga tangata.

Kua rongo kē ngā pānga taiao i ngā hapori puta i te motu, ā, ka kaha ake nei te auautanga mai me te kinotanga o ēnei pānga. Kāore te ao i te ara tika kia herea te paemahana ki te 1.5°C. Ki te kore tēnei āhuatanga e arongia ai, ka tahuri kia hoki tere rawa atu nei ki raro ake i te 1.5°C. Tā ia hautanga te karo nei, te tahuri nei rānei e whai pānga tonu.

Ko te tahua whāinga me te tukuwaro 2050 e tautoko a Aotearoa New Zealand ki whakamimiti i ngā tukuwaro. Tā te whāinga he whakarato mahere pae tawhiti e tohua ai te anga whakamuatanga. Ko te tahua tukuwaro e whakawāhangatia te haerenga ka whakaaweawe ai ngā whakataunga pae tata me ngā hohenga. Ko ngā hohenga pae tata me tautoko ake i te whāinga pae tawhiti.

He rangirua te anamata otiia, kei whakatokangia ngā hohenga ina hoki ki te kore e arongia ai ka kikino kē atu ngā putanga. He mahi whakatau kei te Kāwanatanga hei ngā marama 20 te haere ake nei e whai pānga ai ki tā te whenua e whakamimiti iho hei ngā tau 5-30 te taka mai nei. He utu tā ēnei whakatau. Ko a mātou tohutohu e toru e toe nei e tautoko ake i te Kāwanatanga te whakaine tūraru me ngā angitūtanga kei ēnei whiringa e taea ai ngā whakatau mōhio.

Ko ngā tūraru e noho tahi nei ki te whakamahanatanga ao he nui kē, manohi anō ngā angitūtanga. Ko ngā whakatau mārama nei e aru whai whakaaro ana e tautoko ake he whakawhitinga pai atu, tōkeke atu anō hoki. Ko te tikanga o tēnei, ko te whakawhitinga e whakahaere pai nei i ngā pānga ki te tangata me te taiao heoi anō e whai hua nui ai i ngā angitūtanga i runga i te āhua e puta mai he hua ki te hunga katoa o Aotearoa.

Tā mātou kokenga

Ko te tūāpapa o tā mātou he taunakitanga otiia, ehara i te mea ko ngā raraunga inenga kau anake. Ka kitea e mātou te nui o ngā momo tohungatanga me ngā mātauranga kē atu. Kua tātaringia e mātou ngā raraunga hou rawa, kua whai whakaaro ki ngā take e herea ana mātou e te Ture kia arongia ai, ā, kua tohua ngā whakamōhiotanga me ngā taunakitanga i ngā whai wāhitanga ki ngā iwi.

Ka whai whakaaro ai mātou ki te hononga i waenga i te Karauna me te Māori, te ao Māori me ngā pānga tonu iho ki ngā iwi me te Māori anō hoki. Ko ā mātou arotakenga, whai wāhitanga atu anō ki ngā hapori e whakaaturia ana e tautoko ai tēnei he whakamimititanga tere ake nei me te tautoko mai anō he whakawhitinga tōkeke mō te hunga katoa o Aotearoa te hua.

Ko ā mātou arotakenga, tohutohu anō hoki he 'tirohanga pūnaha' te kawe, me te aha, ka whai whakaaro ai mātou ki te tūhonotanga o ngā kaupapa here a te Kāwanatanga, te ao ohaoha, te ao ahumahi, te papori me te taiao. Ko te whai wāhi atu ki te tangata me ngā hapori pēnā me koe he whakarato taunakitanga, arotakenga me ngā whakamōhiotanga i ngā whakaaro maha rerekē, ā, he mea nui tonu hei whakaū kia hāngai, kia taea ai te whakatinana, ā, he māramatanga pai o roto i a mātou tohutohu whakamutunga.

Ko te tikanga o tēnei tirohanga pūnaha nei e whaiwhakaaro anō mātou mō te urutau ki te whakamahanatanga o te ao ki te taha anō o ngā whakamimititanga tukuwaro. Me whaiwhakaaro anō ngā Kaupapa Here Whakamahanatanga Ao kaha nei te hanga, kia whakapaetia mā te aro ki tētahi take Kotahi kau nei e kikino ake ai ko tētahi take kē atu.

He uaua kia whakapaetia he aha rā kei te anamata. Whakamahia ai e mātou he tauira kia whai mōhiotanga he aha rā ngā pānga o ngā tū whakatau rerekē.

Ko tō tātau tauira whānui ā-ohaoha nei kua whakawhanakehia e ngā mātanga hou te rongo o te ao, ā, kua arotakengia motuhaketia ai. Ko a mātou tauira kua whakahoungia, kua arotakengia tāruatia hei wāhanga o te pūnaha tātaringa.

Ka whakamahia e mātou he tauira tūāhua kia whai māramatanga ki ngā momo hohenga me ngā taumata tahua e whakatutukihia e Aotearoa New Zealand te whāinga 2050. I pēnei ai mātou nātemea he ara maha e taea ana e Aotearoa. He rerekē ngā ara me ngā tūāhua ki ngā whakapae e whai take ai pea i te wā tata nei otiia, ka hē ana i a mātou ka whaiwhakaaro ai ki ngā whai pānga e mōhio pū ana mātou te hou mai nei, ā, ka whai pānga ki ō mātou āheinga kia whakamimiti iho i ngā tukuwaro, te urutau rānei ki ngā pānga.

Ka whai whakaaro ai mātou ki ngā utu, ngā hua me ngā pānga o ngā ara kē atu. Ka kore mātou e whakahaere tātaringa mō ngā hua utu hei wāhanga ki ā mātou tohutohu; koia tēnei te wāhanga o te pūnaha e ao kē ana mā te Kāwanatanga e mahi nō te wā ka waihanga kaupapa here nei e hāngai ana. He pēnei mai nātemea me whiri e te Kāwanatanga ko ēhea kaupapa here e whakamahi ana, ā, ko ngā kaupapa here kē he utu kē, he hua kē.

Hei muri i te uiuinga

Ka whai whakaaro ai mātou ki ngā whakahoki kōrero ka whakahokia mai ki a mātou. Ka whakamahia e mātou hei tōna wā e tika ana, kia arotake tāruatia tō mātou tūāpapa taunakitanga, tā mātou kokenga me ngā kitenga.

Ka whakarato mātou a mātou tohutohu e toru whakamutunga ki te Minita Whakamahanatanga Ao i mua i te 31 o Hakihea 2024.

I konei whai whakaaro ai te Kāwanatanga ki a mātou tohutohu, tae ake anō ki ngā whaikupu i mua i tana whakatau whakamutunga hei tēnei taha mai o te tau 2025.

Ki te hiahia whakawhiwhi whakahoutanga koe mō ēnei mahi, waitohu mai ki: bit.ly/TandB2024

Me pēhea koe e tuku tāpaetanga ai

Mutu ana i a koe te pānui mai i ngā puka uiuinga, ā, kua rite mai koe ki te whakahoki kōrero mai, he ara kē atu kia tuku mai ai tō tāpaetanga. Me tae ai ki a mātou i mua i te paunga o te Paraire 31 o ngā rā o Mei 2024.

Mā te ipurangi

E taea ana e koe te tuku tāpaetanga mai mā tā mātou atamira: haveyoursay.climatecommission.govt.nz

Ko te whakamahi i te atamira nei e taea ana e koe te whakarato whakahoki kōrero mai mā te whakautu pātai ki tētahi uiuinga ipurangi.

He whiringa kē atu anō

E taea ana e koe te tuku mai āu whakahoki kōrero ki:

- **Īmēra:** haveyoursay@climatecommission.govt.nz
- **Mā te pouaka:** Uiuinga – Whāinga me ngā tahua, Te Komihana Whakamahanatanga Ao, PO Box 24448, Wellington 6142

Kia mōhio mai: Ina taea ana, e tono ana mātou kia tuku ai a koutou tāpaetanga mā te atamira ipurangi. Nā konei, e āhei ai mātou ki te pupuri rekoata o āu whakapānga, he whakarato anō māu he pārongo matatapu hira, ā, he tono i tō whakaaetanga kia whakamahia, kia tāia i tāu nā tāpaetanga. Mēnā rā kāore koe e taea ana te tuku mai i āu whakahoki kōrero mā te ipurangi ka hiahiatia ai kia tuku mā te īmēra, mā te pouaka rānei, tēnā whakakīia te pepa whakapā me te whakaaetanga ka noho tahi mai ai ina tuku mai koe i tō tāpaetanga. Ki te kore koe e hōmai i ēnei pārongo, e kore e taea ana e mātou te kī mārika e whakaae ai tō tāpaetanga.

Whakapā mai

Ki te tono pepa whakapā me te whakaae, mehemea rānei he pātai āu mō tēnei uiuinga, he hiahia tomonga rānei āu kāore e whakaea ana i ngā whiringa o runga ake nei, tēnā īmēra mai ki a mātou ki haveyoursay@climatecommission.govt.nz

Foreword

We are asking Aotearoa New Zealand for your thoughts on three different but related pieces of work to help us develop advice for the Government. We will use what you tell us to test our analysis and findings. This will help ensure that our final advice is **relevant**, **practical** and **informed** by your needs, views and concerns. The Government will then use these three pieces of advice to make decisions on how the country can reduce climate polluting gases.

Your feedback

You are an important part of our process, we want to hear your thoughts.

Nā te whakarongo, titiro me te whakaaro ka puta mai i te kōrero.
Through listening, looking and thinking we receive wisdom to speak.

It is important that our advice reflects different perspectives and priorities from across the motu. The transition to a low emissions and climate resilient society brings a mix of opportunities and benefits, challenges and costs. The effects – good and bad – will be felt by all of us.

We are looking for evidence, perspectives, insights and other information that tests our approach and analysis, and helps us to assess the different options. This will improve our final advice to the Government on where the country should be heading, and what the future could look like for current and future generations.

What does this consultation cover?

This is one of three consultation documents, each about a piece of advice we are developing. These three pieces of advice are separate, but connected (**Figure 1**). They are all essential to plan Aotearoa New Zealand's journey get to the emissions reduction target by 2050, and beyond.

The consultation documents build on our previous work, including our 2021 report *Ināia tonu nei* and *2023 Advice on the direction of policy for the Government's second emissions reduction plan*. They have also been informed by our public 'call for evidence' in 2023.

These documents include:

- Two **discussion documents** – one on our review of Aotearoa New Zealand's 2050 emissions reduction target; and another on our review on whether emissions for international shipping and aviation should be included in that target, and if so, how.
- One piece of **draft advice** – on the fourth emissions budget period (2036–40), and whether emissions budgets one, two, and three should be revised.

The 2050 emissions reduction target (**Figure 2**) was set by Parliament to focus Aotearoa New Zealand's efforts on climate action. It provides a consistent signal to government, businesses and communities so they can plan long-term action and investment. The Commission is required to review the target every five years against a set of criteria, and provide advice on whether it needs to change to keep the country moving in the right direction.

We are also looking at whether emissions from shipping and aviation to and from Aotearoa New Zealand should be included in the emissions reduction target – and if so, how.

Both these reviews are considering whether changes to the current target are needed.

Emissions budgets are stepping stones towards Aotearoa New Zealand's 2050 target. They set out how much greenhouse gas emissions are allowed in each five-year period, and each budget is smaller than the one before so that climate polluting gases decline over time. The emissions budgets draft advice is about delivering the current 2050 emission reduction target.

The decisions the Government makes following our final advice about whether to change the target, and on the fourth emissions budget, will set the pace for climate policy over the coming decades. Government policy needs to keep pace with what is required to meet Aotearoa New Zealand's emissions reduction commitments (**Figure 3**). This work will provide the Government with the evidence it needs to make decisions. It also provides transparency so the public can hold the Government to account. An equitable transition to low emissions will require coordination across a wide range of government agencies and levels of government, as well as with iwi/Māori.

Our role is to provide independent, impartial advice. We look at the science, work to understand lived experience, and talk to people to inform our advice.

The Government has choices on how to act. Our advice helps it understand different choices, and how they add up. The Government does not have to take our advice, if it does not then it must say what it will do instead. Where we are going is important – so is how we get there.

Figure 1. How these three pieces of work are connected. *The 2050 emissions reduction target is what the country is aiming for. Emissions budgets set the path to the target – so if the target changes, this will affect the future advice we give on emissions budgets. If we recommend that emissions from international shipping and aviation are included in the 2050 target, this may affect our recommendation of whether that target should be changed, and will affect our future advice on emissions budgets.*

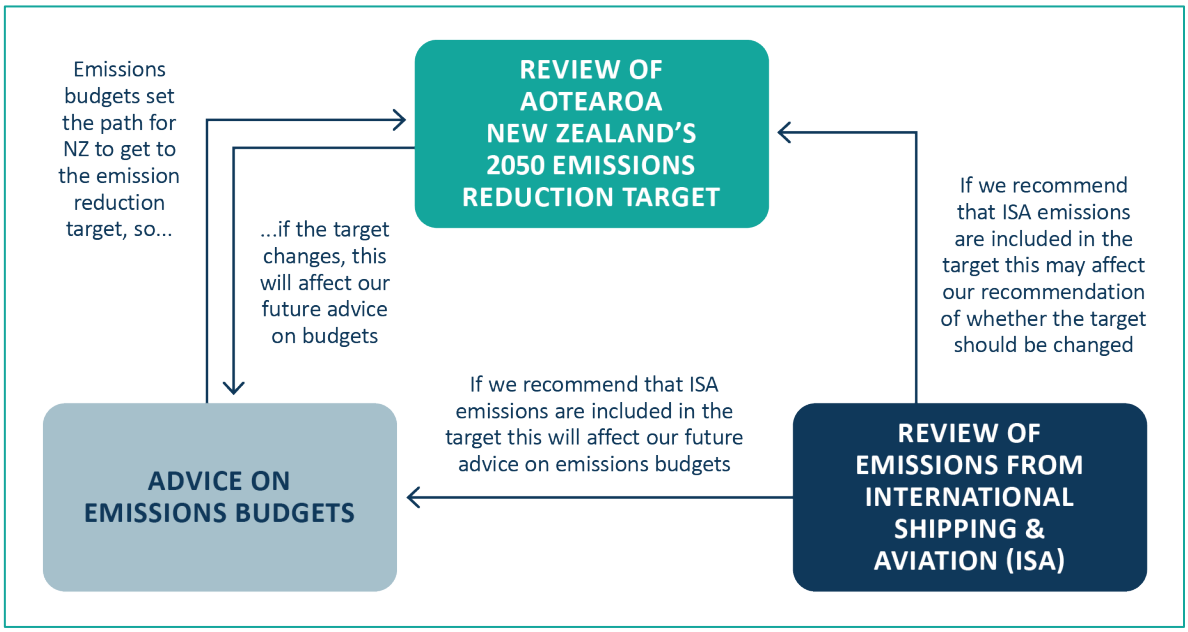


Figure 2. 2050 emissions reduction target. *Aotearoa New Zealand has a 'split gas' target for domestic emissions, which considers biogenic methane separately from all other greenhouse gases. This reflects the different impact that methane has compared with other greenhouse gases, such as carbon dioxide. The target has three components. The first is to reduce emissions of greenhouse gases (other than biogenic methane) to net zero or lower, by 2050 and beyond. The other two components are focused on lowering biogenic methane emissions by at least 10% below 2017 levels, by 2030; and 24–47% below 2017 levels, by 2050 and beyond.*

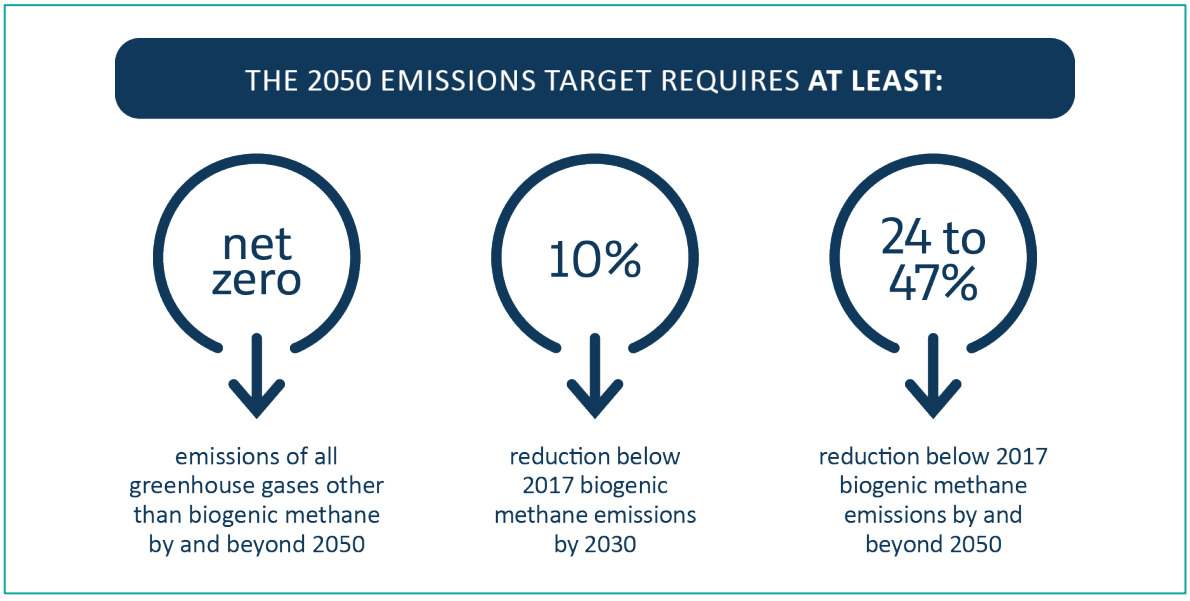
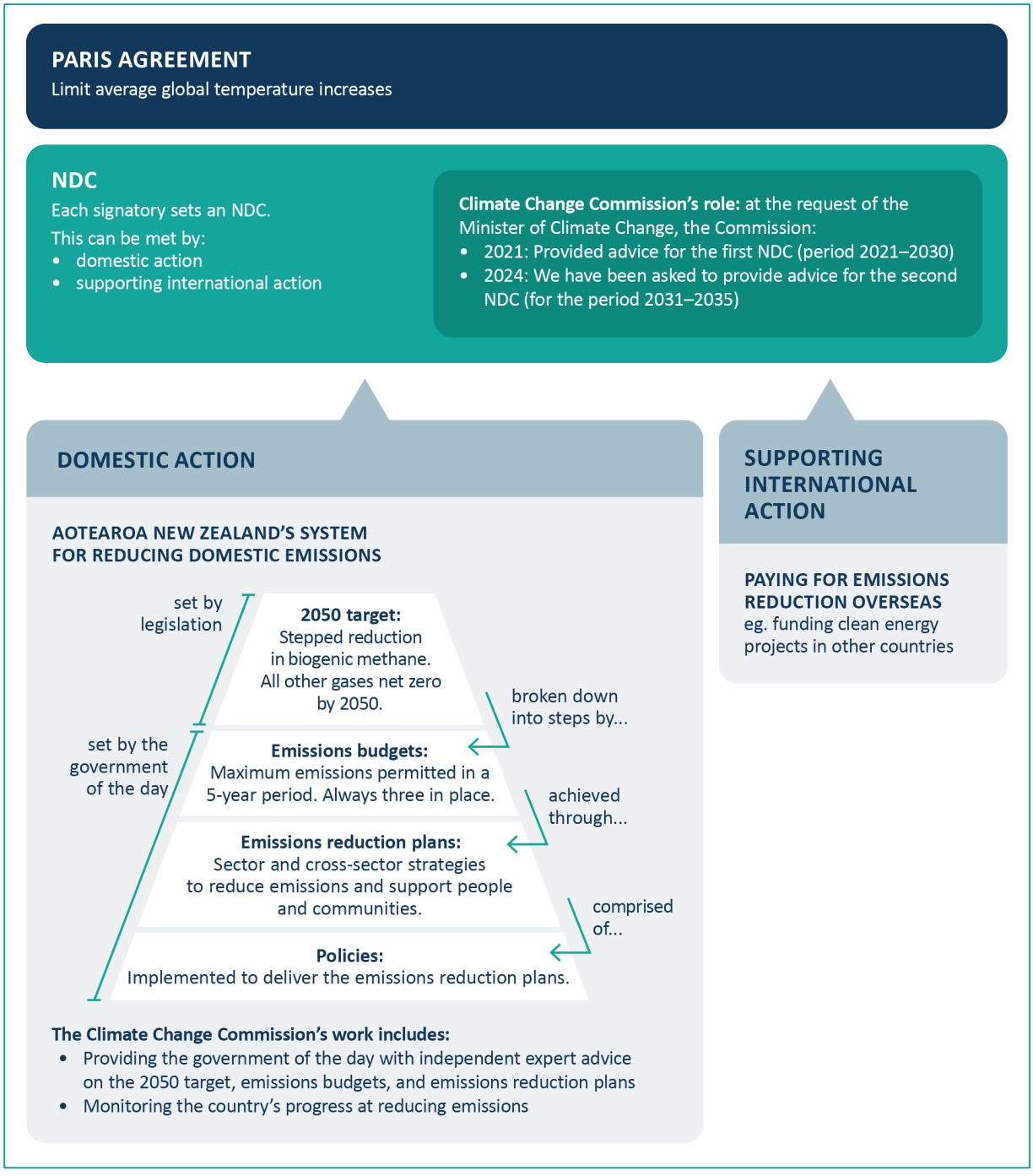


Figure 3. Emissions reduction commitments and the system for meeting them. *By signing the Paris Agreement, Aotearoa New Zealand committed to holding "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursuing efforts "to limit the temperature increase to 1.5°C above pre-industrial levels". Each signatory had to set a nationally determined contribution (NDC), covering the decade 2021–2030. Following NDCs will cover five-year periods, and must get more ambitious each time. An NDC can be achieved by reducing domestic emissions, and by paying for emissions reductions overseas – for example through funding clean energy projects in other countries. The 2050 target and emissions budgets (together with emissions reduction plans) are part of Aotearoa New Zealand's system for reducing domestic emissions.*



Our role

Successive governments have committed to reducing Aotearoa New Zealand's climate polluting gases. Our role is to provide independent, impartial advice about the choices the government of the day has to respond to climate change. Our independence provides assurance to New Zealanders – and internationally – about the credibility of Aotearoa New Zealand's action on climate change.

The Climate Change Response Act sets out what the Commission has to give advice on, and what we have to consider as we do. It sets criteria that our emissions budgets work has to follow, and sets the scope of our two reviews of the 2050 target and of emissions from international shipping and aviation.

The Act also requires that we proactively engage on our advice. Hearing the views of stakeholders such as yourself is critical for us to develop advice that reflects the real-world, lived experience of whānau, communities and businesses across the motu. Engagement is so valuable to our mahi. Your feedback and insights make our advice more robust.

Your input into this consultation will help us to test the way we have analysed the evidence, test our findings, and to present examples for how the target could be changed in response to one or both reviews.

Why this work matters

Aotearoa New Zealand, alongside 195 other economies, has made a global commitment to help limit climate change. The world is transitioning to a low emissions future, which brings new economic opportunities and new kinds of jobs. Aotearoa New Zealand needs to act to benefit from these opportunities, and to avoid being stranded as a high emissions producer. Many international customers are looking at the 'emissions profile' of their products and their suppliers. The actions Aotearoa New Zealand takes now, and in the important decisions to come, are important for our global reputation – and our access to global markets.

This package of work is about ensuring that Aotearoa New Zealand makes this transition in a timely way and with minimal economic, social, environmental, and cultural impact – and maximises opportunities for the same, in an equitable way for all New Zealanders. For example, our draft advice on the fourth emissions budget shows that transitioning to electric vehicles and reducing vehicle use could save $23 billion by 2040 by reducing public health costs and improving productivity. It would also improve quality of life.

Climate impacts are already being felt by communities across the motu, and will become more frequent and severe. The world is not on track to limit warming to 1.5°C. If this is not urgently addressed, then the impetus will be to ensure a return to under 1.5°C will be as quickly as possible. Every fraction of a degree averted or reversed makes a difference.

The 2050 target and emissions budgets help focus Aotearoa New Zealand's efforts to reduce emissions. The target provides a long-term goal that signals the direction of travel. The emissions budgets break the journey into steps and influence short-term decisions and actions. These short-term actions need to add up to the long-term goal.

The future is uncertain, but that cannot paralyse action because doing nothing will lead to worse outcomes. The Government has to make decisions in the next 20 months that will affect how the country reduces emissions over the next 5–30 years. These choices will have consequences. Our final three pieces of advice will help the Government assess the risks and opportunities around these choices, so it can make informed decisions.

The risks that climate change brings are significant, but so are the opportunities. Well-informed and considered decisions can support a smooth and more equitable transition. This means a transition that manages the impacts for people and the environment, while making the most of the opportunities in a way that benefits all New Zealanders.

Our approach

Our work is evidence based, but that doesn't just mean quantitative data. We value different types of expertise and forms of knowledge. We have analysed the latest data, considered the issues the Act requires us to address, and drawn on insights and evidence from engagement with people.

We consider the Crown–Māori relationship, te ao Māori and specific effects on iwi/Māori. Our analysis and engagement with communities shows this will support faster emissions reduction and help achieve an equitable transition for the benefit of all New Zealanders.

Our analysis and advice takes a 'systems view', which means we consider how government policies, economy, industry, society and the environment are all connected. Engaging with people and communities like you who can provide evidence, analysis and insights from different perspectives is essential to ensure our final advice is relevant, practical and well-informed.

This systems view means that we also consider adaptation to climate change alongside emissions reduction. Robust climate policy needs to take both into account, or action to tackle one problem could make another issue worse.

It's difficult to be certain what the future will look like. We use models to understand what the impacts of different choices might be.

Our economy-wide models have been developed by internationally renowned experts and independently reviewed. Our models have been updated, and re-reviewed, as part of this analysis.

We used scenario modelling to understand what types of actions and what budget levels could get Aotearoa New Zealand to the 2050 target. We did this because there are several pathways that Aotearoa New Zealand could take. Scenarios and pathways are different from forecasts and predictions which might be useful in the short term but will be wrong as we consider impacts that we know are coming and will affect our ability to reduce emissions or adapt to the impacts.

We consider the costs, benefits and impacts of different pathways. We do not conduct cost-benefit analysis as part of our advice; this is more appropriately done by the Government as part of its process when developing specific policies. This is because the Government needs to choose which policies it uses, and different policies have different costs and benefits.

After consultation

We will consider each piece of feedback we receive. We will use it, where appropriate, to re-evaluate our evidence base, approach and findings.

We will deliver our three pieces of final advice to the Minister of Climate Change by 31 December 2024.

The Government will then consider our advice, including any recommendations, before making its decisions by the end of 2025.

If you would like to receive updates on this mahi sign up to: bit.ly/TandB2024

How you can make a submission

Once you have read the consultation document(s) and are ready to provide your feedback, there are multiple ways to send us your submission. These need to be received by the end of Friday 31 May 2024.

Online

You can make a submission via our online engagement platform: haveyoursay.climatecommission.govt.nz

Using this platform, you can provide your feedback by answering questions in an online survey.

Alternatively, you can upload your submission as a file, such as a PDF, Word document or spreadsheet.

Other options

You can send us your feedback via:

- **Email:** haveyoursay@climatecommission.govt.nz
- **Post:** Consultation – Target and budgets, Climate Change Commission, PO Box 24448, Wellington 6142

Please note: Wherever possible, we ask that you send your submission using our online engagement platform. This allows us to keep a record of your contact details, provide you with important privacy information, and ask your permission to use and publish your submission. If you cannot submit your feedback online and wish to send it by email or post, please complete the contact and consent form and include it when you send in your submission. **If you do not provide this information, we cannot guarantee that your submission will be accepted**.

Get in touch

To request the contact and consent form, or if you have questions about this consultation, or if you have accessibility requirements not met by the submission options above, please email us at haveyoursay@climatecommission.govt.nz

Chair's message

Aotearoa New Zealand is a trading nation, and we are more dependent on international shipping and aviation than many other countries. Emissions from the movement of people and freight to and from Aotearoa New Zealand are significant and growing, despite our national commitment to reduce the country's total emissions. The Government needs to decide whether to include these emissions in the country's 2050 emissions reduction target.

Your feedback on our work is important because our final advice will recommend whether or not these emissions should be included into the 2050 target – and if so, how. Emissions from international shipping and aviation affect all of us, whether through our livelihoods, overseas travel to connect with family and friends, or purchasing imported food and other goods. You know your sectors and communities, and how the different options we have presented here are likely to affect them.

Globally, action on international aviation and shipping emissions is gaining momentum. Aotearoa New Zealand is already being affected by the actions of international bodies, overseas markets and customers who are demanding emissions improvements from producers and distributors everywhere.

The choices that the Government makes could affect future access to overseas markets and international demand for Aotearoa New Zealand's exports and tourism. Having an independent entity like the Commission reviewing and assessing the situation to inform the Government's decision adds credibility in the eyes of our offshore markets and regulators.

Although emissions for international shipping and aviation have been grouped together for this review, it is important to understand the emissions profiles of these sectors are different and need to be assessed differently. Each has different low emissions technologies, economics and regulation that will affect that mode of transport and sector differently.

All greenhouse gas emissions matter, whatever sector they are caused by and whichever country they originate from. This is why the global goal – which Aotearoa New Zealand has committed to – is to reduce emissions from all sources significantly and permanently as much as possible, as soon as possible. Investors, producers and consumers who lead the charge to reduce emissions will be best placed to benefit from the opportunities.

Your submissions, by informing our final advice and recommendations, will help the Government decide if and how Aotearoa New Zealand should tackle these international emissions.

Dr Rod Carr, Chair

Chief Executive's message

This is the first time that Aotearoa New Zealand has thoroughly examined whether it should include emissions from international shipping and aviation into the country's 2050 emissions reduction target.

Since the target was set in 2019, global focus and action on these international emissions has increased. Major economies, including the UK, EU and USA, have already set domestic targets for these international emissions, and policies to achieve them. The Commission is developing advice for the Government on whether Aotearoa New Zealand should do this too, by including them into the country's 2050 emissions reduction target.

The actions Aotearoa New Zealand takes now, and the decisions to come, are important for our global reputation and future access to global markets.

Hearing from you through this consultation is a vital part of our process. Your feedback and insights will help us to properly understand the implications, and assess the effects, of the different options on your sectors and communities.

The Commission's role is to test the current situation, and examine issues like: how will Aotearoa New Zealand's approach position the country for future access to global markets, how can the country best contribute to limiting global warming to 1.5°C, and is the approach heading in the direction New Zealanders want? Our review will provide the Government with independent evidence-based advice in answer to these questions, so that it can make the necessary decisions.

The primary decision facing the Government, is whether to include emissions from international shipping and aviation into the 2050 target. If the answer is 'yes', then how these emissions are counted and how they are included into the target matters. There are different options for both of these 'how' questions, and they have different impacts on industry, communities and the environment.

This work has already been informed by our previous analysis and engagement over the last four years, and by a specific 'call for evidence' we ran in 2023. In particular, submissions to the call for evidence and follow-up engagement with representatives from both shipping and aviation has led to a deeper understanding of the issues.

Early engagement showed support for addressing these emissions. It also showed there is uncertainty around the exact path to take, and emphasised the need for long-term policy certainty and consistency with overseas approaches wherever possible.

Through this consultation we want to gain as broad a view as possible of the issues, opportunities and impacts we need to consider. We want to hear your feedback on our initial assessments, the potential options, and what factors should be considered. We will then draw our conclusions and deliver our final advice and recommendations to the Government before the end of the year.

The evidence and preferences shared with us and the issues and opportunities raised help shape our analysis. Ngā mihi to everyone who has already contributed to this mahi, and to all who provide a submission in this consultation.

Jo Hendy, Chief Executive

Executive summary

Under the Climate Change Response Act 2002 (the Act), He Pou a Rangi Climate Change Commission (the Commission) must advise the Government by the end of 2024 on whether to include international shipping and aviation emissions in the 2050 target, and if so, how.

This document sets out our initial thinking about whether to include international shipping and aviation emissions in the country's long-term emissions reduction target, and the questions this raises.

We are looking for your feedback to strengthen our understanding of the issues and impacts that need to be taken into account as we prepare our final advice and recommendations.

The key choice Aotearoa New Zealand has

Emissions from international shipping and aviation are contributing to climate change. Global action to reduce these emissions is being coordinated by the International Maritime Organization and International Civil Aviation Organization.

Aotearoa New Zealand has a choice whether to leave it to international efforts to address these emissions, or to take a more active role by bringing them into the country's 2050 emissions reduction target (and its supporting budgets and plans).

No change for these industries is not an option. Global action will cause change to international shipping and aviation whether or not these emissions are included in Aotearoa New Zealand's 2050 target. The choice for the country is to what extent it seeks to play an active role in the process of change.

If the Government decided to include these emissions in the target, it would need to make decisions on two further areas – how the emissions could be counted, and how they could be built into the structure of the 2050 target. This would need to cover: what level of emissions reduction to aim for, and whether these emissions should be added to the net zero component of the target or addressed separately.

See the diagram (**Figure 4**) for a visual of the choices Aotearoa New Zealand has, and see the *Foreword* for explanation of the 2050 target.

The information needed to make choices

The right-hand side of **Figure 4** shows the issues and impacts that need to be taken into account when considering the options the country has. That information – on what the rest of the world is doing, on current and future technology options, and on the potential impacts of including these emissions in Aotearoa New Zealand's 2050 target – forms the core of this document, in *Chapters 2 and 3*.

The consultation focus

This document aims to provide you with an early view of the options the country has and what Government will need to consider when deciding whether international shipping and aviation emissions are included in the 2050 target.

We are consulting part-way through the process of developing our advice, to gain as broad a view as possible of the issues, opportunities and impacts we need to consider. We are keen to hear your feedback on our initial assessments before we complete analysis and modelling that will support final judgements and recommendations.

We want to hear which options you favour, and in particular what you think should be taken into account when weighing these options up. Have we represented all the main issues, is there information missing, and where do you think we should place emphasis in our final advice to Government?

This is one of three different but related pieces of work we are consulting on at the same time – see the *Foreword* for more information about how they are connected, and why we are seeking your input this way.

The Commission will provide its final advice to Government in December 2024. The Government's decisions are due 12 months later.

Chapter 1: Introduction

Our approach

The Commission's work to develop this advice on options for international shipping and aviation emissions is carried out in the context of the overall purpose of the Act:

> *"to provide a framework by which New Zealand can develop and implement clear and stable climate change policies that contribute to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5° Celsius above pre-industrial levels."*

As an independent Crown entity, our review is based on research, evidence and modelling, drawing on expertise of Commissioners, He Pou Herenga (a Māori advisory body to the Board), and staff. We are informed by evidence and insights gathered through direct engagements, as well as the information we receive through calls for evidence, including the one we ran on this work from 31 March – 31 July 2023.

To make decisions about including international shipping and aviation emissions in Aotearoa New Zealand's 2050 target requires a clear view of the potential impacts of those decisions.

This document provides our initial view of likely impacts of including those emissions in the target, across the wide range of areas we consider for all our advice. This includes exploring what this could mean for the economy, for the environment, for society and for future generations, and considering te ao Māori, the Crown–Māori relationship, and the specific effects for iwi/Māori. This is required in the Act.

It also shows where impacts might change depending on *how* these emissions were included – recognising that the way the change might be built into the target structure, and the level of emissions reduction aimed for, can affect the scale of the likely impacts.

We are now inviting further input, to test and strengthen our analysis, before we develop our final advice and recommendations to the Government. We are looking forward to the engagement possible with people through this public consultation process.

Our final advice will pull together the two parts of our review, to recommend specific options. That will include information about the potential impacts of those recommended options.

Why international shipping and aviation emissions matter

The science tells us that international shipping and aviation are contributing to climate change.

International shipping and aviation emissions present a risk to efforts to limit global warming. The two sectors – responsible for 2% of historic global greenhouse gas emissions – could consume over 20% of the total emissions scientists have calculated would give us a 50% chance of staying under 1.5°C if action is not taken.

In Aotearoa New Zealand, international shipping and aviation emissions are not included in the country's current target for reducing greenhouse gas emissions by 2050 – as set in the Climate Change Response Act 2002. The 2050 target does include emissions from domestic shipping and aviation in and around the country.

The emissions caused by traffic to and from Aotearoa New Zealand are significant, and growing. One measure of these emissions can be taken from the volume of fuel that goes into ships and planes when they re-fuel here: in 2019, estimated emissions from the fuel taken on board in Aotearoa New Zealand were close to 5 $MtCO_2e$[i]. That figure was equal to around 9% of the country's total net greenhouse gas emissions that year (from other sources). These emissions increased from 3.25 $MtCO_2e$ in 2009 to 4.91 $MtCO_2e$ in 2019, a 51% increase.

As an island nation, Aotearoa New Zealand relies heavily on international shipping and aviation for tourism, business, imports, exports, and connections with friends and whānau abroad. The choices made about these emissions could affect Aotearoa New Zealand's international relationships, access to overseas markets and demand for the country's products and services.

[i] Megatonnes of carbon dioxide equivalent greenhouse gases. A megatonne of carbon dioxide equivalent (CO_2e) refers to the mass of greenhouse gases that would warm the earth as much as one megatonne of carbon dioxide, using the GWP_{100} metric for the conversion.

Chapter 2: Key issues

International efforts to reduce these emissions

The worldwide action to reduce these emissions is led by the International Maritime Organization (IMO) and International Civil Aviation Organization (ICAO). Increasingly countries are setting their own targets and implementing policies to reduce them.

The IMO and the ICAO have separately set targets to reduce international shipping and aviation emissions to net zero globally by or around 2050. These goals likely cannot be met without domestic policy action by individual countries. Major economies, including the European Union, United Kingdom, and United States of America, are now supporting these goals by setting domestic targets and putting in place policies to achieve them.

Ways these emissions could be reduced

There are a range of options to reduce greenhouse emissions from international shipping and aviation. The evidence shows that increasing efficiency (e.g., improved engines and craft, and operational changes such as powering vessels with electricity when stationary) will not be enough on its own. The increase in demand has outpaced emissions reductions from efficiency to date, and this is expected to continue.

Shifting to alternative fuels is necessary to achieve significant emissions reductions. These fuels include green methanol or ammonia for shipping, and sustainable aviation fuels generated from plant or animal material or electricity.

Emissions can also be reduced by people choosing to travel less or buying fewer goods produced overseas.

Global models suggest that emissions from international shipping and aviation could drop drastically using a mix of new technology and alternative fuels, but they are unlikely to drop all the way to zero by 2050. To be consistent with scientists' modelling of what is required to limit warming to 1.5°C the remaining emissions need to be offset by making greater reductions in emissions from other sectors, or by removing greenhouse gas emissions from the atmosphere (for example, through increased forest areas absorbing CO_2).

Chapter 3: Potential impacts and the choice to make

Considering the impacts of including these emissions in the target

The Commission's role in advising the Government requires us to consider what decisions might mean for the economy, for the environment, for society and for future generations; this includes considering te ao Māori, the Crown–Māori relationship, and the specific effects for iwi/Māori.

These are key areas where we are keen to hear more through feedback, about the implications that you think need to be taken into account – see *Chapter 3*.

This is our initial summary of the likely impacts of including these emissions in the 2050 target:

- Global action is likely to reduce the emissions intensity of international shipping and aviation to and from Aotearoa New Zealand, whether or not these emissions are included in the 2050 target.
- Our initial analysis shows the impacts for the Crown–Māori relationship, for te ao Māori and specific effects on iwi/Māori would include recognising the impacts on their ability to maintain whakawhanaungatanga (relationships) with whānau overseas, protecting te taiao (the environment) for future generations, and for the Māori economy. A transition to reduce emissions from international shipping and aviation should be done in partnership with iwi/Māori, and we want to continually deepen our understanding of what taking a te ao Māori approach to addressing these emissions could mean.

- Including international shipping and aviation emissions in the target would create a legal requirement for these emissions to be included in the country's emissions budgets, emissions reduction plans, and monitoring reports – this is likely to prompt policy action to reduce emissions faster. (Advice on specific policy options to be implemented is out of scope for this review.)
- Government policy action to increase reductions in these emissions is likely to lead to more encouragement of alternative fuels, as they are considered the most effective means of achieving significant emissions reductions.
- As well as reducing emissions, alternative fuels for international shipping and aviation can provide other benefits such as better air quality, which can improve health outcomes for New Zealanders.
- However, the current higher cost of alternative fuels could affect the price of international shipping and aviation. This could reduce demand for tourism and exports with flow-on economic and social impacts.
- The impact of higher fuel prices may be reduced through improved efficiency of ships and planes, which can reduce the amount of fuel used.

Not including international shipping and aviation emissions in the 2050 target could mean:

- That the reduction of these emissions on routes to/from the country may be slower than for other developed countries that have adopted targets.
- This could have impacts on Aotearoa New Zealand's market access, as a result of not having the right fuels to support ship visits, perceptions of the country's environmental credentials impacting demand for exports and tourism, or regulation changes in overseas markets.

The first choice to make: our initial assessment

At the end of *Chapter 3* we provide an initial assessment of the options Aotearoa New Zealand has for the first choice in focus in this review: to include international shipping and aviation emissions in the country's long-term emissions target, or not (or to defer to a future review of the 2050 target). We prompt for feedback at that point, with consultation questions about this choice.

Our initial analysis shows that including these emissions in the 2050 target would be consistent with the purpose of the Act, with global efforts under the Paris Agreement to limit global warming to 1.5°C above pre-industrial levels, and with action being coordinated by the international bodies, IMO and ICAO.

Our analysis also shows current global efforts in international shipping and aviation are unlikely to achieve the emissions reductions required to meet the goals these sectors have set to help limit warming to 1.5°C. Additional action is needed. Our early finding is that an approach combining strong international and domestic action is likely to be in Aotearoa New Zealand's best interests, and to result in the greatest reductions of international shipping and aviation emissions.

We need to do more analysis to be able to make a recommendation – in particular to assess the impact of the different ways that these emissions could be included in the 2050 target. That is how we would confirm which options provide the most appropriate way for Aotearoa New Zealand to meet its obligations under the Act and international commitments.

The next choice: how emissions could be included in the 2050 target

The next step is to explore more closely the options for including international shipping and aviation emissions in the 2050 target. This includes considering the practicality and the likely impacts of different options for counting international shipping and aviation emissions, the level of emissions reduction aimed for, and how these emissions could be included in the structure of the target itself.

How the 2050 target is changed to include these emissions could change the extent of likely impacts for individuals, communities, and businesses. It could also change the overall result, for example if the

target allowed these emissions to be entirely offset by planting trees, it may not lead to extensive action to reduce emissions.

Our initial analysis of these options is summarised in *Chapter 4* and *Chapter 5*, as shown below. We invite your feedback on all these choices – there are consultation questions following each section.

Chapter 4: Options for measuring emissions

How emissions could be counted

If international shipping and aviation emissions are included in the target, a decision will be needed on *how* emissions could be counted. This would make it possible to estimate Aotearoa New Zealand's current emissions and to set five yearly budgets to reduce these emissions. We have identified six options:

- Refuelling – fuel sold in this country
- Fuel use to/from next port – for the specified travel leg
- Fuel use to/from final port – for the entire journey
- Fuel use within the Exclusive Economic Zone
- Share of global emissions
- Fuel used by operators based in this country.

Our initial analysis is that refuelling and an estimate of emissions to/from the next port could be appropriate measurement approaches.

Including 'other impacts' in the target

In addition to the greenhouse gases covered by the 2050 target, international shipping and aviation has other impacts on the atmosphere that contribute to climate change. A decision will be needed about including these 'other impacts'. Options are:

- Include 'other impacts' through a multiplier
- Exclude 'other impacts' from the target at this point
- Reconsider in future reviews of the 2050 target – or possibly earlier if there was a significant change.

Our initial analysis is that it may be better to defer any decisions about accounting for these impacts until the science is more certain.

Chapter 5: Options for including these emissions in the 2050 target

Structure of a target

If international shipping and aviation emissions are added to the 2050 target, a decision will be needed about where they are added: to the net zero component of the target, or as separate components. Options are:

- Include in the net zero component of the target
- One new component seeking gross reductions for international shipping and aviation
- Two new components seeking gross reductions for international shipping and for international aviation separately
- Two new components seeking reductions for international shipping and for international aviation separately but allowing these sectors to offset their emissions.

Our initial analysis is that either inclusion in the net zero component of the 2050 target, or separate gross components of the target, could be effective target structures.

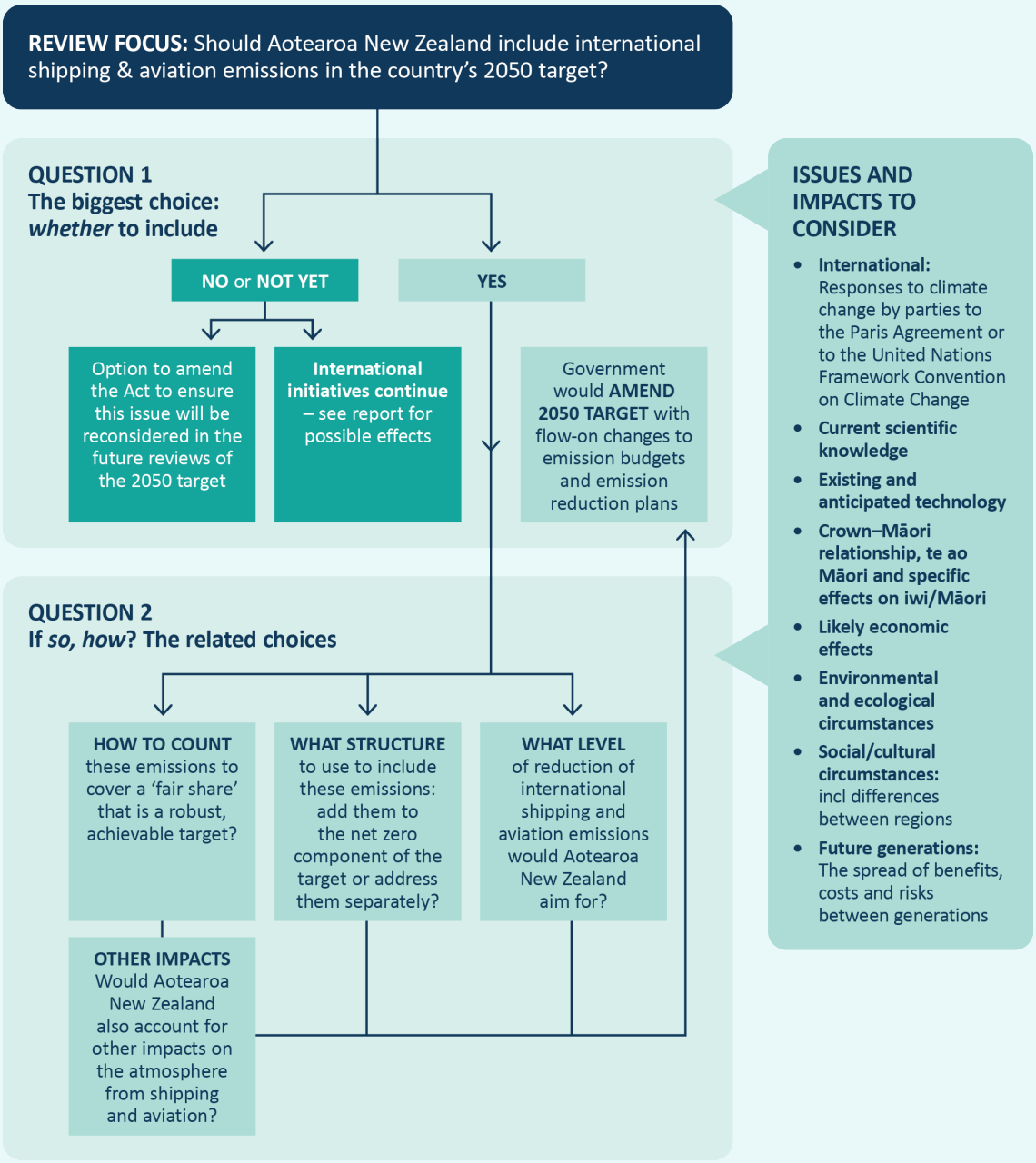
Level of reduction aimed for

If international shipping and aviation emissions are added to the 2050 target, decisions will be needed about the level of emissions reduction for international shipping and aviation to aim for and whether the ambition level of the target as a whole should change. A range of levels of reduction is possible.

The things to think about

What choices are you facing when considering whether Aotearoa New Zealand should include emissions from international shipping and aviation in the country's emissions reduction target.

Figure 4: *The things to think about*



Source: Commission analysis

CHAPTER 1

Introduction

This chapter provides an overview of international shipping and aviation emissions, and the approach we have taken to this review.

As an island nation located far from other major economies, Aotearoa New Zealand relies heavily on international shipping and aviation to connect with the rest of the world. These sectors help New Zealanders keep in touch with friends and family living abroad, enable tourism and business engagement around the globe, import and export goods crucial to the economy and daily life, and help keep Aotearoa New Zealand closely connected across the Pacific region.

International transport contributes to greenhouse gas emissions, but those emissions are currently not covered by the country's emissions reduction target (while emissions from domestic shipping and aviation in and around the country are). This document considers the question *whether* the emissions from international shipping and aviation for Aotearoa New Zealand should be in the 2050 target – and if so *how*. The Commission is required in the Climate Change Response Act 2002 to provide advice on this to the Government by the end of 2024.

Our approach has been to build a research and evidence base to identify the options and form an initial view of the possible impacts of those options – across the wide range of areas we consider for all our advice. We are asking for public feedback at an early stage – so your input can be considered as we refine our advice. This will help ensure that our final advice to Government is relevant and practical, and informed by the different needs, views, and concerns of people from across the motu.

You can see more about this consultation in the *Foreword*, including information on the two related but separate pieces of work we are consulting on at the same time. We are looking forward to the engagement possible with people across Aotearoa New Zealand through this process.

This chapter sets out what we mean by 'emissions from international shipping and aviation', and why they matter in the world, and for this country. It also gives you a view of how we have created our initial analysis, and the structure of the document overall.

Emissions from international shipping and aviation

International shipping and aviation emissions come from travel between Aotearoa New Zealand and other countries by people or freight. They include emissions from travel within Aotearoa New Zealand when an international vessel stops at multiple domestic ports as part of an international freight or cruise trip.

All other emissions created from travel within Aotearoa New Zealand by ship or plane are considered domestic emissions. These are covered by the country's 2050 emissions reduction target and are reported in New Zealand's Greenhouse Gas Inventory. Emissions from fishing vessels are counted in the domestic emissions of countries they refuel in.

Because international shipping and aviation emissions are outside the 2050 target, they are also outside the five-year emissions budgets that are set as stepping-stones to the target, and the emissions reduction plans the Government sets to achieve those budgets.

At the time of setting the 2050 target, some submitters on the draft amendments questioned whether excluding the international shipping and aviation emissions from the target was in line with the purpose of the Act – to provide a framework for Aotearoa New Zealand to contribute to global efforts to limit global warming to 1.5°C above pre-industrial levels.

This work responds to a requirement added by Parliament to the Act for the Commission to advise "on whether the 2050 target should be amended to include emissions from international shipping and aviation (and, if so, how the target should be amended)."

Why these emissions matter

Globally, greenhouse gas emissions from international shipping and aviation are significant and increasing. This is also the case in Aotearoa New Zealand.

One measure of these emissions can be taken from the volume of fuel that goes into ships and planes when they re-fuel in a country: in 2019, estimated emissions from the fuel taken on board in Aotearoa New Zealand were close to 5 $MtCO_2e$[ii]. That figure was equal to 9% of the country's total net greenhouse gas emissions that year (from other sources). These emissions increased from 3.25 $MtCO_2e$ in 2009 to 4.91 $MtCO_2e$ in 2019, a 51% increase.[1]

Aotearoa New Zealand's international shipping emissions come mostly from the movement of imports and exports, and from international cruise ships.[2] Tourism is the activity creating most international aviation emissions, but other factors also contribute. In 2017, 51% of Aotearoa New Zealand's international aviation emissions were related to international visitors, 31% to New Zealanders travelling, 11% to imports, and 9% to exports.[3]

The heavy fuel oil and jet fuels used to power current fleets of international ships and aircraft create emissions that are 98–99% carbon dioxide, which traps heat in the Earth's atmosphere, leading to an increase in the Earth's temperature.[4]

[ii] Megatonnes of carbon dioxide equivalent greenhouse gases. A megatonne of carbon dioxide equivalent (CO_2e) refers to the mass of greenhouse gases that would warm the Earth as much as one megatonne of carbon dioxide, using the GWP_{100} metric for the conversion.

Historically, international shipping and aviation contributed a relatively small share of greenhouse gas emissions, but this is changing. In its Sixth Assessment Report (AR6), the Intergovernmental Panel on Climate Change (IPCC) stated that international shipping and aviation contributed 2% of total historical net human-caused carbon dioxide emissions between 1950 and 2019.[5] Today, they are twice as high: as of 2022 the International Energy Agency estimates the international shipping and aviation sectors are each now responsible for around 2% of global emissions, with both shares continuing to grow.[6]

International shipping and aviation emissions present a risk to efforts to limit global warming

According to the IPCC, the goal set under the Paris Agreement to limit global temperature rises to 1.5°C depends on:

- reducing carbon dioxide emissions to net zero by the 2050s (the 'net zero' part means any remaining carbon dioxide emissions need to be offset by removing carbon dioxide from the atmosphere, for example through increased forest areas absorbing the gas)
- reducing greenhouse gas emissions across all sectors of the economy.[7]

The IPCC has stated:

> *"All global modelled pathways that limit warming to 1.5°C (>50%) with no or limited overshoot, and those that limit warming to 2°C (>67%), involve rapid and deep and, in most cases, immediate greenhouse gas emissions reductions in all sectors this decade."*[8]

In AR6, the IPCC estimated the total amount of greenhouse gases that can be emitted that would still give the world a 50% chance of limiting global warming to 1.5°C.[9] The latest update by the United Nations Environment Programme shows that 'remaining global carbon budget' is around 250,000 $MtCO_2e$ from 2023 to 2050.[10] This is equivalent to around 4–5 years of total global emissions at current rates.

Modelling by the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO) shows the volume of emissions from international shipping and aviation that can be expected if action is not taken. If that happened each of these sectors would consume up to 11% of the total budget remaining.[11] The two sectors – previously responsible for 2% of total global greenhouse gas emissions – could consume over 20% of the world's remaining carbon budget if action is not taken.

If sectors such as international shipping and aviation sit outside efforts to reduce emissions, combatting climate change can be more difficult and costly, and the risk increases that international targets including the Paris Agreement will not be met. It means other sectors must reduce their emissions further and/or there is increased reliance on removals – which may not be achievable.

Whether and how countries should take responsibility is being considered globally

There are efforts underway to reduce shipping and aviation emissions across the world. The IMO and ICAO are coordinating global action on international shipping and aviation emissions. Both have set targets to reduce these emissions to net zero at a global level by or around 2050.[12]

In support of these targets, IMO and ICAO have asked individual countries to create national action plans to reduce their emissions from international shipping and aviation. Major economies like the European Union, United Kingdom, and United States of America are now setting domestic targets and putting in place policies to achieve them.

The IMO and the ICAO have made it clear that action is needed in individual economies, and across the international sectors. There is need for a shift to increase the efficiency of ships and planes through design and technology improvements, use of low emissions alternative fuels, and/or by reducing demand.

Significant emissions reductions are possible in international shipping and aviation. For example, the IPCC has estimated that by 2030, the world could reduce international shipping and aviation emissions by 690 $MtCO_2e$ through low-cost changes.[13] However, there are practical barriers to reducing the emissions entirely by 2050. To achieve the targets set by the IMO and ICAO, the remaining emissions would likely need to be offset by removing greenhouse gas emissions from the atmosphere (such as through increased forest areas absorbing CO_2).

Aotearoa New Zealand's international obligations

The Commission is required to consider the purpose of the Act in all its work, including the need to "provide a framework by which New Zealand can develop and implement clear and stable climate change policies that contribute to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5° Celsius above pre-industrial levels."

This section provides a brief summary of the country's current international obligations, as directly relevant to greenhouse gas emissions from international shipping and aviation.

Aotearoa New Zealand is a signatory to the United Nations Framework Convention on Climate Change, which since the 1990s has coordinated global efforts to combat climate change.

Under that convention, the Kyoto Protocol was developed, which created the first set of global commitments by countries to reduce their emissions. Aotearoa New Zealand is an Annex I party to the protocol, which means it was one of the developed countries identified to take a lead on reducing emissions and set binding targets to do so starting in 2008. Under the Kyoto Protocol, international shipping and aviation were carved out of countries' individual targets. Instead, an obligation was created to work with two international bodies to reduce those emissions, the IMO, and the ICAO.

The Kyoto Protocol was followed by the Paris Agreement, which is now the key agreement driving action on climate change and asks countries to set emissions reduction targets every five years starting in 2020. These are called Nationally Determined Contributions (NDCs). Unlike the Kyoto Protocol, the Paris Agreement does not mention international shipping and aviation emissions. It is up to individual countries to determine what forms part of their NDC. However, developed nations like Aotearoa New Zealand are encouraged to lead and set strong economy wide targets to reduce their emissions.[14]

To ensure clear accounting, the Paris Rulebook, born out of the Paris Agreement, continues to require that countries report their emissions from international shipping and aviation separately when producing their emissions inventories. This does not, however, prevent them setting targets to reduce these emissions.

While the Kyoto Protocol commitment periods have ended, the obligations to work with IMO and ICAO to reduce emissions have not changed, and Aotearoa New Zealand and other countries continue to do so.[15]

While not legally binding, Aotearoa New Zealand has also signed up to several international declarations to reduce emissions from international shipping and aviation. These include the Declaration on Zero Emission Shipping by 2050, the Clydebank Declaration for Green Shipping Corridors, International Aviation Climate Ambition Coalition, and Aviation Net Zero Declaration.[16]

Our approach

The Commission's role as an independent Crown entity is to provide expert, evidence-based advice to Government that represents broad thinking about the impacts of climate change and implications for Aotearoa New Zealand over time.

Our review of options around international shipping and aviation emissions is based on research, evidence and modelling, drawing on expertise of Commissioners, He Pou Herenga (a Māori advisory body to the Board), and staff. We are informed by evidence and insights gathered through direct engagements, as well as the information we receive through calls for evidence, including the one we ran on this work from 31 March – 31 July 2023 (see box).

As set out in the *Foreword*, we are now inviting further input, to test and strengthen our analysis, before we develop our final advice and recommendations to the Government.

We are consulting on our approach and early findings for this review as there is high public interest and the resulting decisions will affect us all. We are looking forward to the engagement possible with people across Aotearoa New Zealand through this process.

The evidence, analysis and insights from different perspectives gained in public consultation will inform our final advice to the Government, due by 31 December 2024. The Government will then consider our advice, including any recommendations we give, before making decisions by the end of 2025.

If an amendment to the 2050 target to include international shipping and aviation emissions is recommended by the Commission and accepted by the Government, legislation would then need to be developed and passed for the change to take effect.

This work is connected to other areas the Commission advises on, including the fourth emissions budget and the regular five-yearly review of the 2050 target required in the Act (also in this consultation round, see *Foreword*).

What Aotearoa New Zealand's NDC should be under the Paris Agreement is out of scope for the questions addressed in this document – because the focus of our review is on the options for the country's 2050 target, not our overall international commitment.

What we heard in the call for evidence
There were 26 respondents in total across the three pieces of work we are currently consulting on.
12 respondents provided evidence or information on the review of whether international shipping and aviation emissions should be included in the 2050 target (this review).
Most submissions on the call for evidence for this review contained a position on including these emissions in the target: 9 respondents supported including it and 2 respondents supported excluding it.
A mix of individuals and organisations provided a range of evidence and preferences on the direction of the Commission's advice to Government.
We met with some of the organisations who submitted evidence and preferences on the call for evidence for this review, as well as with a range of other key stakeholders relevant to international shipping and aviation between July and December 2023.
We have considered and reflected the evidence, preferences and discussions provided where appropriate in our analysis.

The formal requirements: matters we must consider

The Act requires us to "provide written advice to the Minister (of Climate Change) on whether the 2050 target should be amended to include emissions from international shipping and aviation (and, if so, how the target should be amended)."

As well as considering the purpose of the Act to support the country's contribution to international efforts to limit global warming, as noted above, the Commission must also consider, where relevant, the matters detailed in section 5M of the Act:

- current available scientific knowledge
- existing technology and anticipated technological developments, including the costs and benefits of early adoption of these in New Zealand
- the likely economic effects
- social, cultural, environmental, and ecological circumstances, including differences between sectors and regions
- the distribution of benefits, costs, and risks between generations
- the Crown-Māori relationship, te ao Māori, and specific effects on iwi/Māori
- responses to climate change taken or planned by parties to the Paris Agreement or to the Convention.

Our analysis needs to consider the potential impacts of a change in line with these obligations under the Act, as well as practical considerations for how a change could be implemented. This means that to answer the question *whether* international shipping and aviation emissions should be included in the 2050 target, we need to consider *how* they would be included at the same time.

We are consulting part-way through the process, to gain as broad a view as possible of potential impacts, before we complete analysis and modelling that will support final judgements about best options.

How we have shaped our initial analysis

Our initial analysis shown in this document reflects research on how these emissions can be addressed at a global level, and also looks at how that may apply specifically to Aotearoa New Zealand.

We worked out that addressing the question properly depended on us first considering the degree to which:

- international shipping and aviation emissions are contributing to global warming
- limiting warming to 1.5°C requires those emissions to be reduced
- Aotearoa New Zealand contributes to and should take responsibility for those emissions
- action is best achieved through targets and policy intervention at an international level, state level, or at both levels
- state-level targets positively or negatively impact international action.

Our initial analysis on those points are set out in this and the next chapter, followed by presentation of information about impacts, and options for including these emissions in the 2050 target.

How we have set out this document	
Chapter 1 – Introduction	**Introduction** to the task and why international shipping and aviation emissions matter, including this outline of the approach we are taking and how we are presenting this information for feedback.
Chapter 2 – Key issues	**Key issues** to consider, including the domestic and global context for emissions reductions in international transport, and the options to reduce these emissions.
Chapter 3 – Potential impacts	**Potential impacts** of including these emissions in the 2050 target, with notes on the policy implications for Government. The end of *Chapter 3* is where we have placed the consultation questions inviting your views on *whether* these emissions should be included in the 2050 target.
The focus then turns to the *how* it could be included – recognising that the choices are intertwined	
Chapter 4 – Options for measuring	**Options for measuring** international shipping and aviation emissions, and whether other impacts that shipping and aviation have should be accounted for.
Chapter 5 – Options for the 2050 target	**Options for the 2050 target** to include these emissions, which looks at how a revised target could be structured, and what the level of emissions reduction could be.

Consultation questions are also asked in these last two chapters, about the options we have developed. And we also prompt you for your feedback on what we have included in our initial analysis and the weight given to different factors in our considerations throughout *Chapters 2–5*.

Please see the *Foreword* for more information about how you can provide feedback. We look forward to your input.

CHAPTER 2

Key issues

This chapter sets out our early view of the issues that need to be taken into account when considering whether to include international shipping and aviation emissions in the 2050 target.

The Commission's advice to Government needs to be based on the best information we can gather. This includes understanding the key issues, such as challenges around international shipping and aviation emissions that are specific to Aotearoa New Zealand, what is happening in the rest of the world, and what opportunities are available from new technology.

The issues set out in this chapter reflect our early findings based on research and initial analysis. We are keen to hear more from people with knowledge and interest in these areas, to inform our view – see the consultation question at the end of the chapter. Your feedback and extra information allows us to develop the best analysis possible, so that our final advice to Government is based on a broad range of experience and knowledge across the motu.

Aotearoa New Zealand's national context

Aotearoa New Zealand is a developed nation and is therefore expected under the Paris Agreement to take a lead on emissions reductions.[17] However, there are several factors that make reducing emissions from international shipping and aviation more challenging for Aotearoa New Zealand than for other countries.

This section sets out these issues. For a view of the possible impacts of a decision to include international shipping and aviation emissions in the 2050 target, see *Chapter 3*.

High use of international shipping and aviation

Movement of people and goods by air and ship is critically important for a small island nation located a long way from key markets and trading partners. Connections within the wider Pacific region and to countries further afield are central to the wellbeing of families, businesses and communities across the motu. This includes maintaining whakawhanaungatanga (relationships) with whānau living overseas.

Aotearoa New Zealand's exports of goods and services including tourism were worth NZ$95 billion in 2023 while imports were worth NZ$108 billion.[18] In addition to the New Zealanders employed directly by airlines, shipping lines, ports, and airports, these transport sectors also support jobs in related areas such as tourism and export industries.

The geographic distance to other major economies means that planes and ships travelling to and from the country need to cover greater distances, increasing their emissions. This means international shipping and aviation emissions will be higher than they would be for other countries to move the same amount of people or goods.

Aotearoa New Zealand cannot use international land transport. This means it cannot reduce its international shipping and aviation emissions by transitioning to electric trucks, cars, or rail in the same way as other countries can.

Most of Aotearoa New Zealand's freight by sea travels long haul. In 2023, 13% of Aotearoa New Zealand's exports went to Australia (considered short-medium haul), and 11% of imports came from Australia.[19] The remaining imports and exports travelled to and from further destinations such as China, the United States of America (USA), and the European Union (EU).

Aotearoa New Zealand ranks sixth in the world for highest international aviation emissions per person based on refuelling occurring within the country, and fifteenth for most flights taken per person.[20]

Most international flights to and from the country are medium haul (less than 6 hours). In 2023, 62% of flights and 55% of passengers travelled to and from Australia, and 11% of flights and 12% of passengers travelled to and from the Pacific islands.[21]

These complexities, combined with the country's high reliance on international shipping and aviation, may make it more vulnerable to changes in consumer preferences or overseas regulatory requirements.

Access to international markets

Aotearoa New Zealand has a globally recognised focus on sustainability and protecting the environment, which provides benefits to the tourism and export industries. "TIAKI – Our drive to care for people, place and planet for our future" is one of four core values underpinning the *New Zealand Story*, which government and industry use to brand the country's tourism and exports.[22] Brand Finance estimates this brand to be worth around NZ$400 billion.[23]

Research by Kantar New Zealand found that greenhouse gas emissions from air travel is one of the sustainability issues of greatest concern for tourists, particularly those from the USA and United Kingdom (UK).[24] A 2023 survey found that between 73% and 95% of respondents in each of Aotearoa New Zealand's key markets reported they intended to travel more sustainably in future.[25]

Many of Aotearoa New Zealand's exports also benefit from this environmental stewardship branding. This is relevant to how people make consumer decisions, and to meeting international regulatory requirements.

The EU's pricing for international shipping covers all of Aotearoa New Zealand's sea freight to Europe. Its Carbon Border Adjustment Mechanism, which will start in 2026, puts a price on the greenhouse gas emissions associated with the production of certain imported goods. Currently, agricultural products are not included in the Carbon Border Adjustment Mechanism, which means they will be priced based only on their transport emissions. This approach puts Aotearoa New Zealand's agricultural products at a relative disadvantage, as its transport emissions are higher than other closer countries.

Aotearoa New Zealand's current refuelling infrastructure for international shipping and aviation is designed for fossil fuels. This means if trading partners move to alternative fuels, other than drop in biofuels, some ships may be unable to visit the country if they cannot refuel in the region.

Taking responsibility for emissions

Although the Government in Aotearoa New Zealand is not required to account for its international shipping and aviation emissions under current law, the same is not necessarily true for businesses operating in the country. Customers and companies alike, including large global brands like Nestlé, are increasingly seeking supply chains that have reduced greenhouse gases.[26] Overseas markets like the EU are increasingly putting regulatory requirements around these emissions as well.

Values around kaitiakitanga (guardianship) mean this is important for many Māori businesses; Stats NZ has reported that in 2021 85% of major businesses involved in collective management of Māori assets indicated they intended to take some action on climate change in the next five years.[27]

For many Aotearoa New Zealand businesses involved in tourism or the import and export of goods, international shipping and aviation emissions form part of the greenhouse gases they report as Scope 3 emissions. These are emissions from upstream or downstream activities of an organisation – outside their direct emissions, and outside the emissions from their purchase and use of electricity, steam, heating or cooling.

Under Aotearoa New Zealand's mandatory climate-related disclosures regime, many businesses are legally required to report on Scope 3 emissions.[28]

This means there can be a mismatch between what businesses and the government are trying to achieve due to differing accountability standards.

Global targets and action

This section sets out our initial analysis of action being taken by international agencies and other economies. Understanding what is happening elsewhere is important for determining what we consider are key factors for the decision whether Aotearoa New Zealand includes international shipping and aviation emissions in the 2050 target:

- would that be consistent with global efforts
- are global efforts consistent with limiting warming to 1.5°C
- what should Aotearoa New Zealand's level of ambition be.

Overseas action also needs to be taken into account when considering the impacts of including these emissions in the 2050 target. Emissions reductions are unlikely to happen at the same rate globally. Recent modelling by the International Energy Agency in its Net Zero Roadmap shows advanced economies reducing their international and domestic aviation emissions by 91% between 2022 and 2050, while emerging markets reduce them by 47%.[29] Shipping and aviation companies are likely to focus their emissions reduction efforts on routes where there is government support or alternative fuels are more readily available. This means what action Aotearoa New Zealand takes relative to other countries can affect its rate of emissions reduction and access to international markets – this is covered in more detail in *Chapter 3*.

Global initiatives led at United Nations level

International Maritime Organization

The *2023 Strategy on Reduction of GHG Emissions from Ships* from the International Maritime Organization (IMO) aims to reduce carbon intensity through energy efficiencies and technologies. Its overall goal is to reach net zero greenhouse gas emissions from international emissions by or around 2050, while promoting an equitable transition.[30]

The IMO strategy sets indicative checkpoints on a path to reach net zero, with goals to:

- by 2030 reduce total annual greenhouse gas emissions from international shipping by at least 20%, striving for 30%, compared to 2008 levels
- by 2040 reduce total annual greenhouse gas emissions from international shipping by at least 70%, striving for 80%, compared to 2008 levels.[31]

The strategy has strengthened the previous targets set in 2018, which were to peak shipping emissions as soon as possible, and to reduce greenhouse gas emissions by at least 50% by 2050 compared to 2008 levels.[32]

IMO outlines two major policy levers, which it says should be developed and agreed by 2025, and in place by 2027. One of these is technical – a marine fuel standard that regulates the phased reduction of emissions intensity from marine fuel, the other is economic – a maritime emissions pricing mechanism.[33] This means there is potential for global emissions pricing and fuel regulations for international shipping to be in place within the next five years.

International Civil Aviation Organization

The International Civil Aviation Organization (ICAO) has adopted a long-term aspirational goal of reaching net zero international aviation CO_2 emissions by 2050.[34]

This has strengthened its previous goal, which was for a 2% annual fuel efficiency improvement goal through to 2050 and a goal for carbon neutral growth from 2020 onwards.[35]

The ICAO's long-term aspirational goal favours measures that directly reduce aviation emissions at their source, rather than relying primarily on offsetting emissions through the purchase and cancellation of emissions units (allowances to emit emissions). These favoured measures include speeding up the adoption of new aircraft technologies, streamlining flight operations, and increasing production and deployment of sustainable aviation fuels.

Although the focus of the revised goal has shifted to direct reduction of emissions at source, one of ICAO's key levers is the Carbon Offsetting and Reduction Scheme for Aviation (CORSIA). This requires airline operators in the scheme to offset their CO_2 emissions that are above a level set at 85% of 2019 emissions. Under CORSIA, operators are required to monitor emissions on all international flights (subject to exemptions for small aircraft and specific purposes such as firefighting).[36] A pilot phase ran from 2021 to 2023 and a voluntary first phase is running from 2024 to 2026. From 2027, this scheme becomes mandatory except for a specific group of 'least developed', 'small island', or 'land locked' developing countries. Aotearoa New Zealand is participating in the voluntary stages.[37] The scheme is due to end in 2035 subject to a review in 2032 considering if it should be extended.

Action by individual countries

National action plans

Countries are expected to take domestic action to reduce international shipping and aviation emissions. Both IMO and ICAO encourage their member states (including Aotearoa New Zealand) to develop national action plans that cover both domestic and international emissions.

For shipping, IMO's *2023 Strategy on Reduction of GHG Emissions from Ships* includes a short-term measure to encourage the development and update of national action plans to address international shipping emissions in accordance with its guidelines. So far, eight countries have submitted their national action plans (Finland, India, Japan, Marshall Islands, United Kingdom, Norway, Singapore, and the Republic of Korea.)[38] Aotearoa New Zealand has not yet submitted a plan.

For aviation, ICAO launched the State Action Plan initiative in 2010 to provide member states with the capacity and tools to reduce their aviation emissions. States are encouraged to work together with local stakeholders to select appropriate emissions reduction measures from ICAO's 'basket of measures' and to calculate the expected results of implementing those measures. States are encouraged to update their plans every three years; to date 146 states representing 98.99% of air travel have voluntarily submitted a State Action Plan.[39] Aotearoa New Zealand submitted a plan in 2016 but has not updated it since.

Action by other major economies

Some major economies, including the UK, EU, and USA are taking further action. A summary of those actions is provided in **Table 2.1**. This shows examples of domestic action complementary to the international regimes. It also shows that some of the economies Aotearoa New Zealand typically compares itself to are currently ahead in addressing these emissions.

Table 2.1: *Summary of international shipping and aviation action by some major economies*

Economy	International shipping actions	International aviation action
United Kingdom	**Sixth carbon budget:** the budget limits the greenhouse gases that can be emitted over the 5 years from 2033 to 2037, including international shipping and aviation.[40] **Net zero target:** the 2050 target will cover the whole economy, including international shipping and aviation emissions.[41]	**Sixth carbon budget and net zero target:** as for international shipping. **Emissions trading scheme**: the scheme prices emissions for flights between the UK, EU countries (excluding outermost regions), and Gibraltar.[42,43] **Sustainable aviation fuel:** use of sustainable aviation fuel will be required from 2025. In addition, the government is investing in sustainable aviation fuel production and will guarantee revenue for producers.[44]
European Union	**FuelEU Maritime:** this regulation requires an 80% reduction in greenhouse gas emissions intensity by international shipping in the EU while sailing, and the use of shore power in port by 2050.[45] **Emissions Trading System:** this prices CO_2 emissions of all large ships entering EU ports from January 2024.[46] **Nationally determined contributions:** the EU accounts for international shipping emissions within the EU in its NDC.[47]	**Emissions Trading System:** this prices emissions for flights between countries in the EU and to/from the UK and Switzerland.[48] The system is intended to cover all international flights; this is paused due to CORSIA until 2027. **ReFuelEU Aviation:** a sustainable aviation fuel requirement will be applied to all flights departing EU airports (70% by 2050).[49,50] **Sustainable aviation fuel:** subsidising the use of sustainable aviation fuels on a cost recovery basis.[51]
United States of America	**Green Shipping Challenge:** launched with Norway to encourage governments, ports, and companies to commit to accelerating the transition to green shipping.[52] **Clean Shipping Act:** this Act seeks to set carbon intensity standards on marine fuels with a target to reach 100% zero emission fuels by 2040.[53]	**Aviation Climate Action Plan:** the plan aims to achieve net zero greenhouse gas emissions from the USA aviation sector by 2050.[54] **Sustainable aviation fuel:** the USA is providing subsidies of up to US$1.75 per gallon (around NZ 60 cents per litre[iii]) on sustainable aviation fuel.[55]

[iii] Conversion accurate as at 9 January 2024.

Other economies with policies to reduce international shipping and aviation emissions include:

- Australia, which has established a Jet Zero Council to advise on achieving net zero aviation emissions and is supporting the development of alternative fuels through the Future Fuels in Australia (2021 to 2050) initiative[56]
- Other economies that have announced sustainable aviation fuel requirements include Türkiye (from 2025), India (from 2027), British Columbia in Canada (from 2028), and Japan (from 2030). In addition, Singapore and Thailand have indicated they are considering requiring use of sustainable aviation fuel.[57]

Other organisations' targets

As well as the action by the two key international sector bodies, and action at state level, other international shipping and aviation bodies are setting their own targets and supporting strategies:

- **Cruise Lines International Association:** is committed to pursue net zero carbon cruising by 2050. Technologies being adopted include using electricity while in port, adopting hybrid engines, and switching to alternative fuels. The association's members cover 95% of global cruise passengers.[58]
- **International Air Transportation Association:** represents 314 member airlines and is aiming to achieve net zero CO_2 emissions by 2050 through sustainable aviation fuels (65% of reductions), new aircraft technology (13%), more efficient operations and infrastructure (3%), carbon capture and storage (11%) and offsets (8%).[59]
- **World Economic Forum:** Airports of Tomorrow initiative with Airports Council International aims to support net zero aviation emissions in 2050 through: addressing airport infrastructure needs, supporting scale-up of sustainable aviation fuel, providing certainty to investors and governments including clarity of financing needs, and matching aviation decarbonisation startups with investors.[60] The World Economic Forum has also undertaken a call to action, with 150 industry leaders calling for net zero shipping.[61]
- **International Airlines Group:** aims to achieve a 10% reduction in CO_2 per passenger kilometre by 2025 and net zero CO_2 across operations and supply chains by 2050. Their Flightpath Net Zero Strategy includes actions to decarbonise their fleet and operations, support sustainable aviation fuel, carbon offsets and removals, and supplier engagement and innovation.[62]
- **Airports Council International:** has created a long-term goal to reach net zero carbon emissions by 2050 while urging governments to provide the necessary support to achieve this.[63] Its 712 members operate 1,925 airports in 171 countries.[64]

Initial analysis on global action

Our initial analysis shows that while the international air and sea transport sectors are targeting net zero greenhouse gas emissions by 2050, the current global action is inadequate to deliver the emissions reductions to achieve that. Further action is required. Several major economies such as the UK, EU and USA are taking further action.

Our analysis also shows that even if these sectors achieve significant emissions reductions, practical limitations of the technology expected to be available mean that reaching goals of net zero emissions would require emissions reductions in other sectors, or increased CO_2 removals such as through forests.

Opportunities to lower emissions from international shipping and aviation

This section shows our initial analysis on current technology to support reduction in emissions from international shipping and aviation.

It summarises our research into options for use of new technology and alternative fuels in each of the two sectors. It includes an overview of production of alternative fuels, and of current barriers to their use.

The impact of adopting some of these technologies, including the implications for the Crown–Māori relationship, for te ao Māori, and specific effects on iwi/Māori, are covered in more detail in *Chapter 3*.

Chapter 3 also sets out the policy considerations for amending the target. In addition to choices around technology the Government also has choices about how it addresses demand for international shipping and aviation which can help to limit emissions.

We are seeking feedback and extra information on this analysis, to strengthen our advice to Government on options for including international shipping and aviation emissions in the country's 2050 target.

Shipping technology

Since the industrial revolution, international shipping has been fuelled almost entirely by fossil fuels such as heavy fuel oil and diesel, which cause high levels of greenhouse gas emissions. In 2022, international shipping released 706 $MtCO_2$ worldwide.[65] Aotearoa New Zealand is contributing to these emissions; the 2019 estimate for emissions based on international ships refuelling in the country was 1 $MtCO_2e$.[66]

Our analysis shows the opportunities for reducing emissions from international shipping include increases in efficiency, and transition to alternative fuels such as biofuels, methanol, ammonia, or hydrogen. The availability and commercial viability of these fuels is growing.

There are some challenges to achieving the net zero by 2050 target set by the IMO for greenhouse gas emissions from international shipping (see *Global targets and action* above). While battery electric vessels can already be used for domestic shipping, they are unlikely to be suitable for long-distance shipping in the coming decades.

The long lifespan of shipping vessels may slow the rate of change; conversely it means that introducing new technology now would provide long-term benefits over the lifetime of the new vessels. It also means if fossil fuel and less efficient vessels continue to be built globally in the short term, there is a risk that vessels with higher emissions get redeployed to the Asia-Pacific region once other shipping regions around Europe and the USA shift to lower emissions technology.

In the cruise ship sector, a focus on passenger numbers and high energy needs mean these companies may be more likely to invest in vessels using liquid fossil gas or certain alternative fuels such as green methanol and shore power. Cargo ships operate in a highly cost competitive industry, so may be more influenced by the cost of different alternative fuel choices.[67]

Aviation technology

The aviation sector currently relies on jet fuel, an emissions-intensive fossil fuel derived from kerosene.[68] Alternative lower emissions fuels – known as sustainable aviation fuels (SAF) – are available, but their current use is limited by cost and supply issues.

In 2022, international aviation emissions were around 440 $MtCO_2$; prior to the impacts of Covid-19 these emissions were over 630 $MtCO_2$ in 2019.[69]

Achieving the ICAO's net zero CO_2 by 2050 target (see *Global targets and action*) will require the sector to improve efficiency, transition to using SAF, and offset residual emissions. While Aotearoa New Zealand national operators are anticipating electric aircraft will be ready for domestic use by 2030, battery weight means they are not currently expected to be usable for international flights.[70]

See **Appendix 1** for more information on technology opportunities.

Table 2.2: *International shipping and aviation technology opportunities*

	International shipping	International aviation
	Efficiency measures	
Design and retrofits	Opportunities include wind-assisted propulsion, solar panels, waste heat recovery, hybrid propulsion, shore power, and hull design.	Opportunities include retrofitting winglets, lightweight aircraft cabin equipment, electric or assisted taxiing, ground power, and more aerodynamic exterior paint.
Operational measures	Route optimisation, slow steaming, efficient port operations.	Route optimisation, efficient airport operations.
	Alternative fuels	
Green methanol	Methanol is produced from fossil gas in Aotearoa New Zealand already. New vessels need to be built or significant retrofitting required but the technology is commercialised.	Green methanol is not a primary technology option being considered for international aviation due to its low energy density.
Green ammonia	Ammonia is not yet commercialised as a ship fuel but is expected to become significant. New engines are required which are expected to come to market soon. At the end of 2022, 150 ammonia-ready vessels were on order globally.[71]	Green ammonia is not a primary technology option being considered for international aviation due to its low energy density.[72]
Biofuels	Biodiesel can be used in existing vessels either as replacement fuel, or through blending with existing fossil fuels.	This is expected to be a significant aviation fuel and can be used in existing planes. Emission reductions can be significant but depend on how it is made.
Fossil gas	Fossil gas is being considered globally as a temporary transition fuel, particularly for cruise vessels. Required infrastructure is not available for Aotearoa New Zealand.	Fossil gas is not an option being considered for international aviation due to its low density and changes to infrastructure and equipment required.[73]
E-fuels	E-fuels are not a primary technology option being considered for international shipping due to comparative costs.	E-fuels are a more sustainable alternative fuel option to biofuels because they are likely to reduce emissions more but are costly.
Green hydrogen	Green hydrogen emits no CO_2 when used and can be produced with near-zero greenhouse gas emissions.[74] It would require new vessels and infrastructure to be built. It is already widely used in some industries, but mostly derived from fossil fuels.[75]	Green hydrogen may reduce emissions more than biofuels but for international aviation requires new planes that are not expected to be available until the 2030s–2040s and new infrastructure, and it has more limited range.

Alternative fuel production in Aotearoa New Zealand

Aotearoa New Zealand has potential to produce SAF, green hydrogen, green methanol, and green ammonia. This country helping to increase global supply can help to lower the cost of alternative fuels.

There is joint government and aviation sector investment in research to understand the viability of using woody biomass and municipal solid waste to produce SAF in this country. There are several other privately funded investigations of other ways to make SAF such as power-to-liquid (see E-fuels in **Table 2.2**).

Analysis shows there is likely to be a need for multiple feedstock types and for some importing of sustainable aviation fuels. For example, Ara Ake estimated replacing international aviation fuel using only woody biomass would require 128% of the waste woody biomass supply available in Aotearoa New Zealand.[76]

Domestic green hydrogen production has been identified by the Government as an opportunity both for domestic use and for export.[77] Green hydrogen can be used as a fuel, or it can be used to create other alternative fuels such as ammonia and methanol.

Aotearoa New Zealand is already a producer of methanol from fossil fuels and could produce green methanol.

The Kapuni project in Taranaki aims to produce green ammonia for fertiliser using green hydrogen creating 40 local jobs.[78] Long term, this process could be scaled to produce green ammonia for shipping fuel.

For some iwi/Māori with strong interests in forestry and agriculture, a transition to alternative fuels could present a significant opportunity for that part of the Māori economy, with potential benefits from increased demand for the source materials such as wood waste that can be used to make fuel.

Producing alternative fuels uses large amounts of energy and investment would be needed to ensure the renewable energy required is available. Aotearoa New Zealand has a competitive advantage because of its high share of renewable electricity generation, reaching 87% in 2022.[79]

There are limited supplies of renewable feedstocks to produce alternative fuels in Aotearoa New Zealand. International shipping and aviation compete for feedstocks with land transport and industrial heating; this means these sectors may need to electrify instead to reduce their emissions. Shifting to electrification is not possible for international shipping and aviation.

Barriers to using alternative fuels

Aotearoa New Zealand faces some challenges in a transition to using alternative fuels. Cost and supply are the largest barriers.

Currently, alternative fuels for international shipping and aviation can be up to six times more expensive than fossil fuels.[80] This is largely due to the limited availability of feedstocks and infrastructure needed for alternative fuels, meaning the supply of fuels such as SAF and green methanol is not meeting demand. This barrier is expected to reduce in the future, as the supply of and demand for alternative fuels increase, causing costs to drop – see *Chapter 3*.

Infrastructure also presents a challenge for Aotearoa New Zealand. The current support for production, storage, handling, and distribution of alternative fuels is limited and would require significant investment if these fuels were to be used at scale. Through engagement, we heard concerns about the capacity of the electricity grid to supply shore/ground power and fuel production.

In addition, Aotearoa New Zealand's regulatory environment is not currently structured to support the implementation of alternative fuels. Investors require confidence, and industry participants may hesitate to fund alternative fuel infrastructure without a clear regulatory framework and market stability.[81] Consenting requirements, standards for things like cryogenic hydrogen transport, and the length of approval processes for new propulsion systems could create additional regulatory barriers if they are not made simple and robust – see also the *Chapter 3* section on Policy considerations.

Our analysis shows the current regulatory environment does not have effective mechanisms for the engagement with groups such as iwi/Māori, business and communities around the motu that would support the innovative development for alternative fuels required.

Consultation question

Is there any further information or evidence the Commission should consider on the national and global context or technology opportunities for making decisions on including international shipping and aviation emissions in the 2050 target?

CHAPTER 3

Potential impacts and the choice to make

To make decisions about including international shipping and aviation emissions in Aotearoa New Zealand's 2050 target requires a clear view of the potential impacts of those decisions. This chapter sets out – for your feedback – the Commission's early findings about possible impacts, and options we have identified.

Considering impacts is a key part of our task to advise *whether* international shipping and aviation emissions should be included in the 2050 target. This chapter provides our initial view of the possible impacts of including those emissions in the target, across the wide range of areas we consider for all our advice. It also includes a summary of the policy matters the Government may have to consider.

There is more information in the following chapters about where impacts might change depending on *how* these emissions were included, if that is what is decided.

Our final advice will pull together the two parts of our review, to recommend specific options. That will include detailed information about the potential impacts of those recommended options.

At this stage, we are seeking your feedback on our findings to date, and what you think we should focus on as we develop our final recommendations. This allows us to develop the best analysis possible, based on broad thinking drawing from a wide range of experience and knowledge across the motu, before we measure the impact of specific options. See the consultation questions set at three points within this chapter.

We are keen to hear from you about possible areas of impact, and what you think we should pay most attention to, as well as the overall questions about which option the country should choose.

Our approach to impacts

The Commission's role in advising the Government requires us to consider the implications of decisions for the country as a whole. We consider what it might mean for the economy, for the environment, for society and for future generations. We look at te ao Māori, the Crown–Māori relationship, and the specific effects for iwi/Māori. This is required in the Climate Change Response Act 2002, as set out in *Our approach* in *Chapter 1*.

Our initial analysis of potential impacts is based on a review of the evidence including international research. This, and other work by the Commission, has provided us with insights about what this could mean for Aotearoa New Zealand.

We can see a 'direction of travel': there are clear indications of the likely nature of impacts from including international shipping and aviation emissions in the 2050 target – and therefore in emissions reduction budgets and plans.

This chapter outlines the impacts we have found are likely if these emissions are included in the target, to support your thinking when you consider the options set out at the end of the chapter. The table in the box following is a summary of our initial analysis, with more detailed information following.

Chapters 4 and 5 also include information about impacts – showing where some impacts would change, depending on how international shipping and aviation emissions were measured, and how they were included in the target itself.

We also note some impacts will not be able to be estimated in detail even for our final advice, as there are areas where the situation is likely to have changed considerably by 2050 (such as technology moving into commercial production).

Our initial analysis of impacts

Summary of the likely impacts	
1	Global action led by international organisations such as the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO) means the emissions intensity of international shipping and aviation to and from Aotearoa New Zealand is likely to reduce, regardless of whether these kinds of emissions are included in the 2050 target.
2	Any decision about including these emissions in the country's 2050 target needs to consider the Crown–Māori relationship, te ao Māori, and the specific effects on iwi/Māori. This would include recognising the impacts for iwi/Māori around whakawhanaungatanga (relationships), protecting te taiao (the environment) for future generations, and the Māori economy. This is as mandated in section 5M of the Act. A transition to reduce emissions from international shipping and aviation should be done in partnership with iwi/Māori, and we want to understand what taking a te ao Māori approach to addressing these emissions could mean.
3	Making changes to the 2050 target to include international shipping and aviation emissions would create a legal requirement to make plans to reduce the emissions, and to monitor progress in their reduction. This is likely to prompt government policy action to speed up reduction of these emissions. This is likely to mean more encouragement of alternative fuels, because the analysis shows they are the most effective way those reductions could be achieved (in policy terms, alternative fuels are the 'largest lever available').
4	Alternative fuels currently cost up to five times more than fossil fuels. Their increased use could increase the price of using international shipping and aviation, which could reduce use of this transport. This could impact Aotearoa New Zealand's tourism and export sectors, and could mean it is harder for people here to connect with people in other countries.
5	If production of alternative fuels is supported with policy and investment the cost can fall to below two times the cost of fossil fuels. Faster action on international shipping and aviation emissions is also likely to mean improved efficiency of ships and planes so they use less fuel. These two changes mean that – in a well-supported transition – the overall price impact and the flow-on impacts, including for cost of living, could be relatively small. While we have not conducted Aotearoa New Zealand specific modelling, international modelling has shown limited price impacts for consumers. As Aotearoa New Zealand currently imports all of its fuels, production of alternative fuels also presents an economic opportunity to increase employment and improve the security of fuel supply.
6	Use of alternative fuels can have environmental benefits and improve air quality, which improves health outcomes. However, care needs to be taken to ensure alternative fuels are sustainably produced so that one environmental problem is not replaced by another.
7	How these emissions might be added to the 2050 target can change these impacts. If the target allowed international shipping and aviation emissions to be entirely offset by planting trees, it may not lead to extensive action to reduce emissions. How emissions are measured, and the level of reductions aimed for (and speed of the reductions) can change the extent of likely impacts.
8	Not including international shipping and aviation emissions in the 2050 target could mean that emissions reductions on routes to/from the country may be slower than other developed countries that have adopted targets. This could have impacts on Aotearoa New Zealand's market access, as a result of not having the right fuels to support ship visits, perceptions of the country's environmental credentials impacting demand for exports and tourism, or regulation changes in overseas markets.

The Crown–Māori relationship, te ao Māori, and specific effects on iwi/Māori

From our early engagements and other work, we understand the international shipping and aviation sectors have many connections to te ao Māori and to many aspects of life for iwi/Māori. International shipping and aviation are impacting the natural environment and ecosystems that are an important source of wellbeing and prosperity, and deeply tied to iwi/Māori identity.

We have heard that addressing these emissions would have positive impacts for many iwi/Māori, including economically. For example, for some iwi/Māori with strong interests in forestry and agriculture, a transition to alternative fuels could present a significant opportunity for that part of the Māori economy, with potential benefits from increased demand for the source materials such as wood waste that can be used to make fuel.

Whakawhanaungatanga (relationships) are important to many iwi/Māori including those with overseas whānau. There are over 170,000 Māori in Australia alone.[82] In our understanding, within te ao Māori caring for the environment must be considered to have a similar level of importance as maintaining livelihoods and kanohi kitea (physical) connection with whānau living overseas (including the need for aviation when people may need to urgently return for activities such as tangihanga (funerals)).

Action to reduce international shipping and aviation emissions could impose costs on and also benefit the tourism sector, where Māori businesses make up a significant portion. In 2020, there were 537 Māori tourism businesses in Aotearoa New Zealand.[83] Tourism is also an important means of sharing and celebrating te ao Māori with the rest of the world.[84]

Including international shipping and aviation emissions in the 2050 target could create short-term cost increases related to exports but also help secure long-term demand. Around 50,000 Māori are employed in export industries as of 2023, including agriculture, horticulture, seafood, wine, digital, technology, and tourism.[85] Stats NZ reported that Māori authorities exported NZ$872 million worth of goods in 2021.[86] Short-term increases in shipping costs could impact exports such as logs from forests owned by iwi/Māori or agricultural products from farms owned by iwi/Māori. However, failure to address these emissions could in turn reduce demand for export products – see *Market access* section following.

If including international shipping and aviation in the 2050 target increases activity involved in offsetting greenhouse emissions (such as planting trees to increase the absorption of carbon dioxide), Māori interests in commercial forestry may be affected. Māori trusts and corporations own more than 30% of production forestry land and large areas of indigenous forest.[87] There are tensions relating to forestry used for emissions removals. Due to the historical circumstances of land owned by Māori, this land is more likely to be steeper and less versatile, and it can be less productive per hectare, making it more likely to be bought out by forestry interests.[88] For example, Ngā Pou a Tāne, the Māori Forestry Association, submitted in opposition to the 2023 review of the New Zealand Emissions Trading Scheme, citing a lack of meaningful engagement with tangata whenua.[89]

An effective and equitable relationship between iwi/Māori and the Crown and private entities is more likely to lead to effective and durable emissions reductions, to the benefit of all New Zealanders, while ineffective relationships could lead to delays and increased costs. One example is the partnership between Ngati Porou and Air New Zealand that aims to contribute to the region's sustainability and tourism goal.[90] The partnership includes both parties assisting one another to advance their economic, educational, sustainable, conservational, and commercial status.

Partnership between iwi/Māori and the Crown to reduce emissions from international shipping and aviation would help ensure appropriate recognition of:

- Te Tiriti o Waitangi/The Treaty of Waitangi
- whakawhanaungatanga (relationships) with friends and family overseas
- the importance of protecting te taiao for future generations
- the potential impacts for Māori businesses
- the potential economic opportunities for iwi/Māori.

Consultation questions

What is necessary to enable an effective and equitable Crown–Māori relationship around international shipping and aviation emissions and the 2050 target?

How could different te ao Māori worldviews influence the decisions on whether, and if so how, to include international shipping and aviation emissions in the 2050 target?

What specific impacts and opportunities for iwi/Māori should be considered if international shipping and aviation emissions were included – or remain outside – the 2050 target?

Economic impacts

Alternative fuels

The current fuel sources for international shipping and aviation have high levels of greenhouse gas emissions – see *Chapter 2: Opportunities to lower emissions*. Alternative fuels are required to significantly reduce these emissions and are already being adopted as part of global action.

The Commission's analysis shows that including international shipping and aviation in the 2050 target is likely to increase the use of alternative fuels, if the country matches policies being adopted by other countries. Our analysis also shows that unless the price difference between alternative fuels and fossil fuels is brought down, goods and services that rely on international transport may become more costly, reducing demand for tourism and exports.[91]

Compared to the current fossil fuels used, alternative fuels can be up to five times more expensive.[92] If policy support and investment in alternative fuels production occurs, this could drop to below two times the cost. The United Nations Conference on Trade and Development (UNCTAD) has projected a 70–100% increase in international shipping fuel costs by 2050.[93] At the same time, the international aviation body ICAO modelled the minimum selling price of bio-based and carbon-capture-based sustainable aviation fuel (SAF) in 2050 to be between 1 to 1.9 times the cost of fossil jet fuel.[94]

Aotearoa New Zealand could domestically produce some of these alternative fuels (such as SAF, green hydrogen, green ammonia, green methanol – see *Chapter 2*), which could help increase global supply, supporting the cost of these fuels being lower in future. Producing alternative fuels domestically is likely to increase employment. The Sustainable Aviation Fuel Consortium estimates that producing 50% of the country's jet fuels domestically by 2050 would create 6,400 temporary infrastructure development jobs, 1,800 new permanent direct jobs, and 5,000 additional indirect jobs.[95] Aotearoa New Zealand imports almost all fuel currently, so this also represents an opportunity to reduce import expenditure and increase the security of fuel supply.

Long-term contracts are currently on offer globally to increase alternative fuel production, such as for green methanol for shipping.[96] If Aotearoa New Zealand does not support establishment of local production before other sources become established, these opportunities may become more limited meaning the industry may find it more difficult to secure finance to establish in this country.

Shifting to more efficient planes and ships is also a significant part of the shift to reduce international shipping and aviation emissions. While the upfront cost of new craft may be up to 20% more expensive, the ongoing fuel savings would help to limit increases in price from alternative fuel use.[97] The Mission Possible Partnership has modelled that fully decarbonising aviation could increase fuel costs 90-190% compared to projected fossil fuel prices, but improved efficiency and technology improvements could mean the overall change in average costs for aviation was between a 5% increase and a 5% decrease compared to today.[98]

In aviation, fuel is on average a third of an airline's costs meaning that an increase in fuel costs is only likely to be partially represented in ticket prices. In shipping the shipping cost is generally a small component of the cost of a product, meaning increases in fuel cost do not necessarily mean a large increase in price. For example, UNCTAD modelled a 50% increase in international shipping operational costs would have only a 0.08% impact on global gross domestic product.[99]

In a well-supported transition to alternative fuels, where the price difference is brought down and efficiency increases, the flow-on impacts of a fuel cost increase to the rest of the economy are likely to be relatively small. For example, the European Union (EU) has modelled for its policies to reduce international shipping and aviation emissions:

- The FuelEU maritime initiative would increase freight costs 0.8 to 15.1%. (This initiative requires an 80% greenhouse gas emissions intensity reduction for international shipping while sailing by 2050 and use of shore power at port.) Shipping activity would increase but be 2.7% lower than it would otherwise be, employment would increase, and NZ$21 billion in air pollution health costs would be saved in 2050.[100]
- Requiring a 63% sustainable aviation fuel blend by 2050 would increase airfares up to 8.2%, demand would increase 77% from 2015 levels but be 5.8% lower than it would otherwise be, and employment would increase.[101]

If refuelling is too expensive in Aotearoa New Zealand because the cost of alternative fuels has not been addressed, this may encourage ships or planes to refuel overseas. If refuelling is not happening where it is most efficient, this could increase costs for New Zealanders as well as global emissions.

Market access

Environmental credentials and a perception of sustainability is a significant part of Aotearoa New Zealand's brand (estimated to be worth around NZ$400 billion[102]), as demonstrated in *Chapter 2*. How Aotearoa New Zealand addresses international shipping and aviation emissions could affect its brand and therefore demand for its products and tourism.

Including international shipping and aviation emissions in the 2050 target is likely to lead to faster reductions in these emissions on routes to and from the country. This affects how likely Aotearoa New Zealand is able to match the rate of change of economies that have a target including these emissions, such as the EU, United States of America (USA), and United Kingdom (UK).

Reducing the greenhouse gas emissions associated with supply chains in line with other developed countries could open more opportunities to trade with or attract tourists from high value markets such as Europe. Being seen to fail to reduce emissions could lead to a drop in demand – for more information see *Chapter 2*, and the section on access to international markets under 'Aotearoa New Zealand's national context'.

Regulatory requirements in other countries are likely to change to match those countries' progress in reducing international shipping and aviation emissions. If Aotearoa New Zealand moves more slowly than other economies, updated regulatory requirements could become a barrier to Aotearoa New Zealand's exports.

In shipping, switching to alternative fuels likely means vessel replacement. If shipping companies switch to alternative fuels and Aotearoa New Zealand is not able to supply those fuels in port, those companies may be less likely to visit the country or need to stop elsewhere before they can come.

Removals or reductions in other sectors

Including international shipping and aviation in the 2050 target may require contributions from other sectors. Practical difficulties in achieving net zero emissions from international shipping and aviation alone by 2050 mean that other areas of the economy may have to reduce their emissions more, or there might be a greater requirement for carbon dioxide removals (such as through forests) to offset residual emissions – see *Chapter 2: Global targets and action*. It might also be cheaper to reduce emissions in other sectors or to use carbon dioxide removals, meaning that action is favoured instead.

Relying more on carbon dioxide removals (offsetting), particularly through forests, could have additional impacts on land use. Carbon dioxide removals or reductions in other areas can also provide additional environmental, economic, and social benefits beyond the emissions reductions they cause, for example reforestation projects can enhance biodiversity and support local communities.[103]

Key elements affecting the level of removals or reductions likely to occur in other sectors are how these emissions were added to the 2050 target (see *Chapter 5*), and the policies used to achieve that updated target (see *Policy considerations* below).

Domestic shipping

Domestic coastal shipping companies in Aotearoa New Zealand are currently at a disadvantage compared to international vessels. While international shipping operators conducting domestic shipping in Aotearoa New Zealand waters are not covered by the New Zealand Emissions Trading Scheme, domestic operators are.[104] Including international shipping emissions in the 2050 target may mean the conditions for doing business between international and domestic shipping become more even.

Fishing vessels are not affected by this change.

Social, cultural, and generational impacts

Benefits for health

Increasing the use of alternative fuels could reduce the negative effects on human health from shipping and aviation emissions. International research estimates that pollution from jet fuel contributes to 16,000 deaths globally each year, and that a shift in fuels to a 50% blend of SAF could reduce premature deaths by 18%.[105]

Emission Impossible estimates roughly 200,000 New Zealanders may be living and working in proximity to harmful ship emissions.[106] New Zealand Institute of Economic Research (NZIER) analysis showed the recent switch to low sulphur fuel requirements should save Aotearoa New Zealand around NZ$75 million in health costs from international shipping each year.[107] However, there would still be NZ$70 million of residual health impacts per year, which could be further reduced through a shift to alternative fuels or shore power.[108]

If the cost of imports or travel increased

If the cost of international shipping and aviation increased, higher travel costs could reduce connectivity for people to friends or relatives overseas, and for Māori people overseas to connect back with their culture. Many New Zealanders live overseas, and more than 1 in 4 people living in Aotearoa New Zealand were born overseas.[109] Around 40% of international flights to and from Aotearoa New Zealand are to see friends and family.[110] There are strong familial and cultural connections to other countries, including around Te Moana-nui-a-Kiwa, the Pacific Ocean, and further afield to other 'homelands' for current residents. The people of Tokelau and the self-governing states of the Cook Islands and Niue are New Zealand citizens and have the right to access the country.

Aotearoa New Zealand's cultural capability could also be limited if there were fewer business trips, international students, and exchanges.

Survey results have indicated higher income households from Aotearoa New Zealand are twice as likely to travel internationally as lower income households meaning increased travel costs would fall largely on higher income households.[111] Each year around half of all global aviation emissions come from 1% of the global population who cause emissions of around 10 tCO_2 each. A further 10% of the world's inhabitants cause aviation emissions of around 1 tCO_2 each; 89% of the population does not fly.[112] However, increased travel costs may have a disproportionate impact on people with lower disposable incomes.

If international travel became more expensive, or the Government addressed the need to reduce these emissions through direct policy action such as limiting passenger numbers, growth in Aotearoa New Zealand's tourist numbers could be slower than it might otherwise have been on current trends. Decreasing tourist numbers could have negative social impacts, in particular reduced employment, which could disproportionately impact younger, female, Māori, and migrant workers who make up a large part of the tourism workforce.[113] Lower international tourism growth could also have positive social impacts from New Zealanders not competing with international tourists to access popular locations[114] and reduced noise pollution from aircraft.[115]

If the cost of imports increased this could disproportionately impact lower socioeconomic households because they have lower disposable income. However, international shipping is usually a relatively small proportion of the total cost of a product, meaning price impacts are likely to be limited. The EU estimated pricing its international shipping emissions would add 7% to shipping costs by 2030, but the increase in prices for goods would be less than a tenth of that (0–0.7%).[116]

Impacts on international relationships

The inclusion of international shipping and aviation emissions in Aotearoa New Zealand's 2050 target could have varying effects on its relationship with other countries. Including these emissions in the target may strengthen perceptions of the country's response to climate change. However, policies implemented to achieve the target could impact its relationship with other countries if it affects their residents' ability to travel and trade.

Australia and Aotearoa New Zealand have a Single Economic Market process which aims to reduce the effect of borders between the countries and to align regulatory policies where possible. If policy actions to address international shipping and aviation emissions are not aligned with this process it may cause tension. Similarly, there may be opportunities for trans-Tasman cooperation to reduce these emissions faster.

In the world, Aotearoa New Zealand is seen as a Pacific country, and part of the wider Indo-Pacific region. The connections between countries around the region reflect whakapapa and familial links, as well as diverse diplomatic, trade and security ties.

Pacific nations provide an example of the varying effects on relationships with other countries. Pacific governments and regional bodies are strong proponents of greater action on climate change including on international shipping and aviation emissions. At the same time, the peoples of the Pacific need to maintain international connections. Aotearoa New Zealand is the main access point for some Pacific countries, including being the only country that flies directly to Niue. In addition to trade and tourism, some Pacific countries also draw some of their income from Aotearoa New Zealand through seasonal employment schemes that require international flights.

Impacts on future generations

Future generations will inherit the effects of increased greenhouse gas emissions over recent centuries. While action to reduce international shipping and aviation emissions may have impacts on the current population, it also spreads the impacts across generations, rather than leaving the effects of climate change to accumulate and intensify for the country's children and their children. The Commission understands that ensuring te taiao (the environment) is left in a state our mokopuna (descendants) would be proud of, able to access, and enjoy in the future, is important for many in te ao Māori.

Reducing emissions from international shipping and aviation will take time, as it depends on the introduction and commercialisation of new technology and alternative fuels. Future generations will benefit most from faster action; our analysis shows that including international shipping and aviation emissions in the target is likely to prompt policy action to reduce emissions faster. Implementing change sooner may also reduce the cost of acting later for future generations such as supporting alternative fuels to be produced at lower cost at scale.

Some of the potential impacts set out in earlier sections with the most relevance for future generations are the increased low emissions travel connections between countries and new employment opportunities through uptake of new technology and alternative fuel production. Similarly, increased costs for international shipping and aviation could create longer term impacts for future generations, such as hindering regional development, the country's cultural capability, or trade.

Environmental and ecological impacts

Emissions reductions

Including international shipping and aviation emissions in the 2050 target is likely to mean Aotearoa New Zealand's greenhouse gas emissions reduce more than they would have otherwise if it increases the overall ambition level of the target (this depends on the level of emissions reduction aimed for in an amended target – see *Chapter 5*). The level of emissions reductions achieved in this country, and collectively across the globe, has a direct impact on the intensity of climate change, reducing the environmental impacts of global warming, which include more frequent and stronger extreme weather, sea level rise, flooding, droughts, wildfires, tropical cyclones, and biodiversity loss.[117] In earlier work, the Commission has heard from iwi/Māori representatives that climate change presents a unique wellbeing risk for Māori, because harm to the environment, such as loss of taonga species, is akin to losing a family member.[118]

A specific impact of reducing emissions from shipping and aviation by switching to alternative fuels would be reduced air pollution compared to fossil fuels.[119] Reduced air pollution can decrease the spread of disease, improve air quality, and reduce toxic stress on ecosystems.[120,121]

Scrubbers

An unrelated environmental issue for international shipping is the effect of sulphur in fuels, and the impacts of a mechanism used to reduce sulphur content in exhausts. There are global regulatory requirements to reduce sulphur pollution. To comply with these requirements, some international ships use scrubbers to reduce sulphur content in their exhausts. These scrubbers release at least 10 billion tonnes of acidic wash water into the ocean each year, contributing to acidification, which harms ocean environments.[122]

Some types of scrubbers also release contaminants; in Aotearoa New Zealand, elevated copper and zinc concentrations have lowered the water quality around Lyttelton, Tauranga, and Auckland ports and Akaroa cruise ship area.[123] Other contaminants which have the potential to accumulate in marine sediments from scrubber discharges include copper, nickel, mercury, zinc, and phenanthrene.

Switching to alternative fuels which do not contain sulphur removes the need for scrubbers.

Environmental impacts from production of alternative fuels

Care needs to be taken to ensure alternative fuels are sustainably produced so that one environmental problem is not replaced by another if their use increases.

Ensuring the production of feedstocks for biofuels is sustainable will reduce the potential environmental impacts that are associated, such as contamination, biodiversity loss, and land use change. Presence of local species can be up to 49% lower at sites planted with first generation biofuel crops and there can be issues with soil erosion and toxic runoff.[124] Biofuels are ideally sourced on land that would not otherwise be used for food production or that requires conversion of natural landscapes that are currently absorbing carbon dioxide.

Producing alternative fuels using renewable energy and renewable sources of CO_2 (such as from direct air capture) provides much more significant emissions reductions than those produced using fossil fuels. Currently, 95% of hydrogen production is from fossil fuels, which provides a lower emissions reduction than green hydrogen.[125]

Environmental and ecological impacts from activity and development

While demand for international shipping and aviation is likely to increase even with strong policy measures under a target that includes these emissions, one potential effect could be a lower rate of growth in the demand. Demand may also reduce if there is a shift to higher value, lower volume trade and tourism.

Demand may also shift between the sectors due to changes to lower emissions, for example more air freight might shift to sea freight, which would generally lower the emissions of transporting these goods.

Environmental benefits of slower growth in demand for international shipping and aviation could include reduced noise pollution, marine habitat degradation, and impacts from development.

Noise pollution from ships can cause stress and hearing shifts for wildlife including marine mammals.[126] Improved ship design and operational planning can both reduce emissions and limit harm to marine wildlife from noise radiated underwater.[127]

Ships collect unwanted microorganisms on their underside. This can transport microorganisms to new environments impacting biodiversity. It also creates drag, which increases fuel consumption up to 20%.[128] Reduced growth in demand for shipping would limit these impacts; more frequent removal of microorganisms also assists.

Another environmental effect of international shipping that would be limited by reduction in growth in demand is the degradation of shallow marine habitat. Ship anchoring is seen as a major driver, killing marine species and releasing carbon stores trapped in the sediment.[129]

Port, airport, and tourist infrastructure developments can have negative environmental impacts. If demand growth was reduced this would reduce the requirement for infrastructure expansion.

Policy considerations

The Commission's final advice will not include recommendations about specific policies the Government should adopt. This is out of scope for this review of whether the emissions from the country's international shipping and aviation should be included in the 2050 target.

However, policy is relevant to decision-making about how an emissions reduction target might be changed. This section sets out what policy considerations are relevant to the review, and makes clear what we seek in feedback on this area.

The relevant matters to consider are:

- if there is domestic policy action Aotearoa New Zealand can take
- whether that policy action would be sufficient to enable Aotearoa New Zealand to shift its level of international shipping and aviation emissions
- whether policy considerations would change how a target should be designed if these emissions were included.

A key point to consider is what would prevent Aotearoa New Zealand from including these sectors in its emissions pricing policies. This was a consideration in Parliament's original decision in 2019 to require this review, rather than include international shipping and aviation in the 2050 target at the outset.

As the focus of this section is on how policy affects how the 2050 target might change to include these emissions, rather than recommending specific policies to be implemented, we do not address in detail how to limit impacts, consider equity, or ensure the principles of Te Tiriti o Waitangi/The Treaty of Waitangi are upheld using policy. However, these will be important considerations for the Government if it adopts policies to reduce these emissions.

Through this consultation we are seeking your views on the policy considerations relevant to choices about how the target could change to include these emissions. What we are looking for is your views on the three overall considerations, rather than your choice about what policy settings you would prefer. Your insights will be included in our analysis to inform our final advice to the Government.

Policy choices the Government would have

Setting a target to reduce greenhouse gas emissions does not on its own have direct impacts on people. It is the choices made by a government on policies set to achieve the target that have the most effect.

Our initial analysis shows there is a range of potential domestic policy measures available to achieve a 2050 target that included international shipping and aviation emissions, and this would provide Government with different choices to achieve it.

A key question facing decision-makers will be what is best left to be managed at international level, and what requires domestic policy action.

Both IMO and ICAO achieving their targets for emissions reduction likely requires states such as Aotearoa New Zealand to take action that complements their approaches. National Action Plans by member states are one of IMO's mechanisms to achieve its emissions reduction strategy.[130] The resolutions at ICAO's last assembly included "addressing GHG emissions from international aviation requires the active engagement and cooperation of States and the industry" and outlined several policies countries should adopt.[131]

There are several policy areas not regulated internationally where domestic action is necessary to support reduction in international shipping and aviation emissions. Including these emissions in the 2050 target could create a framework to support these policies being prioritised and implemented in a consistent way. Currently, policies to reduce these emissions appear to have less priority in government programmes than policies to support reductions in other sectors.

Measures that are already effectively regulated internationally may be best left regulated at that level. If domestic policies for international shipping and aviation are developed in an area with existing international regulation, such as pricing of aviation emissions, they must be developed carefully to avoid undermining international regulations, as this could shift sources of emissions to other countries or cause emissions to increase globally.

Our early stakeholder engagement and research has identified that cost and supply of alternative fuels is the largest barrier to emissions reduction, in both international shipping and aviation. This is an area where both IMO and ICAO encourage countries to implement domestic policies to help.

Our initial engagement and research also identified that to have the confidence to make the investments required, the sectors need long-term policy certainty, and consistency with other nations where possible. Strong multi-party support for policy actions would help provide this type of policy environment. The system of long-term emissions reduction targets, budgets, and plans that would be created by international shipping and aviation emissions being included in the 2050 target could help provide this policy environment.

Bilateral or regional partnerships with other nations such as Australia to create green routes where stronger emissions reduction policies are in place could help advance change in addition to domestic and global action. Aotearoa New Zealand is already participating in work to develop green shipping corridors for international shipping to and from the country.

Emissions pricing

Emissions pricing can have three main purposes: it can provide incentives for uptake of alternative technology, it can aim to reduce demand, and it can provide funding for emissions reductions.

The nature of these transport sectors means emissions pricing is most efficient at an international level. If there was effective global transport emissions pricing it could undermine global efforts if Aotearoa New Zealand also adopted emissions pricing for the international shipping and aviation sectors. However, there are not currently international emissions pricing mechanisms that deliver a strong enough price on these emissions. If domestic pricing is adopted to supplement international pricing systems, it should ensure companies are not unfairly charged twice for the same emissions.

Aotearoa New Zealand operates the New Zealand Emissions Trading Scheme (NZ ETS) which is a market created by the government to support the country to meet its emissions budgets, the 2050 target, and its Nationally Determined Contribution (NDC). Participants in the NZ ETS face the costs associated with emissions while being free to decide how best to reduce emissions. The NZ ETS covers every sector in the economy included in the net zero component of the 2050 target (except for nitrous oxide from agriculture). The NZ ETS does not cover agriculture emissions included in the biogenic methane components of the target (as set out in the *Foreword*), and it does not cover international shipping and aviation emissions as they are outside the target.

Emissions pricing options available internationally and in this country

IMO has committed to developing a market-based measure. Decisions are due to be made in 2025 with implementation in 2027. The form of that market-based measure and its price have not yet been agreed. There are several options being considered including a universal levy or building financial penalties and rewards into standards for the emissions intensity of fuels. The price proposed for a levy by Pacific Island nations was for no less than US$150 per tonne of greenhouse gas emissions. The IMO will next meet to consider these in September 2024.

ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) prices aviation emissions globally with some exceptions. However, offsetting is only required for emissions above 85% of 2019 levels, which is not consistent with ICAO's net zero CO_2 2050 target. In addition, the current price for offsets is low, meaning significant behaviour shifts are unlikely. To drive significant emissions reductions, CORSIA needs strengthening; this could occur through ICAO's scheduled three-yearly reviews. The scheme is set to end in 2035 and a review by 2032 will determine if it is extended. ICAO's position is that CORSIA should be the only aviation pricing mechanism.

There may be legal barriers to Aotearoa New Zealand adopting some forms of aviation emissions pricing. The Chicago Convention and Aotearoa New Zealand's air services agreements exempt aviation fuel from customs duties and any similar charges. This means a direct tax on aviation fuel may breach international obligations.

An emissions trading scheme (such as the NZ ETS) could be argued to be outside of these provisions on the basis it is not a customs duty or similar charge; this is what was found for the EU's scheme in 2011.[132] However, other countries rejected this judgement so it may not hold in other jurisdictions. The legality of using the NZ ETS for international aviation is likely to be tested if adopted.

A departure tax on passengers would not fall within these legal provisions, so could be used. The Parliamentary Commissioner for the Environment has previously recommended one.[133] However, while departure taxes are common, they have been challenged, particularly when used for environmental reasons such as in the UK in 2012.[134] While Aotearoa New Zealand may win these challenges, there may still be trade or relationship impacts.

In shipping, legal challenge is less likely. The EU includes international shipping in its Emissions Trading System, and several ports around the world adopt variable port charges, where better environmentally performing ships pay lower port fees.

Growth in demand for international transport

Growth in demand for international shipping and aviation is the main reason these emissions have grown. This is despite significant efficiency improvements in the sectors. However, limiting demand to reduce emissions is likely to have greater economic and social impacts than technology change would.

The Government could take measures to reduce demand for aviation and cruise ships with more limited economic impacts by changing how it markets Aotearoa New Zealand overseas, to focus on attracting high-spending tourists rather than volume.

Direct policy action to reduce numbers faces some challenges. Aotearoa New Zealand's air services agreements guarantee other countries a certain number of flights, meaning flight numbers cannot be directly limited without renegotiating these agreements. Limiting the number of passengers permitted entry would be possible under these air services agreements. However, there are bilateral arrangements guaranteeing visa access for some countries and reducing visa access for Aotearoa New Zealand may result in reciprocal restrictions for New Zealanders accessing other countries.

Limiting airport expansion could reduce future demand growth for international aviation. Whether demand growth can be reduced by limiting airport expansions will depend on how much existing spare capacity there is in the system at the time and whether there are already consented expansions under development.

For shipping of goods, there is a risk that measures to reduce the growth in demand could increase emissions overall. This could occur if the emissions involved in the production of the goods being shipped are not considered at the same time. International shipping comprises a relatively small share of the total emissions of some of the goods Aotearoa New Zealand exports relative to the emissions they create during their production meaning if these products were displaced by goods that produce more emissions during their production it would increase global emissions.

Reductions in the growth of demand as a result of New Zealanders choosing not to travel or buy international goods does not face the barriers that government policy may. A reduction in international shipping caused by New Zealanders buying fewer goods from overseas, or buying local goods instead, may impact revenue for shipping lines and businesses overseas but would not have significant negative domestic impacts. New Zealanders choosing to limit their overseas travel means people who need to travel can still do so. Both actions can benefit the economy by increasing spending on goods or services in the country and reducing overseas spending by New Zealanders.

Alternative fuels

Both IMO and ICAO encourage states to support the research, development, and deployment of alternative fuels. The Government is already exploring opportunities particularly for SAF and hydrogen. The Government has committed to plan for transitional low carbon fuels, including the infrastructure needed to increase the use of methanol and hydrogen to achieve sovereign fuel resilience.[135]

Achieving maximum use of alternative fuels requires a two-pronged approach: investment to stimulate growth of an alternative fuel supply, and the creation of certainty of demand – to attract the capital required for production plants – through measures such as emissions pricing or fuel requirements.

IMO is looking to develop a goal-based marine fuel standard by 2027, which would phase down emissions-intensive fuels over time. If effective, this may mean domestic requirements around alternative fuel use are not required for shipping, and domestic focus would need to be on supporting production to be established.

For aviation, ICAO encourages states to adopt SAF requirements and support production through research and development, targeted incentives or tax relief, and ensuring regulatory settings support their use.[136] ICAO estimates states need to invest US$75 to 870 billion in research and development by 2050 to achieve its most ambitious emissions reduction scenario.[137]

Efficiency

Measures are being implemented globally by IMO and ICAO to improve the efficiency of planes and ships including: the Energy Efficiency Design Index to improve the efficiency of new vessels, improving efficiency of existing ships through the Energy Efficiency Existing Ship Index, improving ship energy efficiency through Ship Energy Efficiency Management Plans, reducing operational emissions of ships through the Carbon Intensity Indicator, and reducing the emissions of new aircraft through the Aeroplane CO_2 Standard.[138] Some of these standards could be strengthened through global collaboration to increase emissions reductions. There is a role for states in optimising air traffic management and operational procedures for aviation and supporting efficient port systems for shipping.

Infrastructure

Infrastructure to reduce the country's international shipping and aviation emissions can only be delivered by Aotearoa New Zealand. The Government could accelerate the transition by increasing resourcing to or supporting coordination of shore power for vessels and ground power for planes, the electricity networks required to enable those, and infrastructure for the production of alternative fuels. A 2017 study identified installing shore power at the Ports of Auckland would cost NZ$18.3 million and reduce ship greenhouse gas emissions by 31% while being used.[139]

Regulatory environment

Ensuring Aotearoa New Zealand's regulatory environment supports reducing international shipping and aviation emissions cannot be addressed at an international level. New regulatory approvals will be needed and ensuring those are streamlined will support the decarbonisation of the shipping and aviation sectors.

The current Government has identified resource consenting as a barrier to development of renewable electricity generation and proposes to streamline this. If successful, this could provide additional renewable electricity to support producing alternative fuels. However, the production of alternative fuels itself may face similar barriers to gaining consents in a timely manner.

The Civil Aviation Authority has a project to scan all Civil Aviation Rules to identify rules that may need to be reviewed or created to support the introduction of alternative propulsion.[140] Maritime New Zealand is planning to review its legislation and rules to ensure that Aotearoa New Zealand is enabling innovation in the maritime sector and managing the safety and environmental risks associated with new technologies.

Consultation question

Is there any further information or evidence the Commission should consider on the potential impacts or policy options if international shipping and aviation emissions were included in the target?

Options we seek feedback on

This section sets out the three options the country has to choose from when considering whether to include international shipping and aviation emissions in the 2050 target:

- Include these emissions in the target
- Do not include these emissions in the target at this point
- Amend the Climate Change Response Act to reconsider this issue in future reviews of the 2050 target.

This section includes our initial summary assessment of the three options. This is based on the national and global context the Government's decisions will be made in (see *Chapter 2*) and consideration of the impacts and policy issues involved, as set out in this chapter.

We seek your feedback on which option you support and what your reasons and evidence for that are – see the consultation question at the end.

The decisions of whether and how to include these emissions in the target are intertwined, as is consideration of the potential impacts of changes to policy. If the Government decided to include international shipping and aviation emissions in the 2050 target, it would need to make decisions on two further areas – how the emissions could be counted, and how they could be built into the structure of the 2050 target. This is covered in *Chapter 4* and *Chapter 5*, including the ways impacts might change depending on *how* these emissions were included. There are further consultation questions in those chapters.

Our final advice will pull together the two parts of our review, to recommend specific options. That will include detailed information about the potential impacts of those recommended options. See *Our approach* in *Chapter 1: Introduction* for information about what happens following delivery of our final advice in December 2024.

Option 1: Include these emissions in the target

If the Government decided to include international shipping and aviation emissions in Aotearoa New Zealand's 2050 target, these emissions would become part of emissions budgets. Subsequently they would need to be included in the Government's emissions reduction plans.

In turn, the Commission would be required to monitor the Government's progress in reducing international shipping and aviation emissions, as part of its ongoing emissions reduction monitoring responsibilities.

Together, these changes would likely lead to more policy action and faster emissions reductions within international shipping and aviation than if the emissions were not included in the 2050 target.

While the exact effects of including these emissions would vary depending on how the emissions were included in the target, our initial analysis is that it would likely lead to an increase in the use of alternative fuels on international voyages to and from Aotearoa New Zealand. This would reduce both greenhouse gas emissions and other forms of pollution associated with current fuels, and likely help strengthen Aotearoa New Zealand's reputation internationally.

The costs associated with international shipping and aviation would likely increase in the short term, with a corresponding impact on demand. These changes would have flow-on economic, social, cultural, environmental, and ecological impacts (as set out above).

Including international shipping and aviation emissions in the 2050 target could have specific effects for iwi/Māori, including the ability to practise kaitiakitanga (guardianship, stewardship) for past and future generations, and whakawhanaungatanga (relationships) with family overseas. Māori businesses would likely see new opportunities (for example in the transition to new energy sources), while for Māori tourism, primary industries, and art businesses may be faced with new costs due to technology and fuel change. As major participants in the primary sector, there may also be opportunities to develop roles as suppliers of the materials for creating alternative fuels. If the option to include these emissions in the 2050 target is the choice made by the Government, the transition to reducing emissions from international shipping and aviation will need to be done in partnership with iwi/Māori under Te Tiriti o Waitangi/The Treaty of Waitangi to ensure it effectively supports equitable transition to a low emissions economy for all New Zealanders. This means that there should be direct engagement with iwi/Māori that is informed by tikanga and that decision-making is done in collaboration with relevant iwi/Māori entities.

The choice to include these emissions in the target does carry a risk that domestic action in policy areas regulated at an international level could undermine international efforts if they are not designed to operate consistently with them. International shipping and aviation policies to achieve emissions reductions must be developed carefully to avoid unintended consequences – including the risk that overall global emissions increase as a result of companies avoiding these policies.

Option 2: Do not include these emissions in the target at this point

If the Government decided not to include international shipping and aviation emissions in the 2050 target, those emissions would continue to be excluded from emissions budgets and emissions reduction plans. Without policy action to support the adoption of alternative fuels, uptake would likely be lower and slower across both sectors, leading to higher emissions than if these emissions were included in the target.

Higher levels of international shipping and aviation emissions would have corresponding impacts on te ao Māori, on the economy, society, culture and environment, as well as potentially straining the Crown–Māori relationship and possibly reducing global demand for Aotearoa New Zealand exports and tourism.

Without domestic action from countries like Aotearoa New Zealand, international shipping and aviation emissions may not reduce enough to contribute to the required global reduction in emissions to limit warming to 1.5°C. Meeting the Paris Agreement would therefore require increased emissions reductions across other sectors, or increased carbon dioxide removals from the atmosphere, for example through higher levels of forestry planting. The costs of reducing emissions may fall inequitably on future generations.

In the absence of policy support for the development and adoption of alternative fuels, their prices would likely be higher. However, as alternative fuel usage would be lower in this scenario, the overall costs associated with international shipping and aviation would not be significantly impacted.

Option 3: Amend the Act to reconsider this issue in future reviews of the 2050 target

If the Government decided to defer its decision on whether to include international shipping and aviation in the 2050 target, the short-term impacts and consequences would likely be similar to those associated with deciding not to amend the target. These would only change if, in the future, the Government determined that international shipping and aviation emissions should be added to the 2050 target.

This approach would allow more time for the international framework and technological pathways to develop further before the Government makes a decision. However, there are restrictions on making changes to the 2050 target, that require a threshold for significant change to be met first. If the decision is not taken on this review, there is a risk that the issue may not be judged to meet that legal threshold. This is because many of these trends can be reasonably foreseen now and many of the technologies required have already been commercialised. This risk could be avoided by an amendment to the Act to specify the issue is to be reconsidered.

Delaying the inclusion of international shipping and aviation emissions in the 2050 target would likely lead to higher costs and lower benefits associated with addressing these emissions, placing an inequitable burden on future generations. It could also mean that some early opportunities to lower emissions in these sectors are missed entirely, for example if a significant fleet replacement cycle is missed.

Our initial assessment of the three options

Our initial analysis shows that including international shipping and aviation emissions in the 2050 target would be consistent with the purpose of the Act, with global efforts under the Paris Agreement to limit global warming to 1.5°C above pre-industrial levels, and with action being coordinated by IMO and ICAO.

Our analysis also shows current global efforts in international shipping and aviation are unlikely to achieve the emissions reductions required to meet the goals these sectors have set to help limit warming to 1.5°C. Additional action is needed from individual states. Our early finding is that an approach combining strong international and domestic action is likely to be in Aotearoa New Zealand's best interests, and to result in the greatest reductions of international shipping and aviation emissions.

We need to do more analysis to be able to make a recommendation – in particular to assess the impact of the different ways that these emissions could be included in the 2050 target, including considering the Crown–Māori relationship and ao Māori worldviews. This is how we would confirm which options provide the most appropriate way for Aotearoa New Zealand to meet its obligations under the Act and international commitments (see *Chapter 5*).

Consultation question

Which of these options for whether international shipping and aviation emissions should be included in the 2050 target do you support? What are your reasons and evidence for that?

- Include in the 2050 target.
- Do not include in the 2050 target at this point.
- Amend the Climate Change Response Act to reconsider this issue in future reviews of the 2050 target.

CHAPTER 4

Options for measuring emissions

We are seeking your feedback on our early findings about options for counting Aotearoa New Zealand's international shipping and aviation emissions, if they were included in the 2050 target.

This chapter sets out six possible ways of counting greenhouse gas emissions[iv] that relate to air and sea travel to and from Aotearoa New Zealand. This is followed by our initial assessment of the feasibility and potential impacts of those options.

We also set out options for accounting for the other impacts on the atmosphere from international air and sea transport, that are known technically as non-CO_2 radiative forcing. This is followed by our initial assessment of those options.

At this stage, we are seeking your feedback on the options for counting international shipping and aviation emissions, which would be needed if the Government decided to include these emissions in the 2050 target. We are keen to hear views about their possible benefits, risks, compliance implications, and accuracy – see the consultation questions at two points in the chapter.

Related choices are set out in *Chapter 5*. These focus on how international shipping and aviation emissions could be included in the structure of the target itself. Our final advice to Government will combine our analysis of these options with consideration of their impacts, to provide advice on *whether* these emissions should be included in the 2050 target, with specific recommendations *how* this could be done. We need to do more analysis to be able to make a recommendation – in particular to more closely assess the impacts of different options. This would include the full range of effects we are required to consider under the Act (as described in *Chapter 3*), including impacts on the Crown–Māori relationship and for te ao Māori.

Your feedback will help inform our further analysis and development of our final advice.

[iv] It is assumed an amended target would cover all standard greenhouse gases emitted by international shipping and aviation using standard emissions factors, as is currently the case for reporting of bunker fuels to the United Nations Framework Convention on Climate Change (UNFCCC).

Measuring emissions

If international shipping and aviation emissions are included in the target, a decision will be needed on *how* emissions could be counted. This would make it possible to estimate Aotearoa New Zealand's current emissions and to include these emissions in the country's five-year emissions reduction budgets.

There are a range of ways to count these emissions, such as estimating them on the basis of the amount of fuel sold for re-fuelling in this country, estimating emissions generated on ship and plane trips to and from the country, or looking at where international shipping and aviation companies are based.

The six emissions measurement options we considered most viable are set out below. How emissions are measured can change the impacts of including these emissions in the target. The measures that capture a larger scope of emissions are likely to have a larger overall impact – this is part of what we will consider further in our final analysis.

Vessels/aircraft may be subject to different standards at each end of their journey for some of these measures, potentially leading to both over and under counting for different journeys. To address this, the Government could put in place special rules under any policies implemented for vessels/aircraft that have already accounted for some of their emissions in another jurisdiction.

Option 1 for measuring emissions: Refuelling

Refuelling within Aotearoa New Zealand – a method of counting emissions often called 'bunker fuels' – is used to measure emissions from international shipping and aviation under the UNFCCC.[141]

The data for international shipping and aircraft bunker fuels sold within Aotearoa New Zealand is available and it is straightforward to quantify this measure. Using bunker fuels as the measure of emissions from international ships and aircraft could enable accurate tracking of progress in achieving targets over time.

In 2019, before the effects of the COVID-19 global pandemic and before changes in shipping fuel refining in Aotearoa New Zealand, the country's international shipping and aviation emissions were estimated using bunker fuels at approximately 4.9 $MtCO_2e$.[142]

Using this method appears to be a fair reflection of Aotearoa New Zealand's emissions for aviation but may underestimate emissions for shipping, because ships tend to avoid refuelling here due to cost. Cruise sector stakeholders told us that cruise ships refuel here on around 40% of their visits. Shipping stakeholders told us that cargo ships largely only use Aotearoa New Zealand as a top-up location for fuel for long trips if it cannot be avoided, or for routes that travel only within the Pacific. This could be addressed by applying a multiplier to shipping based on the proportion of ships which do not refuel in this country; the Government does not currently collect the data that would enable a multiplier to be calculated.

There is a risk that airlines may refuel more overseas before travelling onward to Aotearoa New Zealand if policy measures to achieve emissions reduction in these sectors were based around refuelling. This risk is relatively small as it would cause a significant cost to the airlines for additional fuel, but it could be addressed by harmonising policy approaches with Australia where this behaviour would be most likely to occur.

Option 2 for measuring emissions: Fuel use to/from *next* port

The second option for counting these emissions is to estimate the greenhouse gas emissions released by international ships and aircraft while travelling to or from the next port. For example, the emissions released by an aircraft travelling from Sydney in Australia to Auckland in Aotearoa New Zealand. This option is used by the UK in its target for aviation using departures and by the EU for its target based on how it measures international shipping and aviation emissions under its Emissions Trading System.[143]

A measure based on emissions to/from the next port could enable accurate tracking of progress in achieving emission reduction targets over time.

Four options have been identified for how emissions to/from the next port could be counted:

- 50% of emissions by all vessels/aircraft
- 100% of emissions by all vessels/aircraft
- departing vessels/aircraft only
- arriving vessels/aircraft only.

The measure could be calculated by self-reporting or government estimation. Self-reporting is more accurate. However, it has been estimated in the EU Emissions Trading System that for shipping, self-reporting costs around NZ$12,000 per ship[v] per year for vessel owners.[144] The EU excludes small vessels to reduce administration costs; this could also be considered for Aotearoa New Zealand.[145]

The EU has included charges under its Emissions Trading System – 100% of emissions from an EU port to another EU port and 50% of emissions to/from a non-EU port.[146] These charges apply to goods travelling between Aotearoa New Zealand and the EU now. Alignment with the EU may reduce compliance costs for shipping companies.

For aviation, the emissions estimate under this measure for 50% of emissions by all aircraft or departing aircraft only is likely to be similar to the aviation bunker fuels estimate, as most aircraft refuel in Aotearoa New Zealand. Assuming a 5% increase in emissions to allow for planes not refuelling in the country, emissions calculated using this method would have been 4.1 $MtCO_2e$ in 2019 for aviation.[147]

The Commission has made an initial estimate of international shipping emissions using the 'to/from the next port' method that would put these emissions at approximately 3.3 $MtCO_2e$ in 2019.[vi],[148] This would mean total international shipping and aviation emissions for 2019 were approximately 7.4 $MtCO_2e$ in 2019, which is around 50% higher than the estimate of emissions based on refuelling. For the method counting 100% of emissions this would be doubled. The approach to estimating these emissions would need to be further refined by the Government to be accurate enough to use for a target.

[v] EUR 6,700 per ship – converted to NZD, 9 Jan 2024.

[vi] This estimate has been produced by taking Customs data for ship arrivals and departures, using QGIS to obtain the latitude and longitude of ports, estimating the distance between the relevant ports using SeaRoute, applying the average weight of vessels coming into Aotearoa New Zealand by type from Ministry of Transport data, and multiplying these values by the average emissions by vessel type and weight using International Maritime Organization fuel consumption data. This method could be the basis of a government calculation with refinement, but it is less accurate than using self-reporting to calculate the actual emissions of these particular ships. Additional data would need to be collected from ships in future about the fuel type they use once alternative fuels began being adopted. The Commission only calculated the emissions for international vessels travelling to/from Aotearoa New Zealand; the vessels also generate emissions while travelling around the country, which are not currently captured; this would further increase the estimate if included.

Option 3 for measuring emissions: Fuel use to/from *final* port

The third option for counting is to estimate the greenhouse gas emissions released by international ships or aircraft travelling from the first port to the final port in their journey. For example, if a ship travelled from Malaysia to Australia, then to Aotearoa New Zealand, this method would cover the emissions of both the Malaysia–Australia and the Australia–Aotearoa New Zealand legs of the journey. This option is likely to capture the greatest volume of emissions of the options discussed. There are no other countries currently using this measure.

The same four options apply for how emissions to/from final port could be set. These are:

- 50% of emissions by all vessels/aircraft
- 100% of emissions by all vessels/aircraft
- departing vessels/aircraft only
- arriving vessels/aircraft only.

This measure could be calculated by self-reporting or government estimation, although self-reporting would be significantly more accurate. Self-reporting of to/from **final** port may be more expensive than emissions estimations to/from the **next** port and there may be jurisdictional issues in requiring this.

This method is unlikely to enable accurate tracking of progress in achieving the emissions reduction target over time unless self-reporting is used, because it may not be possible to track emissions between overseas ports accurately.

There is significant complexity to calculate emissions to/from the final port for both shipping and aviation. For shipping, a single vessel may carry goods from multiple countries. For aviation, the aircraft may carry both goods and passengers. The calculation method would need to be worked through carefully with stakeholders.

The University of Otago has estimated these emissions to be 8.4 $MtCO_2e$ for international aviation coming to and from Aotearoa New Zealand in 2017.[149] For comparison, bunker fuel emissions reported in that year for international aviation were 3.9 $MtCO_2e$.[150] Shipping emissions calculated on this basis are also likely to be considerably larger than bunker fuel estimates.

Option 4 for measuring emissions: Fuel use within the Exclusive Economic Zone

Emissions could be measured by estimating emissions from all international operators of shipping and aircraft in Aotearoa New Zealand's exclusive economic zone. Emissions within Aotearoa New Zealand's Exclusive Economic Zone (EEZ) are likely able to be measured as a quantity. This option would help create a level playing field with domestic shipping. There are no other countries known to be using this measure currently.

A measure based on emissions within Aotearoa New Zealand's EEZ could enable accurate tracking of progress in achieving the emissions reduction target over time. This type of measure would prevent avoidance of the target by stopping in another destination before travelling to Aotearoa New Zealand. However, vessels/aircraft could avoid emissions being captured by changing speed or switching fuels when they enter the Exclusive Economic Zone. Fuel usage could be averaged over the full journey to prevent avoidance.

Although Aotearoa New Zealand has jurisdiction over natural resources in its 200 nautical mile EEZ, its regulatory abilities are not as comprehensive as in its 12 nautical mile territorial waters.

If every country adopted a similar approach, emissions occurring over international waters would not be accounted for.

Option 5 for measuring emissions: Share of global emissions

Aotearoa New Zealand could choose to take a share of global international shipping and aviation emissions, based on what it considers its fair portion of the burden. There are no other countries known to be using this measure currently.

Three options have been identified for how a share of global emissions could be set:

- share of global trade/tourism
- share of gross domestic product (GDP)
- another fixed proportion chosen by the Government.

This approach would not enable accurate tracking of progress in achieving targets because it would not track reductions Aotearoa New Zealand's actions caused relative to those by others. If fixed to an economic measure, such as the country's trade share or GDP, a reduction in economic performance could cause the target to be met without emissions being reduced. Aotearoa New Zealand could also eliminate emissions from international shipping and aviation on all routes to the country and still be responsible for a share of global emissions.

Economic measures of Aotearoa New Zealand's fair share result in a larger share of emissions from shipping than bunker fuels (1.5 to 1.7 $MtCO_2e$ versus 1 $MtCO_2e$ in 2019) but result in a much lower estimate of aviation emissions.[151] In 2019, Aotearoa New Zealand's emissions based on GDP were approximately 3.2 $MtCO_2e$[152] while emissions on the basis of merchandise trade for shipping and tourism for aviation were approximately 3.1 $MtCO_2e$.[153]

Option 6 for measuring emissions: Fuel used by operators based in this country

Emissions could be measured by estimating emissions from all international shipping and aviation operators based in Aotearoa New Zealand. The USA uses this approach for flights between ICAO member states.[154]

Air New Zealand is the only major national operator identified in Aotearoa New Zealand. Air New Zealand's emissions were 3.3 $MtCO_2e$ per year in 2019.[155] Two smaller organisations have freight planes registered here which do some trans-Tasman trips: Airwork and Texel Air Australasia. No vessels conducting international shipping have been identified as registered here. It may create market distortion to only capture one major company and it would mean shipping emissions would not be captured.

There is a risk that measuring emissions from national carriers only would shift emissions from being counted by Aotearoa New Zealand to other countries by disadvantaging Aotearoa New Zealand companies relative to their international competitors. This impact could be reduced by not limiting policy measures that may impact competitiveness to only national carriers, but this would create a mismatch between policy and target scope.

Initial assessment for measuring emissions

Our initial analysis shows that refuelling and an estimate of emissions on fuel used to/from the next port could be appropriate ways to measure Aotearoa New Zealand's international shipping and aviation emissions – if these emissions were included in the 2050 target. The other measures considered all appear to present difficulties in accurately measuring the amount of emissions, or creating risk of emissions leakage.

An estimate of emissions based on fuel used to/from the next port is likely to capture a greater volume of emissions than estimating emissions based on refuelling, particularly for shipping. This means that its potential to reduce emissions and its impacts may be larger than a measure based on refuelling.

As part of this consultation, to contribute to our final analysis, we are seeking your feedback and more information around the potential benefits, risks, compliance implications, and accuracy of these options.

Consultation question

If international shipping and aviation emissions were included in the 2050 target, which of these options for counting the emissions would you support? What are your reasons and evidence for that?

- **Option 1:** Refuelling – fuel sold in this country.
- **Option 2:** To/from next port – for the specified travel leg.
- **Option 3:** To/from final port – for the entire journey.
- **Option 4:** Fuel use within the Exclusive Economic Zone.
- **Option 5:** Share of global emissions.
- **Option 6:** Fuel used by operators based in this country.

Other climate impacts from international shipping and aviation

The National Greenhouse Gas Inventory (GHG Inventory) analyses Aotearoa New Zealand's official emissions profile, accounting for carbon dioxide, methane, nitrous oxide, and four types of fluorinated gases ('f-gases'). For most sectors, the gases counted by the GHG Inventory represent a majority of their global warming impact.

However, international shipping and aviation have several other impacts on the atmosphere that contribute to climate change. This is known technically as non-CO_2 radiative forcing. Some of these impacts cause more warming and some cause cooling.

If international shipping and aviation emissions were included in the 2050 target, these additional impacts would not be recognised without further change to the structure of the target.

These additional impacts on the atmosphere from international shipping and aviation include:

- the production of greenhouse gases other than those counted by the GHG Inventory
- the production of other pollution, such as particulate matter
- changes to the amount of light reflected from a surface (known as albedo)
- changes to ozone levels.

Accounting for all these impacts, including the greenhouse gas emissions covered by the GHG Inventory, both international shipping and aviation are contributing to a warming climate. These other impacts appear to be disproportionately large for aviation in particular, meaning it is important to consider them if these emissions are included in the 2050 target.[156]

Other climate impacts from international shipping

Most of the atmospheric warming caused by international shipping is the result of carbon dioxide emissions and the impact of changes in the amount of light reflecting from the ocean surface (albedo) as a result of ship wakes; at the same time, other impacts that shipping has on the atmosphere have an overall cooling effect. If these other impacts were recognised in the 2050 target, while CO_2 emissions would still need to be reduced, they would likely reduce the level of emissions reductions required to meet the target in the short term.[157]

International shipping's role in contributing to net global warming has changed significantly over the last five years. In its Sixth Assessment Report the Intergovernmental Panel on Climate Change (IPCC) stated that shipping would have an overall cooling effect in the near term, while it would cause warming on a 100-year horizon.[158]

However, in 2020, the International Maritime Organization implemented new regulations that require ships to use low-sulphur fuel for public health reasons. Sulphur acts to cool the planet by scattering sunlight and increasing the albedo of clouds. Under the new regulations, the maximum allowable percentage of sulphur in fuel was lowered from 3.5% to 0.5%, leading to a 10% reduction in sulphur dioxide emissions in 2020.[159]

The reduction in sulphur dioxide emissions from international shipping means the short-term cooling effects for shipping have been reduced, increasing the urgency of reducing CO_2 emissions to prevent warming.[160] The pollution from ships can also have an impact on marine clouds, increasing their droplet count and making them longer-lived and more reflective.[161] This greater reflection has a net cooling effect.[162]

The wakes of ships can increase the amount of reflection of the ocean (the surface albedo) by more than 100%, reducing overall global warming.[163]

Other climate impacts from international aviation

Contrails and aviation-induced cirrus, two cloud types created by aircraft, have been identified as causing more warming than the direct greenhouse gas emissions from aircraft.[164] However, how large this effect is has been questioned. Two recent studies found contrails and cirrus clouds did not reduce at the levels expected during the COVID-19 pandemic lockdowns in 2020 when few international flights were operating.[165] Previous model-based estimates may have significantly overestimated the amount that aviation is involved in the formation of contrail and cirrus cloud types.[166]

Ozone, a greenhouse gas, is created by international aviation emissions in the lowest layer of the atmosphere. The amount of ozone produced by an aircraft varies depending on several factors, including how 'clean' the atmosphere is. This means the Pacific, which has a relatively clean lower atmosphere, is about five times more sensitive to aviation emissions than Europe. In the most sensitive areas over the Pacific (near the Solomon Islands), each kilogram of aircraft emissions can result in the formation of an extra 15 kilograms of ozone within one year, creating additional warming impacts.[167]

International approach to reporting these other impacts

Scientists are actively researching the contribution of other impacts on the atmosphere associated with international shipping and aviation. But there is not yet a scientific consensus on how these additional impacts could be accounted for.

Currently, no jurisdictions include these other impacts as part of international shipping and aviation emissions reduction targets. The UK greenhouse gas reporting guidelines state there is no suitable metric for calculating their impact.[168]

One avenue being considered, including by ICAO, is a multiplier. A multiplier would increase the emissions reductions required under a target by a set amount, based on a calculation of the additional warming caused by impacts other than CO_2 emissions.

A multiplier of 1.9 times CO_2 emissions for aviation was recommended in international guidance for organisations issued by the UK Government in 2018, based on the best available scientific evidence at the time.[169] However, more recent research suggests this may be an overestimation. A multiplier for shipping is not provided in these sources.

ICAO has stated that it will adopt a multiplier when the scientific community reaches a general agreement on the issue and is collaborating with the IPCC on a methodology.[170]

Whether to include other impacts in the target

This section discusses the options for including these other impacts of international shipping and aviation in the 2050 target. The points made here assume that the Government had chosen to include international shipping and aviation emissions in the 2050 target, as these additional impacts could only be considered if that as the case.

Option 1: Include other impacts through a multiplier

If the Government chose to account for other impacts through a multiplier, Aotearoa New Zealand would have taken the highest possible level of accountability for its contribution to climate change resulting from international shipping and aviation.

A multiplier of 1.9 times has been previously calculated for the other impacts of international aviation; however, there is a risk the country could take responsibility for more warming than it is causing if this is an overestimation, as more recent research suggests. Taking more responsibility than required will result in greater emissions reductions from Aotearoa New Zealand, having positive impacts on the climate through reduced climatic events which negatively affect livelihoods.

Use of a multiplier could lead to a greater emphasis on reducing demand and changing flight routes, likely increasing the costs associated with including international shipping and aviation emissions in the 2050 target. Although a reduction in demand would have positive environmental impacts, it could also increase the social and cultural impacts – see *Chapter 3*.

There are other risks related to uncertainty, for instance if flight routes were changed to reduce aviation-induced cloud formation, and the underlying science or calculations informing those route changes was inaccurate, then measures intended to reduce warming could in fact increase it. Research by Digby et al.,[171] found:

> *"The navigational avoidance of potential contrail-forming regions is not yet a viable solution. If the effective radiative force of aviation-induced cirrus is indeed lower than previously believed, then the necessary increase of fossil fuel consumption caused by rerouting may result in a net increase in aviation's climate impact."*

Using a multiplier limits this risk compared to directly including these other factors in a target. However, a multiplier is still likely to result in increased efforts to limit other impacts so that the multiplier is reduced over time.

Option 2: Exclude other impacts from the target at this point

If the Government chose not to account for other impacts in the 2050 target, Aotearoa New Zealand would include only the international shipping and aviation emissions currently covered by the GHG Inventory.

While this would not provide coverage of all impacts of international shipping and aviation, it would mean accounting of these emissions had higher certainty than if other impacts were included. Quantifying the warming impact of the other impacts on the atmosphere of these transport sectors is difficult, and an area of active research.

Option 3: Reconsider in future target reviews/if significant change

The additional impacts on the atmosphere from international shipping and aviation could be reconsidered through future 2050 target reviews; this could be earlier if there was significant change, for example if ICAO or the IPCC recommended a multiplier.

Delaying inclusion of these other impacts in the 2050 target could provide more time for research to better understand their effects, and lead to a future amendment that more accurately represents the measures needed to meet the purpose of the Act and the Paris Agreement.

Initial assessment

Our initial assessment of the options for accounting for other impacts of international shipping and aviation on the atmosphere is that the science related to their warming effects is still developing. As a result, the total contribution of Aotearoa New Zealand's international shipping and aviation emissions is difficult to quantify. It may be best to defer any decisions about accounting for these impacts until the science is more certain.

The uncertainty around the effects of these other impacts creates difficulties in measuring them or responding effectively to them.

Leaving these other impacts out, or deferring decisions until the science is more certain, would mean Aotearoa New Zealand was likely underestimating the country's total contribution to climate change from international aviation, and likely overestimating the contribution of shipping.

As part of this consultation, we are seeking your views on how other impacts are considered, and the options for accounting for them if international shipping and aviation emissions were included in the 2050 target.

Consultation questions

Is there any further information or evidence the Commission should consider on other impacts from international shipping and aviation contributing to climate change?

If international shipping and aviation emissions were included in the 2050 target, which of these options for addressing other impacts would you support? What are your reasons and evidence for that?

- **Option 1:** Include other impacts through a multiplier.
- **Option 2:** Exclude other impacts from the target at this point.
- **Option 3:** Reconsider in future 2050 target reviews – or possibly earlier if there was a significant change.

CHAPTER 5

Options for including these emissions in the 2050 target

This chapter explores the options for including international shipping and aviation emissions in the structure of Aotearoa New Zealand's 2050 target.

We are seeking your feedback on our initial analysis of two aspects of this possible change: how these emissions could be included in the structure of the target and what level of emissions reduction could be aimed for. Our early findings are based on our review of international examples and modelling.

The key choice about the target structure is whether to include these emissions in the existing net zero component of the 2050 target, or to set up a separate component, or components. There are four options presented, each with commentary on their likely impacts, followed by our initial assessment. We are keen to hear your views on the risks and benefits of the different approaches, and which you prefer.

The second focus in the chapter is on the level of emissions reduction. We present our initial modelling to show the level of emissions reduction possible in different scenarios.

The chapter also considers how residual emissions should be dealt with, if Aotearoa New Zealand includes international shipping and aviation emissions in its target. This recognises it is unlikely that gross emissions would be at zero by 2050.

We are keen to hear what level of emissions reduction you would favour, and your views on managing any residual emissions.

Our final advice to Government will combine our analysis of these options with consideration of their impacts, to provide advice on whether these emissions should be included in the 2050 target, with specific recommendations how this could be done. We need to do more analysis to be able to make a recommendation – in particular to more closely assess the impacts of different options. This would include the full range of effects we are required to consider under the Act (as described in *Chapter 3*), including impacts on the Crown–Māori relationship and for te ao Māori.

Your feedback will help inform our further analysis and development of our final advice – see the consultation questions at the end of the two main sections. The options for how international shipping and aviation emissions could be counted are set out in *Chapter 4*.

Options for the target structure

This section outlines our initial assessment of the choices the Government has about how international shipping and aviation emissions could be built into the structure of the 2050 target – would these emissions be added to the net zero component of the target, or addressed separately. It includes the implications of each option to support your feedback.

We have identified the four most viable options:			
Option 1	**Option 2**	**Option 3**	**Option 4**
Include international shipping and aviation emissions in the existing net zero component of the 2050 target	Add a new, separate component to the 2050 target covering gross emissions from international shipping and aviation	Add two new, separate components to the 2050 target, one covering gross emissions of international shipping and the other gross emissions of international aviation	Add two new, separate components to the 2050 target, one covering net emissions of international shipping and the other net emissions of international aviation

Option 1 for target structure: Include in existing net zero component of the 2050 target

Including international shipping and aviation emissions in the existing net zero component of the 2050 target would be consistent with approaches taken globally. As the net zero component of the 2050 target is both broad (it covers a wide range of greenhouse gases) and flexible (it can be achieved through both gross emissions reductions and carbon dioxide removals), this approach would enable Aotearoa New Zealand to pursue the lowest-cost emissions reductions because the target can be met by whatever method is cheapest.

However, that same breadth and flexibility means that the net zero component of the 2050 target could be achieved through carbon dioxide removals or reductions in other sectors, rather than through a gross reduction of international shipping and aviation emissions. This could lead to higher costs and flow-on impacts for other sectors. The Government could manage these impacts through policy settings around how residual emissions are managed and who should pay for them.

If the Government prioritises carbon dioxide removals over reducing gross emissions from the sectors, that may increase the costs of reducing emissions for future generations and impact on land use from increased forestry. Increased forestry may also have specific effects for iwi/Māori due to their landholdings; this may also impact on the Crown–Māori relationship.

While emissions budgets must be met as far as possible through domestic emissions reductions and domestic removals, if there is a significant change of circumstances then offshore mitigation can be used. The limit for this is currently set to zero – no international units may be used. If the limit on international units is lifted in future the Government would be able to choose whether to accept international units surrendered through schemes such as CORSIA for international aviation where those units are considered to have sufficient integrity. If this were to occur, it could help improve consistency between the 2050 target

and the international regimes but would also create a risk of undermining the effectiveness of the 2050 target in achieving domestic emission reductions.

Co-benefits and impacts from reducing international shipping and aviation emissions may be less likely due to this ability to reduce emissions through other means, relative to a separate target. However, different co-benefits may occur from emissions reductions in other sectors.

Option 2 for target structure: Add a new separate component – combined gross international shipping and aviation emissions

This target structure would mean gross emissions reductions are prioritised over offsets or carbon dioxide removals, which minimises costs on other parts of the economy and future generations. It enables emissions to shift between international shipping and international aviation to achieve the target component (this is not possible if there are two separate components for each sector).

Separate components of a target generally result in less efficient emissions reductions overall, as cheaper options in other sectors cannot be used to help meet the target. Individual components of the target may be set either too high or too low, meaning emissions reduction opportunities are not taken, or additional costs incurred. They also increase the risk of sector-specific lobbying around emissions reductions, creating a less stable policy environment.

The technology pathways for these sectors are uncertain and could change significantly by 2050. In the existing net zero component of the 2050 target, sectors can compensate for each other when technology progresses more quickly or slowly than expected. Target reviews every five years can adjust the target if a significant change occurs.

This option would provide less flexibility for the Government to meet the target. This could be mitigated by setting the additional component of the target as a range rather than a single point, using existing provisions in the Act to bank and borrow between emissions budgets (carrying forward over- or under-achievement to the next five-year budget), or by enabling limited transfer of over-achievement between the net zero component and an international shipping and aviation component.

A separate gross component of the target may not be seen as consistent with global efforts to limit warming to 1.5°C. This is because the IPCC has shown carbon dioxide emissions need to be reduced to net zero by or around 2050 globally to limit warming to 1.5°C and the sectors' global targets are net zero. However, Aotearoa New Zealand can also amend its existing net zero component of the 2050 target to increase the overall level of ambition to offset any residual emissions from the gross target.

If a separate component of the target is adopted which does not allow emissions reductions to be used from other components, the Government could recognise the full lifecycle emissions of biofuels for the international shipping and aviation sectors, as international models and targets do. Under the Climate Change Response Act currently, if biofuels are used by a shipping line or airline these are treated as causing no emissions at that point. Where biofuels are produced domestically their production emissions are captured by other sectors. If biofuels are imported, the emissions are considered the responsibility of the country that produced them. Capturing all biofuels emissions in the target for the sectors would increase the incentive to focus on adopting alternative fuels that deliver large emissions reductions compared to fossil fuels, rather than importing a large volume of alternative fuels that do not reduce overall emissions by much.

Option 3 for target structure: Add two new separate components – gross international shipping and gross international aviation emissions

This would enable the target to reflect the different opportunities that the international shipping and aviation sectors have to reduce their emissions. While both sectors have net zero by 2050 targets globally, their pathways to get there are very different.

It would also reflect a difference in the way action to reduce these emissions could impact on Aotearoa New Zealand, as aviation changes primarily affect people's ability to do things like practice whakawhanaungatanga and connect with whānau overseas, as well as the tourism sector. Changes in shipping, however, primarily affect the export sector.

This option has many of the same impacts as a separate combined component of the target, but also enables the Government to focus on emissions reductions by international shipping and aviation without imposing costs on each other. Some negative impacts of a combined gross component of the target are reduced if there are two separate components, such as the impact of uncertain technological pathways on achievability and limited flexibility.

Having two separate components of the target for shipping and aviation would make it easier to apply different emission measurement approaches for each sector, if they were more appropriate to one sector than the other. For example, an estimate of emissions based on fuels used to/from the next port for shipping and bunker fuels for aviation.

Option 4 for target structure: Add two new separate components – net international shipping and net international aviation emissions

This would enable the components of the target to be met by emissions reductions outside of the emissions captured for international shipping and aviation sectors.

This could include:

- recognising international units surrendered through schemes such as CORSIA for international aviation where those units are considered to have sufficient integrity
- carbon dioxide removals obtained by or for the international shipping and aviation sector such as using enhanced mineral weathering, direct air carbon capture and storage, or bioenergy carbon capture and storage
- enabling emissions reductions or carbon dioxide removals by sectors under the net zero component of the target to be used to meet the international shipping or aviation target instead. Reductions or carbon dioxide removals would not be able to be counted twice.

Recognising the international units through regimes like CORSIA would make the regime more complementary to the international targets.

This option carries several significant risks, as the three methods listed have a high degree of uncertainty associated with them.

International units through CORSIA currently trade at much lower prices than units under the New Zealand Emissions Trading Scheme (NZ ETS) and the IMO does not have an international shipping emissions pricing model in place yet. These regimes can change over time without Aotearoa New Zealand's control. Recognising these units under the Act risks undermining effective domestic emission reductions by encouraging purchase of cheaper international offsets instead. The Government could choose to limit which categories of units it accepts to those of higher integrity. Recognising international units only for these two sectors may raise questions why other sectors where emissions are difficult to reduce are not similarly allowed to use international units currently.

Technologies for carbon dioxide removal are yet to be commercialised and the cost of them is currently unclear. A new framework would need to be created to recognise these technologies and ensure carbon dioxide removals were genuinely permanent and sustainable.

Allowing multiple targets to be met using emissions reductions currently counted for the net zero component of the target could make it difficult for emissions budgets to be accurately set. There would also need to be strong checks and balances in place to avoid any risk of double counting.

Initial assessment of options for the structure of a target

Our initial analysis shows that either inclusion in the net zero component of the 2050 target, or separate gross components of the target, could be effective target structures. Including these emissions in the net zero component of the 2050 target enables pursuing the lowest cost emissions reductions overall, while separate gross components of the target would enable a clear focus on reducing international shipping and aviation emissions specifically.

Separate net components of the target would make the regime more complementary to the international regimes but would appear to add significant risk to the operation of the target.

As part of this consultation we are seeking more information and your feedback on the relative benefits and risks of these approaches.

Consultation question

If international shipping and aviation emissions were included in the 2050 target, which of these options for the structure of a target would you support? What are your reasons and evidence for that?

- **Option 1:** Include in the net zero component of the target.
- **Option 2:** Separate combined international shipping and aviation gross component of the target.
- **Option 3:** Separate gross international shipping and aviation components of the target.
- **Option 4:** Separate net international shipping and aviation components of the target.

Potential level of emissions reduction

There are multiple options for setting a level to aim for to reduce Aotearoa New Zealand's international shipping and aviation emissions, if these emissions were included in the 2050 target.

Most international models are based on emissions calculated across the lifecycle of biofuels, capturing all the emissions involved in their production and use. On this basis, emissions could reduce up to 91% for shipping and 65% for aviation depending on the approach taken. To address residual emissions, carbon dioxide removal techniques like forestry would be needed.

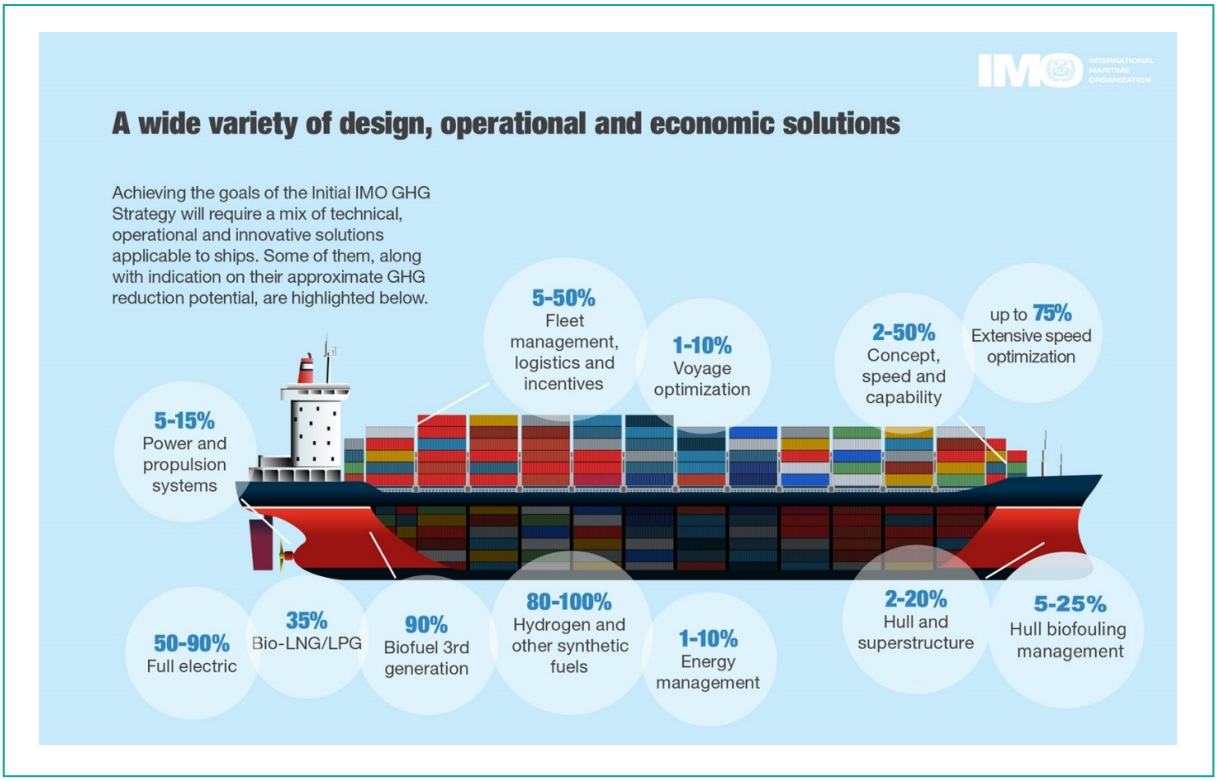
In Aotearoa New Zealand, however, under the Climate Change Response Act biofuel emissions only count against the sectors that produce the fuels and the raw materials used to create them. This means that where the country imports biofuels, or replenishes the materials used to produce biofuels domestically (for instance, by replanting trees used as feedstock), using these fuels would not increase reported emissions. Under these rules, if international shipping and aviation shifted completely to alternative fuels these sectors could be reported as reaching gross zero by 2050.

Shipping emissions reduction

International shipping models

The IMO aims to reduce international shipping emissions by at least 20-30% compared to 2008 levels by 2030; at least 70-80% by 2040, and to net zero greenhouse gases in 2050.[172]

Figure 5.1: *International Maritime Organization solutions in Initial Greenhouse Gas Strategy*[173]



Source: International Maritime Organization

International models show multiple potential ways to achieve these targets:

- the International Energy Agency models that CO_2 emissions from domestic and international shipping could fall 91% by 2050, primarily through use of biofuels and hydrogen[174]
- the International Renewable Energy Agency modelled that a pathway to reducing emissions from international shipping consistent with limiting warming to 1.5°C by 2050 would mean a reduction in energy demand through energy efficiency measures, and a transition to green ammonia as a primary source of energy[175]
- the Science Based Targets Initiative found a maritime sector pathway consistent with limiting warming to 1.5°C would see a 96% reduction of emissions by 2040, and a 100% reduction by 2050 – it found low and zero emissions fuels would need to make up 27% of maritime fuels by 2036, and almost entirely replace fossil fuels by 2045.[176]

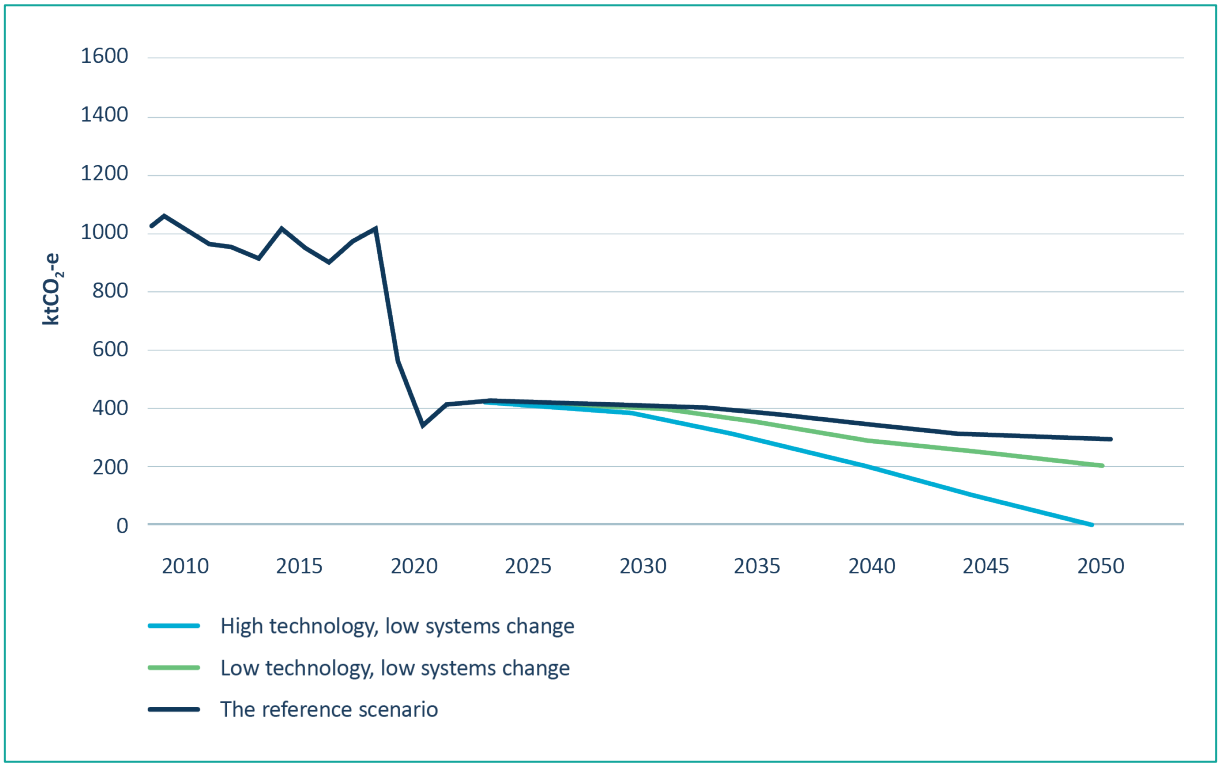
Commission shipping modelling

The Commission has modelled what could happen to Aotearoa New Zealand's international shipping emissions based on refuelling data out to 2050 in different scenarios based on these global trends. This shows there is a wide range of possible outcomes for the country's international shipping emissions in 2050.

In all scenarios, demand for international shipping is expected to remain in line with Ministry of Transport projections. In a scenario with low levels of technology change, low carbon liquid fuels begin to be used to reduce fossil fuel consumption, but fossil fuels are still in use by 2050. In a scenario with high levels of technology change, low carbon liquid fuels completely displace fossil fuels by 2050. The reference scenario, under which there is no change to fuel use or type, demonstrates a small reduction in emissions due to efficiency improvements, but emissions are more than double that of the low and high-technology scenarios in 2050. High technology, low systems change (light blue) and low technology, low systems change (green) scenarios are projected in comparison to the reference scenario in **Figure 5.2**.

The Commission's assumptions used to generate this model are set out in more detail in in the *Technical Annex – Modelling and analysis* and the *Assumptions log*.

Figure 5.2: *Commission international shipping modelling*[vii]



Source: Commission analysis

[vii] The significant drop in emissions in 2020 is due to low-sulphur fuel not being available at Marsden Point changing refuelling patterns, rather than a significant change in shipping activity.

Aviation emissions reduction

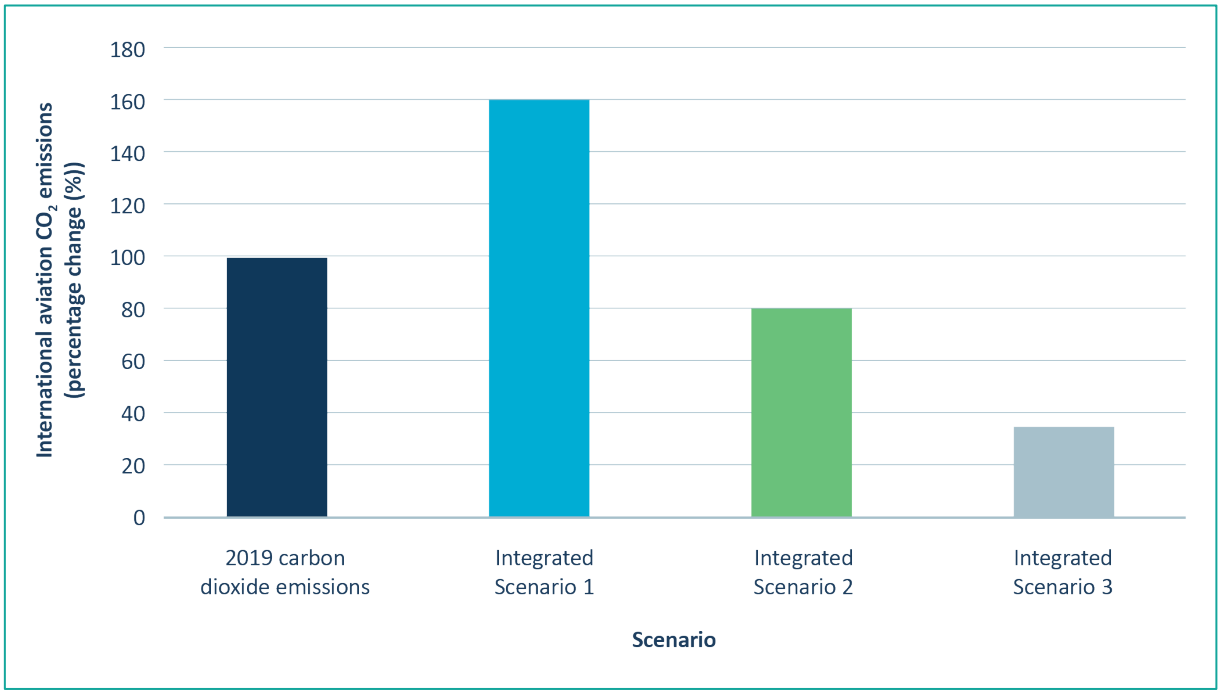
International aviation models

The International Civil Aviation Organization (ICAO) has set a 'long-term aspirational goal' for international aviation emissions to reach net zero CO_2 by 2050. To show what actions are needed to achieve this goal, the agency has published three integrated scenario pathways with varying combinations of technologies, operations, and fuel types (see **Figure 5.3**).[177]

Under ICAO's Integrated Scenario 1, CO_2 emissions would be 60% higher in 2050 than in 2019. Under Integrated Scenario 2, emissions would be 20% lower than 2019 levels, and 65% lower under Integrated Scenario 3.

If emissions were reduced in line with Integrated Scenario 3, residual emissions would be around 200 $MtCO_2$ in 2050, equating to an 87% reduction compared to a baseline scenario of no intervention. ICAO models Integrated Scenario 3 as being achieved through a combination of changes to technologies (21%), operations (11%), and fuels (55%).[178] These pathways show that ambitious change is possible, driven primarily by sustainable aviation fuel, however due to the increasing demand forecast even with significant change high levels of offsets are needed to address residual emissions.

Figure 5.3: *International Civil Aviation Organization integrated scenario projections of percentage change in international aviation CO_2 emissions in 2050 after reductions, compared to 2019*[179]



Source: International Civil Aviation Organization

Other international models of pathways towards international aviation emissions reductions include:

- the International Energy Agency models that emissions from aviation (domestic and international) could fall 74% by 2050. Under this scenario, SAF produced through electricity would provide approximately 40% of the sector's energy. In their model, decarbonisation is expected to occur nearly twice as fast in advanced as emerging economies[180]
- the International Air Transportation Association has modelled a path for their operations to achieve net zero carbon emissions by 2050, which includes a:
  - 65% emissions reduction from transitioning to SAF
  - 13% reduction from new technologies including electric or hydrogen aircraft
  - 3% reduction from operational efficiencies
  - 19% reduction from offsets or carbon capture[181]
- the Science Based Targets Initiative has modelled a CO_2 emissions intensity reduction of 73.2% in 2040 and 97.4% in 2050 is required for consistency with limiting warming to 1.5°C.[182]

Aotearoa New Zealand aviation models

Two Aotearoa New Zealand-based models have calculated how aviation emissions (international and domestic) could reach net zero CO_2 by 2050. We have not identified any equivalent models for Aotearoa New Zealand-based emissions from international shipping.

In 2021, Air New Zealand included in their sustainability report a roadmap for the airline to achieve net zero CO_2 in 2050. It estimated a 50% emissions reduction from SAF, a 20% reduction from zero emissions aircraft (battery or green hydrogen-powered), up to a 2% reduction from operational efficiency (such as through reducing cabin weight and using electricity to power the plane when not flying), and a 20% reduction from fleet renewal. Under their roadmap, any residual emissions are addressed through carbon offsetting, achieved either by purchasing carbon credits or through capturing CO_2 from the air and storing it underground.[183]

Academics Dr Paul Callister of Victoria University of Wellington's Institute of Governance and Policy Studies and Professor Robert McLachlan of the School of Fundamental Sciences at Massey University modelled different pathways for Aotearoa New Zealand's international and domestic aviation emissions through to 2050. Their models assumed a 20% efficiency improvement of aircraft and that 100% use of SAF could be achieved by 2050. They also looked at different rates of demand. The study found that with their assumed technological changes, only reductions in demand of 6% per year would be consistent with limiting warming to 1.5°C. Their finding assumes Aotearoa New Zealand's aviation emissions remain proportionally consistent with global emissions.[184]

Commission aviation modelling

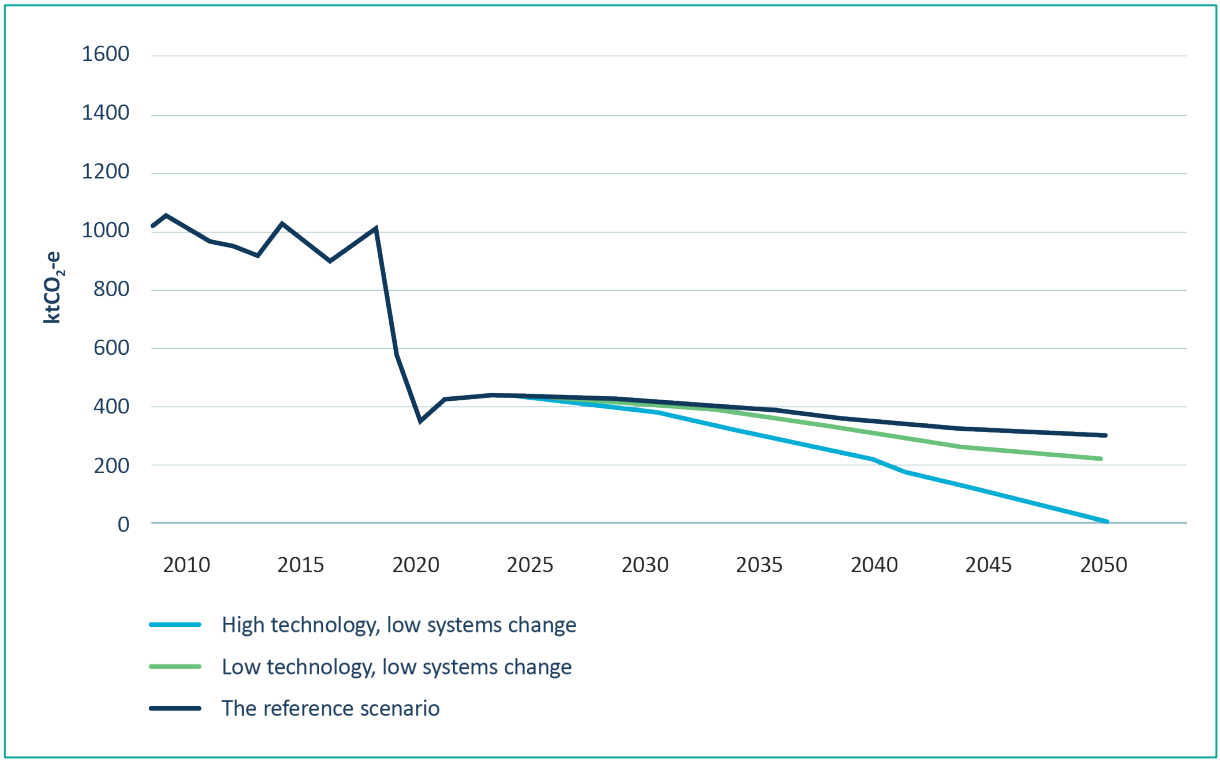
The Commission has modelled what could happen to Aotearoa New Zealand's international aviation emissions based on refuelling data out to 2050 in different scenarios based on these global trends. This shows there is a wide range of possible outcomes for Aotearoa New Zealand's international shipping emissions in 2050.

All scenarios forecast demand to increase from current levels based on Ministry of Transport projections. The structural change scenarios (light blue (high technology, low systems change) and green (low technology, low systems change) on **Figure 5.4**) assume a 20% lower demand compared to the baseline forecasts could occur.

Efficiency is assumed to increase offsetting some of the impact of the increase in demand however the use of SAF is modelled to be the primary driver of meaningful emission reductions. In the low-technology scenario, use of SAF will gradually increase, reaching 22% of total aviation fuel by 2050. In the high-technology scenarios, fossil fuels will be entirely replaced by 2050.

The Commission's assumptions used to generate this model are set out in more detail in the *Technical Annex – Modelling and analysis* and the *Assumptions log*.

Figure 5.4: *Commission international aviation modelling*



Source: Commission analysis

Options for the target level of emissions reduction

This section discusses the range of potential options for the level of emissions reduction if the Government chose to include international shipping and aviation emissions in the 2050 target.

How the emissions reductions sought should be reflected in the target depends on the decisions on the target structure and the approach to emissions measurement. The Commission's initial analysis indicates these emissions could be included with no change in timing for the target, meaning these emissions reductions would also have a 2050 goal. The key technologies necessary are expected to be available by 2040. There are, however, a wide range of possible levels of reductions that could be aimed for by 2050.

The speed and level of emissions reduction aimed for affect the scale of potential impacts (as identified in *Chapter 3*). Higher levels of ambition mean trading off higher benefits with higher costs.

Higher levels of emissions reduction or a faster rate of emissions reduction may increase the new economic opportunities associated with reducing international shipping and aviation emissions, as well as co-benefits for health, wellbeing, and environmental outcomes associated with alternative fuels.

Higher levels of ambition may have specific effects for iwi/Māori including on the ability to practice whakawhanaungatanga (relationships) with relatives overseas, protecting te taiao (the environment) and future generations, as well as opportunities and costs for Māori businesses.

Higher levels of ambition could increase the costs associated with the transition in the short term. In the long term, higher ambition is likely to reduce the costs and impacts for future generations of transitioning these sectors overall.

Whatever form a target takes, it is necessary to consider what gross emissions reductions are possible and how any residual emissions are dealt with. We are seeking feedback on key questions for this area rather than setting out fixed options.

Intensity-based targets that focus only on reducing emissions per tonne of freight or number of passengers are not being considered, because this would not capture demand at a target level, which would reduce the incentive to address overall emissions. Historically, emissions for international shipping and aviation have not reduced, despite significant increases in efficiency, because of accompanying increases in demand. Intensity measures could be used for individual policy instruments to support implementation.

As a developed nation, Aotearoa New Zealand is expected to take a lead in reducing emissions under the Paris Agreement. As an island nation further from other major economies, the country has larger international shipping and aviation emissions for the same items/travel trips relative to other countries. Costs associated with the reduction of emissions from international shipping and aviation may be disproportionately higher for Aotearoa New Zealand than other countries. It also means that the country is more vulnerable to changing consumer preferences or overseas regulatory requirements around those emissions.

Range of levels of gross emissions reduction possible

Regardless of the target structure or the approach taken to measure emissions, the level of gross emissions reduction that is possible needs to be calculated to set the appropriate level of ambition for the target. Our analysis has focused on the level of change possible since 2019 because this is the last reliable year of data for international shipping and aviation emissions prior to the impacts of COVID-19, the introduction of low-sulphur shipping fuel requirements, and changes at Marsden Point.

There are a range of credible scenarios for the level that emissions could reduce, depending on demand changes, the cost and availability of alternative fuels, and whether new technologies are successfully commercialised. Reductions will depend to a large extent on the policies that governments put in place between now and 2050.

As noted above, if the emissions involved in the production of alternative fuels are included, the potential reductions are up to 91% for international shipping in the International Energy Agency's modelling and 65% for international aviation in ICAO's modelling.[185] With Aotearoa New Zealand's split in emissions between the sectors based on refuelling, this would be equivalent to a 70% combined gross reduction target. Demand reductions are limited in international models and could increase the potential reduction further.

If the emissions associated with alternative fuels are treated as sitting with the sectors that produced the fuels instead of shipping and aviation, the potential emission reductions for international shipping and aviation could be close to 100% by 2050 if those transport sectors fully adopt alternative fuels.

There are factors specific to Aotearoa New Zealand which may influence how applicable these global pathways are here. These include:

- the cost of producing alternative fuels domestically
- any limits on the volume of alternative fuel that can be produced due to availability of feedstock or electricity system capacity
- the likely level of demand
- the distance and destinations of voyages to and from Aotearoa New Zealand
- what infrastructure is available.

Reducing net emissions

Regardless of the choices around target structure, if the Government added international shipping and aviation to the 2050 target it would need to decide whether to increase or decrease the overall ambition level of the net zero component of the target.

Including international shipping and aviation in the net zero component of the 2050 target would effectively increase the level of ambition of the target by including more hard-to-reduce emissions within it. However, the Government could choose to change the ambition level if international shipping and aviation emissions were added, to reduce this impact.

If separate gross components of the target were adopted and the Government still wanted to address residual international shipping and aviation emissions, the ambition level of the net zero component of the target would need to be increased.

The greenhouse gas emissions from international shipping and aviation are 98 to 99% CO_2.[186] The IPCC has found that "Pathways that limit warming to 1.5°C (>50%) with no or limited overshoot reach net zero CO_2 in the early 2050s, followed by net negative CO_2 emissions."[187] This means Aotearoa New Zealand taking an even share of global efforts to mitigate the emissions from international shipping and aviation in 2050, would require reductions or carbon dioxide removals in other sectors to address residual international

shipping and aviation emissions to at least balance them to net zero by 2050 and to overcompensate for them after that. If Aotearoa New Zealand took an equity approach based on its historical emissions rather than simply taking an even share, this would require higher levels of emissions reductions or carbon dioxide removals in other sectors.

Addressing residual emissions could be done domestically through the 2050 target or internationally through Aotearoa New Zealand's Nationally Determined Contribution under the Paris Agreement. What residual emissions the country takes responsibility for should consider what is already being offset through international schemes. Currently, CORSIA is only covering the growth in emissions from 2019 levels for international aviation, meaning existing emissions for international aviation still need to be accounted for and IMO does not have a scheme in place yet for shipping.

Initial assessment for target level of reduction

Our initial assessment is that global pathways such as those modelled by ICAO and the International Energy Agency set out credible levels of gross emissions reductions that Aotearoa New Zealand could achieve, but they rely on the commercialisation of technology, which may not emerge if it is not actively supported by governments.

As part of this consultation and the next stages of our analysis we are seeking more information and feedback from you around how applicable these pathways are to Aotearoa New Zealand specifically.

Consultation questions

Different global models have put the gross emission reductions possible for shipping at up to 91% and for aviation up to 65% accounting for emissions involved in the production of their fuels. If not accounting for emissions involved in producing fuels, reductions could be up to 100% if full adoption of alternative fuels is achieved.

- If international shipping and aviation emissions were included in the 2050 target, are those more ambitious levels of gross emissions reductions appropriate to target or are there other circumstances that should be considered? What are your reasons and evidence for that?
  - High ambition of emissions reduction – near or at what models have shown is possible
  - Moderately ambitious emissions reduction
  - Emissions remain the same or increase
- If international shipping and aviation emissions were included in the 2050 target, should the existing net zero component of the target's level of emissions reduction be changed to match any residual international shipping and aviation emissions?

APPENDIX 1

The technology opportunities to reduce international shipping and aviation emissions

Shipping technology opportunities

Efficiency measures

Emissions can be reduced 20–30% from current levels by improving the energy efficiency of shipping vessels.[188]

These efficiencies can be gained by replacing or retrofitting existing ships with wind-assisted propulsion, solar panels, waste heat recovery (converting energy from a ship's exhaust into electrical energy), hybrid propulsion (a combustion engine combined with a battery and electric motor), and shore power (using electricity instead of fuel to power the ship at port).

Energy efficiency can be increased through low friction coatings, air lubrication systems, and biofouling removal.[189]

Improving hull design can also decrease drag in the water including lightweight construction, bulbous bow, and above water aerodynamic improvements.[190]

The efficiency of international shipping can also be improved through operational measures, including route optimisation, efficient port operations, and slow steaming (operating ships at significantly less than their maximum speed to reduce emissions). While slow steaming can reduce container ship fuel consumption by up to 53%, it may not be appropriate for ships carrying time-sensitive cargo, such as perishable agricultural products.[191]

Alternative fuels

Green methanol

Methanol is a safe, proven, cost-competitive marine fuel that can significantly reduce emissions.[192] Green methanol, methanol which has been produced sustainably, can be made by combining green hydrogen (produced using low emissions electricity and water) and a sustainable source of CO_2 or by turning sustainable biomass sources like food waste into a gas.[193] Sustainable sources of CO_2 include sustainably sourced biobased feedstocks (raw materials processed to create fuel) or direct air capture.

Methanol is produced from fossil gas in Aotearoa New Zealand already, and mature infrastructure exists along with guidelines for storage and refuelling. However, using methanol as a fuel for international shipping requires new vessels to be built or significant retrofitting. Methanol vessels capable of servicing Aotearoa New Zealand could be available from 2027 if green methanol is available.[194] However, methanol is not supplied as a shipping fuel in Aotearoa New Zealand currently and it is fossil methanol rather than green methanol being produced.

Ethanol is an alcohol like methanol and may be used as a marine fuel in future. It would require a similar engine to methanol.[195]

Green ammonia

Green ammonia can be made by combining nitrogen and green hydrogen.[196] Green ammonia is not yet commercialised as a ship fuel but is considered likely to be a significant fuel by 2050. A new engine type is required to use ammonia in shipping, but it is expected these will come to market soon. At the end of 2022, 150 ammonia-ready vessels were on order across the world.[197]

The main concerns associated with green ammonia are that it is highly toxic and corrosive, requiring strict safety standards, measures, and training.[198]

Biofuels

Biofuels are derived from the organic material that makes up plants or animals, known as biomass. Biofuels can be used in existing vessels either as a replacement fuel, or through blending with existing fossil fuels.

Biodiesel, a type of biofuel, is available now and is currently made largely from vegetable oils, animal fats, or recycled restaurant grease.[199] However, competition for these materials means that alternative fuels less reliant on them – such as methanol and ammonia – are expected to play a larger role in international shipping by 2050.

For some iwi/Māori with strong interests in forestry and agriculture, a transition to alternative fuels could present a significant opportunity for that part of the Māori economy, with potential benefits from increased demand for the source materials such as wood waste that can be used to make fuel.

Fossil gas

Fossil gas is being considered by some globally as a temporary transition fuel. While fossil gas still has a large emissions profile due to being a fossil fuel, by switching immediately to liquid fossil gas, international shipping could achieve up to a 20% emissions reduction. The cruise sector is already making the transition, with 15 of the approximately 300 cruise ships globally running on gas and another 13 gas powered vessels on order.[200]

This change could lock ships into a particular fuel pathway meaning if the transition to fossil gas is made, opportunities for decarbonising later may be more limited. Long term, gas-based pathways could include:

- fossil gas blended with green hydrogen to reduce its emissions intensity. When the hydrogen market is more developed, fossil gas could be replaced with green hydrogen
- replacing fossil gas with biomethane from waste or synthetic methane in the long term.

A gas-based transition is less likely to be used by ships servicing Aotearoa New Zealand. This is because the country does not currently have the infrastructure to supply fossil gas as a ship fuel. The relatively small domestic gas supply makes it unlikely to be economically viable to build the infrastructure needed for transitional use.[201]

Green hydrogen

Green hydrogen is produced using renewable electricity. It emits no CO_2 when used and can be produced with near-zero carbon emissions.[202] Strong hydrogen demand growth and the adoption of cleaner technologies for production may enable hydrogen to contribute significantly to international shipping decarbonisation.[203] Ships will need to be retrofitted to be equipped with hydrogen-specific fuel cells.[204]

However, green hydrogen is not yet commercially viable and faces challenges. Due to the intensive method of production of green hydrogen, costs of production are significant. The low density of hydrogen means that unlike biofuels or e-fuels, it requires new engines and storage facilities.[205]

Aviation technology opportunities

Efficiencies

While efficiency has improved by over 70% since jets were first used in the early 1940s, increasing passenger numbers has led to an overall increase of emissions.[206]

Aircraft design improvements such as retrofitting winglets to reduce drag, light-weight aircraft carbon equipment, electronic or assisted taxiing, ground power, and thinner and more aerodynamic exterior paint have reduced fuel burn per passenger kilometre by 55% since 1990.[207]

New engines could reduce CO_2 emissions by another 20%. Next generation aircraft which increase efficiency such as through blending the body and the wing can significantly increase efficiency.[208]

Alternative fuels

There are multiple types of sustainable aviation fuel which could be used to reduce international aviation emissions. Each enables different levels of emissions reductions and has different practical considerations to produce or use them at scale. The production of sustainable aviation fuel doubled in 2023 and is expected to triple in 2024. However, this would still be only 0.5% of total aviation fuel demand in 2024.[209]

Biofuels

Bio-based aviation fuels are generally considered sustainable when they are produced from renewable feedstocks like animal fats, waste, and crops or forests without major environmental or land-use impacts (see *Chapter 4: Policy and impact considerations*). Depending on the feedstock, greenhouse gas emissions can be reduced by up to 89% compared to fossil jet fuel.[210]

As biofuels are also used in land transport and shipping, there is increasing competition for feedstocks used to produce them. The United States of America, Brazil, Europe, and Indonesia are the dominant markets currently supporting the use of biofuels, accounting for 85% of total demand.[211] Sustainable aviation fuel using biomass may reduce the supply available for these other sectors, and competition for feedstocks could increase prices.

E-fuels

Electric fuels or e-fuels (also called power-to-liquid fuels) are created by using renewable electricity and water to produce green hydrogen, and then combining that green hydrogen with CO_2 from the air.[212] E-fuels are a more sustainable alternative aviation fuel option because they are likely to reduce emissions by more than biofuels. Biofuels also have potential impacts on land use change and feedstock competition with other sectors.[213] However, e-fuels may cost more to produce and require significant amounts of renewable electricity.

A proposal by Channel Infrastructure is currently being investigated to produce up to 60 million litres a year of this fuel at Marsden Point, which would supply 3% of total aviation fuel needs for Aotearoa New Zealand.[214]

Green hydrogen

As with shipping, green hydrogen is produced using renewable electricity, emits no CO_2 when used and can be produced with near-zero carbon emissions.[215] For aviation, it must be converted to a liquid through compression and significant cooling. It can then be used either through being directly burned in aircraft, or through using a hydrogen fuel cell to generate electricity to power the aircraft motor.

Green hydrogen is not yet commercially viable. The low density of hydrogen means that unlike biofuels or e-fuels, it requires new engines and storage facilities.[216] Hydrogen aircraft are most suitable for short or medium haul routes as they are not able to travel long distances. Models show that a hydrogen plane may only be able to get from Aotearoa New Zealand to Australia and the closer Pacific islands in the 2040s.[217] As development of this technology occurs, range may increase.

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