

The NDC and further domestic action

Commission information note: 22 October 2021

Purpose

This note summarises key facts about the potential impacts of Aotearoa attempting more domestic abatement than what was recommended in *Ināia tonu nei: a low emissions future for Aotearoa*, rather than relying on offshore mitigation. An increased appetite for domestic emissions reduction could result from either an updated Nationally Determined Contribution or simply a wish to focus more on the domestic transition. The note covers risks and uncertainties at a high level. Further actions could be taken to mitigate some areas of uncertainty but due to timing this note is derived from pre-existing analysis.

Key messages

- The Commission's recommended domestic budgets are ambitious and achievable, while being fair, inclusive and equitable, meeting the requirements under Section 5M of the Act.
- The Commission believes that the budgets can be met with technologies that are available today. If new technologies develop more quickly in the next few years, then it may be possible to reduce domestic emissions more quickly and at less cost.
- However, even in the most technology optimistic scenarios that we modelled a significant amount of offshore mitigation is needed to meet the current NDC, as new technology development and adoption, and behaviour change, take time – and afforestation cannot deliver sufficient removals quickly enough.
- Without rapid adoption of technologies not yet available, reducing domestic net emissions much beyond the levels set out in the recommended budgets through to 2030 is expected to cause damaging and inequitable levels of economic and social disruption.
- In the near term (over the next decade), purchasing offshore mitigation allows Aotearoa to strengthen its NDC while putting the country on the pathway to a low emissions future and managing the impacts on communities and businesses.

Analysis

Models used for past analysis

- The ENZ model was used to perform bottom-up calculations of emission reduction opportunities and only considers first order effects. This is complemented by the use of the CPLAN macroeconomic model to understand equilibrium economic impacts of emissions reduction policies.
- In addition to our demonstration path, two other scenarios are included here – Tailwinds (ENZ) and TP4 (CPLAN). Tailwinds tells us what might be possible under optimistic assumptions of technology and behaviour change. TP4 was constructed to result in similar levels of domestic net emissions over the NDC period. TP4 provides information on the economic impacts of achieving similar abatement if technology and behaviour do not change as dramatically as the Tailwinds scenario.

Past modelling results for emissions outcomes¹

- Table 1 shows domestic net emissions over the NDC period (2021-2030), and the consequent abatement achieved and offshore mitigation needed in different scenarios.
- When measured against the current policy reference case (CPR), our demonstration path generates around 42-46 Mt CO₂e abatement, which is almost half of the abatement needed to meet the current NDC.²
- The stronger effort scenarios of Tailwinds/TP4 generates an additional 25-33 Mt CO₂e abatement relative to the demonstration path, resulting in approximately three quarters of the abatement needed to meet the current NDC.
- Both the demonstration path and Tailwinds/TP4 scenarios require offshore mitigation to meet the current NDC (22-55 Mt more needed).
- If the NDC was extended to the upper quartile of the IPCC range we presented in *Ināia Tonu Nei*, an additional 69 Mt of abatement would be required beyond what is needed to meet the current NDC.

Table 1: Emissions and abatement in CPLAN and ENZ scenarios over the NDC period (Mt CO₂-e)

	CPLAN net emissions	ENZ net emissions	Abatement delivered above CPR	Offshore mitigation needed - 30% NDC	Offshore mitigation needed -45% NDC
Current Policy Reference (CPR)	697	690	0	94-101	163-170
Demonstration path	651	648	42-46	52-55	121-124
Tailwinds		623	67	27	96
TP4	618		79	22	91

Economic Impacts of emissions outcomes

- Table 2 below shows that modelled economic impacts of more ambitious emissions reductions rise exponentially as the limits on the deployment of commercially available technologies are approached, and economic contraction is required to obtain these reductions. The GDP impact of achieving the demonstration path is approximately \$30 GDP/tonne abated over the NDC period 2021-2030. The additional impact of reaching TP4 is approximately \$300 GDP/tonne abated over the same period. See Figure 1.
- The additional GDP impacts of ~\$10b out to 2030 for the TP4 scenario beyond the demonstration path result from delivering about 80% of the mitigation needed for the current NDC, which is around half of the mitigation needed for a strengthened (-45%) NDC.
- Although the average abatement cost was approximately \$300 of GDP per tonne it was higher at the end of the NDC period, close to \$600 of GDP per tonne.
- This indicates that further domestic abatement by 2030 beyond TP4/Tailwinds would be exponentially more expensive. Figure 1 below illustrates how domestic abatement costs grow exponentially compared to international abatement.

¹ Note that the figures in this note apply AR4 global warming potentials.

² Net emissions do also decline in the current policy reference case, but here the abatement required is measured against the CPR pathway to show the required *additional* action to meet targets.

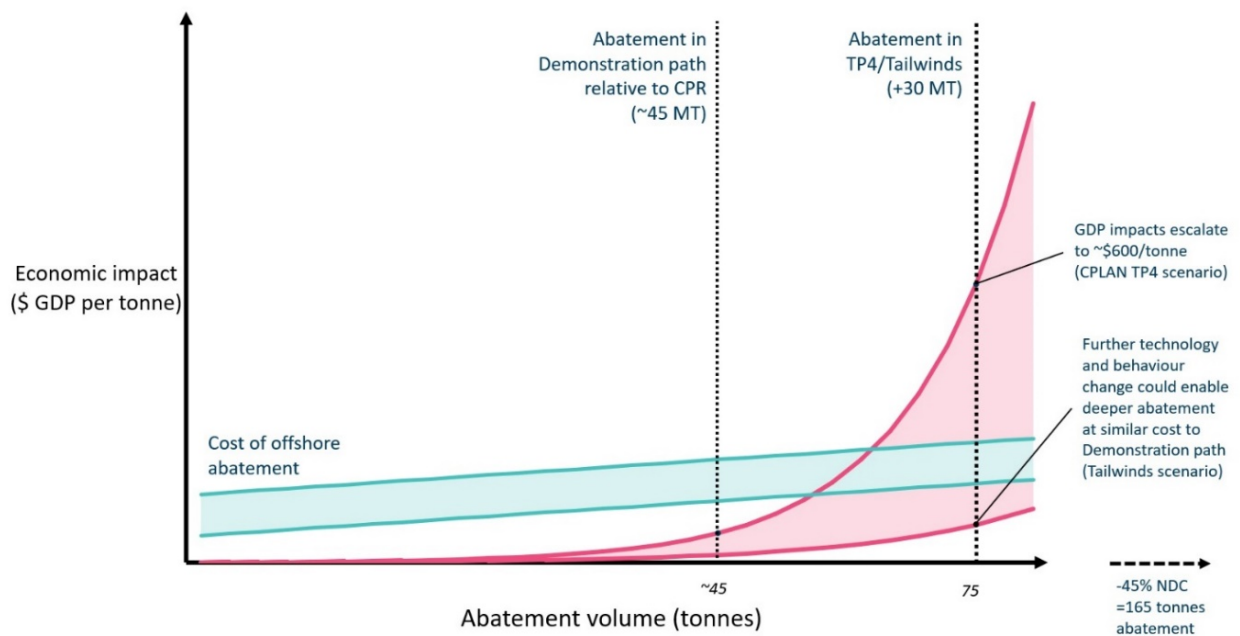
Table 2: Impacts over NDC period (2021-30) as modelled by CPLAN

	Net emissions	Abatement relative to CPR	Cumul. GDP impact relative to CPR
Demonstration path	651 MtCO ₂ e	46 MtCO ₂ e	-\$1.5 billion
TP4	618 MtCO ₂ e	79 MtCO ₂ e	-\$11 – 12 billion

Strengthening the 2050 target does not produce comparable economic disruption

- Strengthening the 2050 target does not face exponential increases in cost in the same way as strengthening the 2030 target due to the ability to plan and implement abatement options in sufficient time, rather than contract current economic activity levels.
- By 2050 the next generation of green technology is also likely to be available, and the combination of time and availability mean the impacts of a higher 2050 target rise less quickly and are more manageable.

Figure 1: Illustration of relative domestic and international mitigation costs for Aotearoa 2021-2030



- The shaded green area indicates the costs of purchasing increasing amounts of offshore abatement, including indirect multiplier effects on the economy in Aotearoa.
- The red curves represent the possible aggregate economic impacts to Aotearoa of achieving that amount of emissions reductions. The upper curve is based on analysis of the TP4 scenario in C-PLAN, where the marginal impact to the economy of each new tonne of abatement rises to around \$600 per tonne by the end of the NDC period.
- The lower curve illustrates the potential for favourable technology, market and policy developments to significantly reduce the cost of delivering additional abatement. Under the Tailwinds scenario, further technology and behaviour change allows some additional abatement to 2030, at similar economic costs to the demonstration path. See Appendix One for more detail.

Costs of purchasing offshore abatement

- Assuming net emissions reduce in line with the Commission’s proposed emissions budgets, an additional 52Mt of offshore mitigation would be needed to meet the current NDC.
- How much this would cost is uncertain. The Commission included a range of possible prices in our assessment in *Ināia Tonu Nei* up to \$140/tonne CO₂-e. These prices were chosen based on the range of prices in comparable markets overseas, and ENZ modelling of the cost of abatement within Aotearoa.

Table 3. Possible economic costs of offshore mitigation used to meet the current NDC (30% below 2005 emissions) under the demonstration path

	Total abatement cost, at different per unit costs		
Cost of mitigation per tonne CO ₂ -e	\$30	\$70	\$140
Direct cost only	\$1.6b	\$3.6b	\$7.3b
Direct + indirect costs ³	\$2.8b	\$6.6b	\$13.1b

- If the NDC was strengthened to -45% on 2005 gross emissions levels, and assuming net emissions followed the demonstration path, the offshore mitigation necessary could cost between \$3.6b and \$16.9b in direct costs, with a potential economic impact of \$6.5b to \$30.5b. This was included as Table 22.3 in the final advice report.

Table 4. Possible economic costs of offshore mitigation used to meet an NDC enhanced to 45% below 2005 emissions under the demonstration path

	Total abatement cost, at different per unit costs		
Cost of mitigation per tonne CO ₂ -e	\$30	\$70	\$140
Direct cost only	\$3.6b	\$8.5b	\$16.9b
Direct + indirect costs	\$6.5b	\$15.2b	\$30.5b

Meeting the NDC with offshore purchasing in comparison to greater domestic action

- We estimated the economic costs of offshore purchasing to meet a -45% NDC, in addition to meeting the demonstration path, could be between \$6.5b and \$30.5b.
- For comparison, C-PLAN indicated additional GDP costs of ~\$10b for the TP4 scenario, which achieved about half of the mitigation needed for a -45% NDC.
- This additional abatement came at an average economic impact of approximately \$300 GDP/t CO₂-e, but was higher at the end of the NDC period, close to \$600/t GDP/t CO₂-e. We would expect that further domestic abatement beyond TP4/Tailwinds by 2030 would be exponentially more expensive and have considerable social and wellbeing impacts. Figure 1 above illustrates how domestic mitigation costs grow exponentially.

The distributional effects of a rapid, high-cost and highly disruptive domestic transition would be very difficult for government to manage in a way that ensures equitable and inclusive outcomes. The domestic economic impact of offshore purchasing could be more easily managed through policies,

³ Indirect cost refers to the knock-on economic activity from spending on offshore mitigation, that would have occurred within Aotearoa that is now happening overseas. See section 22.4.1 of *Ināia Tonu Nei* for more detail.

pricing instruments and taxation. The global climate benefits of investment in offshore mitigation by Aotearoa could also be substantial.

Appendix – Scenario Details

Further domestic action – Tailwinds in ENZ

Tailwinds represent a combination of further action from government, and circumstances working in our favour. It represents our best estimate of the optimistic end of what is possible to deliver domestically, while accounting for the wider social impacts of the transition. Tailwinds achieves an additional 25 Mt CO₂-e abatement in 2021-2030 over and above the 42 Mt abatement achieved by the demonstration path.

This abatement is heavily reliant on factors outside the Government’s control, in particular:

- Methane inhibitors or vaccines becoming available and gradually adopted for dairy farming from 2025 – 11.5 Mt CO₂-e
- EVs being cheaper and more available than assumed in the demonstration path – 4.8 Mt CO₂-e

Some areas can be driven by policy, but it is hard to know how much policy will achieve. In Tailwinds we have assumed that stronger policies achieve:

- Greater uptake of public and active transport as well as other mode-shift – 2.0 Mt CO₂-e
- Increased LFG capture, lower waste volumes and greater waste collection – 2.5 Mt CO₂-e
- Faster conversion of industrial boilers and greater efficiency improvements – 2 Mt CO₂-e

For road transportation, the Tailwinds scenario has a net cost saving of \$8.9b (Real 2020\$) compared with the demonstration path over the NDC period. This comes from reductions in the number of new vehicles needed due to mode-shift, as well as lower fuel costs from both mode-shift and electrification. This cost assessment does not consider the costs of transport infrastructure or mode-shifting freight. We also could not model what policies or investments would be needed to generate the levels of mode-shift included in Tailwinds.

We are not currently able to estimate the costs of other measures which exist between the Tailwinds scenario and demonstration path, and these are subject to significant uncertainty.

Further domestic action – TP4 in C-PLAN

Table 3 below outlines total emissions for Aotearoa over the NDC period 2021-2030 under two different C-PLAN scenarios. The first scenario is the demonstration path that aligns with the emissions budgets we have recommended to government. The second scenario is a faster reductions scenario (TP4).

Table 5: Emissions and abatement over NDC period as modelled by C-PLAN

	C-PLAN emissions (2021 – 2030)	C-PLAN emissions avoided (2021 – 2030) relative to CPR	C-PLAN GDP impact (total 2021 – 2030) relative to CPR
Demonstration path	651 MtCO ₂ e	46 MtCO ₂ e	-\$1.5 billion
TP4	618 MtCO ₂ e	79 MtCO ₂ e	-\$11 – 12 billion

The GDP impact provides an indication of the potential impact on the economy. However, it does not factor in the benefits and opportunities of meeting emissions budgets. For example, the benefits to health and health equity, or opening up opportunities in new markets that could add value to Aotearoa exports. The GDP impact also gives no indication of distributional impacts across society.

The two C-PLAN scenarios show that the costs of meeting emissions budgets rise exponentially as the limits to what technology can be used/modelled are reached, and economic output is instead reduced to meet targets. The GDP cost of achieving the demonstration path is approximately \$30 GDP/tonne abated. The additional cost of reaching TP4 is approximately \$300 GDP/tonne abated.

In TP4 biogenic emissions were held constant, and only remaining emissions were reduced to meet a more stringent 2030 target (long-lived gases and fossil methane). Further modelling runs would be required to accurately represent a scenario in which a greater proportion of the NDC was met domestically – however this is not straightforward, as C-PLAN does not model land-use change directly.

There would likely be cheaper mitigation options available in the NDC period for biogenic methane that were not included in TP4 – particularly in converting sheep and beef land to forestry, which can be economic over the long-term. This option generates more than 90% of its mitigation benefits after 2030 largely in the form of forest sequestration – which does not contribute to meeting the 2030 NDC. The mitigation benefits that occur before 2030 are small on a per hectare basis. To achieve mitigation at sufficient scale to contribute meaningfully to meeting the NDC, wide-scale conversions from sheep and beef farming to forestry would be required.

For a sense of scale, the demonstration path assumes 25,000 ha per year of new forests in the NDC period. If we were to double that to 50,000 ha per year, we would generate an additional 16 Mt CO₂-e abatement in the NDC period.

In the long-term, forestry's economic returns are commensurate or better than sheep and beef farming, but in the short to medium term conversion at that scale would come with significant regional impacts. It is also potentially a faster pace of afforestation than is desirable for the long-term transition to a low emissions economy in Aotearoa, as it may inhibit reductions in gross emissions over the 2030s.

To achieve and maintain net zero emissions in 2050 requires a sustained level of forest planting into the long term. Accelerating forestry conversions early in the NDC period also potentially risks the social license for continued afforestation and therefore the net zero target.