

# **Submission on the 2021 Draft Advice of He Pou a Rangi Climate Change Commission**

**March 2021**



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# Introduction

## Citizens' Climate Lobby

Citizens' Climate Lobby was founded in the United States in 2007 to bring people together to work on finding solutions to climate change. CCL now has 602 active groups around the world and is established in many countries including the USA, Canada, Australia, Germany, Sweden and the United Kingdom. Citizens' Climate Lobby was established in New Zealand in April 2019 as Citizens' Climate Lobby New Zealand (CCLNZ).

CCL globally has identified the Carbon Fee and Dividend as an important policy tool that could help to quickly bring emissions under control. The Carbon Fee and Dividend is a form of carbon pricing whereby a fee is applied to fossil fuel emissions at source and all the revenue from the fee is returned to citizens pro rata as a monthly dividend. The policy is explained in more detail below.

Climate change is the most serious environmental crisis humanity has ever had to confront. Corrective political action has been severely delayed and time is short to avoid enormously costly and undesirable outcomes. We must urgently act to reduce our emissions and to create a just transition to a low carbon economy.

## Draft Advice

CCLNZ is supportive of the 2021 Draft Advice of the Climate Change Commission (Draft Advice) and in particular the call for the Government to take further action beyond current policy settings to ensure New Zealand is on a pathway consistent with limiting climate change to less than 1.5°C. CCLNZ also supports the advice that New Zealand should prioritise cutting gross emissions and limiting reliance on forestry offsets.

CCLNZ believes that the Draft Advice should provide more guidance regarding how to ensure that carbon pricing in New Zealand is politically acceptable and equitable.

## Carbon Pricing

Carbon pricing is an important tool in combatting climate change because it sends a price signal through a multitude of markets to encourage the adoption of low emission practices. The carbon price necessary to achieve New Zealand's emissions targets is likely to be high. The Climate Change Commission has assumed emissions values for the energy and transport sectors of \$140 in 2030 and \$250 in 2050.<sup>1</sup> The required carbon prices estimated by the IPCC are even higher.<sup>2</sup>

Carbon prices at high levels will be challenging both in terms of their political acceptability and their fairness. The current New Zealand Emissions Trading Scheme (NZETS) lacks

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<sup>1</sup> These figures do not necessarily translate into carbon prices as they depend on other regulatory measures that are adopted. CCLNZ agrees that other regulatory measures are desirable because some barriers and transformations are best addressed through regulation, but carbon pricing is very efficient and can lead to unforeseen innovations and beneficial new markets so the more that can be achieved through carbon pricing the better

<sup>2</sup> (IPCC, 2018b, p. 152)

broad popular appreciation and is likely to work regressively,<sup>3</sup> disproportionately affecting people on lower incomes. Experience so far shows that, more than 12 years since it began, the NZETS has achieved only a relatively low price when compared to other carbon pricing schemes.<sup>4</sup>

We believe that the Draft Advice should provide more guidance to the Government on how to manage the political acceptability and fairness of high carbon prices. There is a substantial amount of research on this subject and, pursuant to section 5ZA of the Climate Change Response Act 2002, the Climate Change Commission must advise the Government on:

*‘how the emissions budgets, and ultimately the 2050 target, may realistically be met, including by pricing and policy methods’.*

In our view the best solution to ensuring the political acceptability and fairness of the required carbon pricing would be for New Zealand to adopt the Carbon Fee and Dividend or, at least, apply a Carbon Dividend to the NZETS.

## Carbon Fee and Dividend

There are four key components to the Carbon Fee and Dividend:

1. A carbon fee is imposed on fossil fuels and other suitable emissions at source.
2. The fee is set at a level that increases each year with the objective of transitioning to high carbon prices in the medium term.
3. All the revenue is returned to the population pro-rata as a monthly dividend by direct payment.
4. Measures are put in place to stop activity and emissions from transferring overseas.

Variants of the Carbon Fee and Dividend have been in use in British Columbia since 2008,<sup>5</sup> Switzerland since 2013<sup>6</sup> and Canada since 2018<sup>7</sup> where the Canadian “backstop” federal carbon levy with carbon income is currently being used by seven of Canada’s 13 provinces.

The Carbon Fee and Dividend policy has also been given the approval of more than 3500 economists including four former chairs of the Federal Reserve, 28 Nobel Laureate economists and 15 former chairs of the Council of Economic Advisers as the recommended form of carbon pricing in the United States.<sup>8</sup>

The Carbon Fee and Dividend policy has a number of important advantages over other forms of carbon pricing which we will cover in detail below.

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<sup>3</sup> See note 12 below

<sup>4</sup> (World Bank, 2020)

<sup>5</sup> (Beck et al., 2015)

<sup>6</sup> (Sopher & Mansell, 2018)

<sup>7</sup> (Greenhouse Gas Pollution Pricing Act, 2021)

<sup>8</sup> (Bernanke, B. et al, 2019)

There are two aspects to the policy, being the dividend and the fee, and we will discuss them separately because it would be possible to implement a carbon dividend as part of the NZETS, with or without also implementing the carbon fee.

## The Case for Carbon Dividends

### Urgent Need for Effective Policies

Action to mitigate climate change has been severely delayed. The causes and risks of climate change have been well understood for decades. The Kyoto Protocol was adopted in 1997 and came into force in 2005. But the opportunity to take effective action before significant warming occurred was lost. To date the earth has warmed 1°C and the effects are becoming noticeable.

In 2018 the IPCC concluded that drastic and sudden reductions in greenhouse gas emissions are required if we are to limit warming to 1.5°C,<sup>9</sup> which is now the best case scenario. Warming above 1.5°C would entail significant additional cost, harm and risk.

Urgent effective action is clearly required but so far it has not been delivered. This is not due to a lack of awareness of the problem. Surveys consistently show that most people understand the need for effective action and are in favour of it.<sup>10</sup> The problem is the political acceptability of climate solutions. Even more important than precisely defining our emissions targets is working out what policies can be used ‘realistically’ to achieve them.

### Political Acceptability

There is a growing literature regarding the policies that can be used to enhance the public acceptability of carbon pricing.<sup>11</sup> Key issues are the impact of the policy on the economic wellbeing of citizens and whether the policy is perceived to be equitable, particularly in relation to its impact on people with lower incomes. The ‘yellow vest’ riots in France and the reaction in New Zealand to increased fuel taxes highlight the need for a fairer approach to carbon pricing.

The NZETS does not perform well when measured in terms of economic wellbeing and fairness: overall people are left financially worse off due to increased prices without compensation and the impact is likely to be regressive.<sup>12</sup> The NZETS is not widely

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<sup>9</sup> (IPCC, 2018a)

<sup>10</sup> (IAG, 2020; YouGov, 2020)

<sup>11</sup> For example (Klenert et al., 2018; Carattini, et al., 2018; Carattini et al., 2017; Landis, 2019)

<sup>12</sup> Although we have not found a study that has looked specifically at whether the NZETS is regressive, and the issue is complex, we believe that the NZETS is likely to place a higher burden in proportion to income on those on lower incomes. People on lower incomes have lower, and often negative, savings rates (Stats, 2018) and so their consumption represents a substantially greater proportion of their income than it does for those on higher incomes. Romanos et al. (2014) have looked at the composition of annual CO<sub>2</sub>-e emissions by income decile. The main categories are transport, utilities and food. The proportion of emissions from food (some of which are exempt from the ETS) is relatively constant across the income deciles. Transport emissions are a higher proportion for the higher income deciles, and their emissions are likely to include a higher component

understood or appreciated by the population. We do not believe that, in its current form, the NZETS is capable of achieving the widespread public support needed to sustain high carbon prices.

## Carbon Dividends

Fortunately, the literature offers strong evidence that the political acceptability of carbon pricing policies can be significantly enhanced by recycling carbon pricing revenues through lump sum dividends,<sup>13</sup> a solution that could be implemented as part of the NZETS, or as a Carbon Fee and Dividend, or both. The most straight forward implementation of revenue recycling is a Carbon Dividend comprising a pro-rata monthly direct payment where every adult resident receives the same amount (plus 50% of that amount for children).

The reasons that a Carbon Dividend is so effective at achieving political acceptability include that:

- most people will be better off financially: i.e., they will receive more in dividends than they pay in increased costs and hence private consumption increases;<sup>14</sup>
- the Carbon Dividend is a benefit to overall economic wellbeing when measured by real gross national disposable income;<sup>15</sup>
- the Carbon Dividend is progressive in that it represents a higher proportion of income for those on lower incomes;<sup>16</sup>
- the Carbon Dividend improves the stability of carbon pricing policy (which is important for the operation of pricing signals) because the regular payments draw the populations' attention to the policy, the good that it does and the need to preserve it.

By making a high carbon price politically sustainable, a Carbon Dividend is the key to meeting our emissions targets through domestic gross emissions reductions with a reduced need for overseas mitigation.

## Modelling

CCLNZ has engaged Infometrics to model a Carbon Dividend in New Zealand using a computational general equilibrium model of the New Zealand economy. Infometric's report is attached in the Appendix.

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of international travel which is not covered by the NZETS. Lower income deciles have a higher proportion of their emissions from utilities, most of which will be covered by the NZETS. Research overseas has found carbon pricing to be regressive (for example: Grainger & Kolstad, 2009; Parry, 2003; Landis, 2019), although that conclusion is not universal (Beck et al., 2015).

<sup>13</sup> (Klenert et al., 2018; Carattini, et al., 2018; Carattini et al., 2017; Landis, 2019)

<sup>14</sup> (Stroombergen, 2021; Ummel, 2020; Holden & Dixon, 2018)

<sup>15</sup> (Stroombergen, 2021)

<sup>16</sup> (Stroombergen, 2021; Ummel, 2020; Holden & Dixon, 2018)

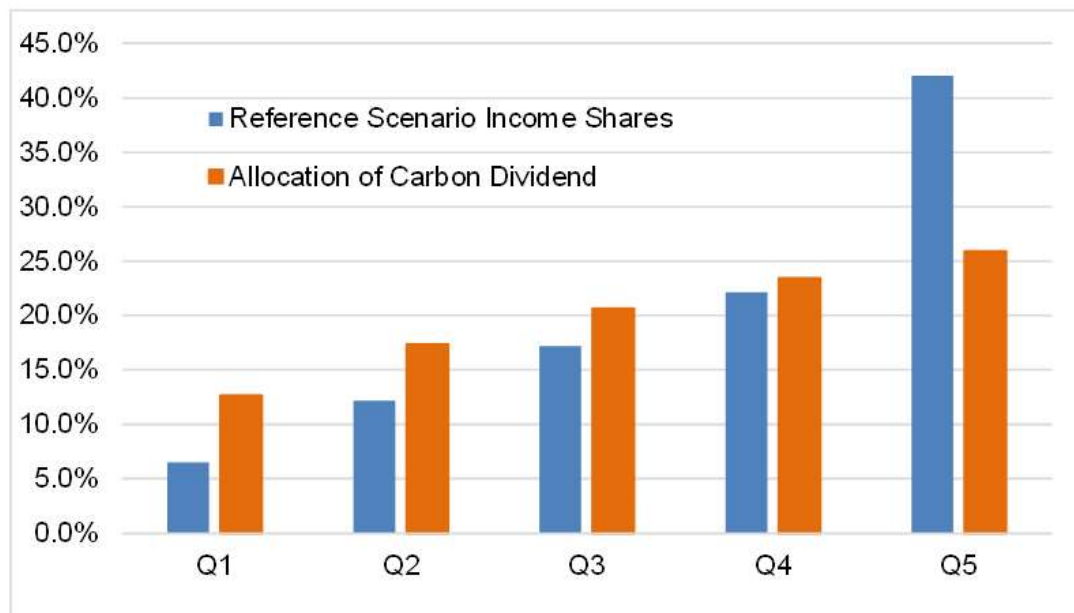
The premise for the report was that CCLNZ does not believe that the NZETS in its current form is capable of achieving high carbon prices. The Reference scenario in the modelling has been set with a carbon price of \$80 per tonne CO<sub>2</sub>-e in 2050,<sup>17</sup> representing an increase above today's unit price that reaches a ceiling due to the political acceptability issues mentioned above. The report then analyses a Carbon Dividend scenario in which the carbon price is \$400 per tonne CO<sub>2</sub>-e with all revenue being returned to the population as a Carbon Dividend.<sup>18</sup>

The model output contained in the report shows a reduction in 2050 CO<sub>2</sub>-e emissions of around 25% in the Carbon Dividend scenario relative to the Reference scenario. In addition, private consumption increases by around 2% (meaning the average person is economically better off) and real gross national disposable income (the best measure of national economic wellbeing) increases by almost 1% in the Carbon Dividend scenario.

Each adult receives a dividend of \$1,100 per annum meaning the average household receives around \$2,400 per annum.

The impact of the dividend is strongly progressive as shown in Figure 1 below, extracted from the report.

**Figure 1: Incidence of Carbon Dividend and Reference Scenario Income by Household Income Quintile**



Thus the Carbon Dividend enables a high carbon price to be achieved in a fair manner while also improving the economy.

<sup>17</sup> All dollar figures in the Infometrics report are in constant 2020 NZ dollars

<sup>18</sup> The Carbon Dividend scenario also assumes a carbon price of \$50 per tonne CO<sub>2</sub>-e in ETS 2 in line with the Climate Change Commission's Headwinds scenario



## Principles

The Climate Change Commission has developed seven key principles to help guide its advice. We believe that a Carbon Dividend aligns well with those principles.

- **Principle 1: Align with 2050 targets.** By enabling higher carbon prices with high levels of political acceptability and sustainability, investors and decision makers will quickly factor higher future carbon prices into their infrastructure decisions, helping New Zealand meet its 2050 targets.
- **Principle 2: Focus on decarbonising the economy.** Higher domestic carbon prices are consistent with reducing gross emissions within New Zealand's borders.
- **Principle 3: Create options.** Having a carbon pricing policy with high levels of popular support, where the average person is financially better off the higher the carbon price goes, creates the option to increase carbon prices further than is currently contemplated should that prove necessary.
- **Principle 4: Avoid unnecessary cost.** It is economically more efficient to employ higher carbon prices in conjunction with well targeted regulation rather than having lower carbon prices and excessive reliance on regulation to meet emissions targets.
- **Principle 5: Transition in an equitable and inclusive way.** The Carbon Dividend is progressive, making carbon pricing equitable, and it would be a key factor in achieving a just transition in New Zealand.
- **Principle 6: Increase resilience to climate impacts.** The Carbon Dividend provides an additional source of income to help people adapt to the climate change that will occur, even if we succeed in limiting warming to 1.5°C.
- **Principle 7: Leverage co-benefits.** Perhaps the biggest impact New Zealand could make towards tackling climate change globally would be to join British Columbia, Canada and Switzerland in demonstrating the effectiveness of a Carbon Dividend as a way to overcome the political constraints that have so far held back effective climate action in larger countries.

# The Case for a Carbon Fee

Although CCLNZ's current priority is to promote a Carbon Dividend for New Zealand, CCLNZ also believes that we should adopt a Carbon Fee (a fee imposed on applicable carbon emissions at source) to work alongside the NZETS. The revenue from the Carbon Fee would be applied to the Carbon Dividend in addition to any NZETS revenue.

While the NZETS has not been effective to date, CCLNZ believes that with all the NZETS revenue being applied to a Carbon Dividend, and other improvements suggested by the Climate Change Commission, the NZETS could be made workable. CCLNZ does not advocate for the repeal of the NZETS.

Nevertheless, on its own an improved NZETS would not constitute best practice for carbon pricing. Although in theory an emission permits regime such as the NZETS can achieve the same outcomes as a Carbon Fee, that is not true in practice. After more than a decade of carbon pricing in many countries, lessons have been learned about carbon pricing mechanisms. Important factors include:

- Only a few countries rely on an emissions trading scheme as their sole carbon pricing mechanism, with most countries having a carbon tax or a carbon fee instead of, or as well as, an emissions trading scheme; sole reliance on emissions trading schemes tends to be used at the subnational or supranational level,<sup>19</sup> often due to complexities in applying taxation in those jurisdictions
- Emissions trading schemes have generally experienced significantly more carbon price volatility than carbon taxes have<sup>20</sup>
- Most emissions trading schemes have low or very low carbon prices<sup>21</sup>
- Carbon pricing works through price signals and the most important are medium and long term price signals that influence infrastructure investment decisions. Carbon taxes and carbon fees provide superior medium and long term price signalling due to lower volatility
- To improve the price signalling provided by emissions trading schemes, many such schemes, including New Zealand's, have implemented price controls
- Use of price controls effectively turns an emissions trading scheme into an overly complex carbon tax
- Emissions trading schemes entail substantially more complexity than carbon taxes or carbon fees because, in addition to imposing a cost on emissions, it is necessary to regulate and maintain a market with all the complexity that creates including issues such as speculation, fraud, insider trading, market manipulation, liquidity, credit risks and transaction costs

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<sup>19</sup> (World Bank, 2020)

<sup>20</sup> Historic carbon price data by country can be downloaded from

[https://carbonpricingdashboard.worldbank.org/map\\_data](https://carbonpricingdashboard.worldbank.org/map_data)

<sup>21</sup> (World Bank, 2020)

- Ideally the Government would signal steady increases in the carbon price far into the future to provide time for the economy to adjust while also having an early impact on long term infrastructure investment decisions to avoid emissions lock-in, but that is easier to achieve with a Carbon Fee than with an ETS<sup>22</sup>

The ideal combination is to have an emissions trading scheme to cover emissions intensive trade exposed (EITE) industries (which could include agriculture) and other politically sensitive emissions, while applying a Carbon Fee and Dividend to domestic fossil fuel and other suitable emissions. This is the system that has been adopted in Canada and Switzerland and CCLNZ recommends it for New Zealand.

Any ‘waterbed’ effect caused by the interaction between the Carbon Fee and the NZETS could be managed in the same way the Climate Change Commission proposes to manage those effects in relation to other regulations.

Whereas it was once considered most efficient to apply the same carbon price to all emissions, we believe that applying a uniform carbon price across all emissions results in the carbon price being limited by the most politically sensitive part of the economy and, when the costs of failing to mitigate climate change are considered, it is most efficient to be pragmatic and impose a higher carbon price where politically possible.<sup>23</sup> New Zealand sensibly abandoned the idea of a uniform carbon price long ago when it adopted free allocations, temporarily exempted agriculture from the NZETS, and introduced industry specific climate regulation.

The point is well illustrated by the example of petrol. At \$35 per tonne of CO<sub>2</sub>-e the NZETS adds only around 8 cents per litre to the price of petrol at the pump. At the same time, the national fuel taxes of 77 cents per litre equate to a carbon price of around \$330 per tonne. Whereas \$35 per tonne might be an appropriate carbon price for some price and politically sensitive industries, it is clearly far too low if we hope to significantly reduce the use of petrol and other fossil fuels in New Zealand, and encourage the development of renewable fuels and other alternatives.

The current proposal to separate the NZETS into two schemes provides the opportunity for New Zealand to convert to the dual mechanism used in Canada and Switzerland: i.e., the NZETS would apply to agriculture, forestry and EITE industries, with a Carbon Fee being applied to other emissions. Revenue from both schemes would be applied to a Carbon Dividend. This would simplify the regime and allow the Government to set very clear medium and long term carbon price signals, giving New Zealand the best opportunity to meet its emissions targets without reliance on overseas mitigation.

It would be possible to implement the Carbon Dividend very quickly, perhaps even prior to the introduction of the Carbon Fee.

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<sup>22</sup> For example the Canadian Federal Government has announced that the federal fuel charge in Canada will increase at C\$15 per annum to reach C\$170 per tonne in 2030 (Environment and Climate Change Canada, 2020)

<sup>23</sup> Furthermore, Vogt-Schilb & Hallegatte (2014) show that it can be inefficient to rely on mitigation options with lower costs in the short term if higher cost options have more long term mitigation potential. In these circumstances, favouring the lower cost mitigation through a uniform carbon price can lead to carbon lock-in that makes it more expensive to reduce emissions in the long term.

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# Appendix – Infometrics Report





# An Economic Assessment of a Carbon Dividend in New Zealand

**for Citizens' Climate Lobby  
New Zealand**

March 2021



**Infometrics**

Economics put simply

## Authorship

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# 1. Introduction & Summary

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Infometrics has been requested by Citizens' Climate Lobby New Zealand to undertake an economic assessment of a proposed Carbon Dividend. Broadly speaking the proposal is to recycle the revenue from a price on GHG emissions (whether via a tax or emissions trading scheme) back to households in the form of a uniform dividend per adult and a lower amount per child.

The premise underlying the proposal is that high carbon prices such as those that emerge from some of the modelling by the New Zealand Climate Change Commission are unlikely to be acceptable to the community unless it can be demonstrated that most people will not be worse off.

The results of the modelling reveal that by 2050 New Zealand's CO<sub>2</sub> emissions decline by 25% relative to a 'Reference' scenario. Real private consumption increases by 1.9% and each adult receives a carbon dividend of more than \$1000 per year. In addition a disproportionate share of the benefits goes to lower income households.

## 2. Methodology

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We use the ESSAM general equilibrium model of the New Zealand economy to investigate the national costs and benefits of applying a high price on greenhouse gas (GHG) emissions and recycling the resulting revenue back to households in the form of a per capita dividend. Details of the proposed scheme are presented in the next section.

### ESSAM Model

The ESSAM (Energy Substitution, Social Accounting Matrix) model is a multi-industry computable general equilibrium (CGE) model of the New Zealand economy. An outline is provided in Appendix A.

As with any model, CGE models can only approximate the highly complex real economy. Therefore the results can only ever be indicative. The interpretation of CGE results should centre on their direction (up or down) and broad magnitude (small, medium or large), rather than on the precise point estimates that the model produces. Essentially we are modelling scenarios: such modelling “does not predict what will happen in the future. Rather, it is an assessment of what could happen in the future, given the structure of the models and input assumptions.”<sup>1</sup>

### Reference Scenario

The model is used to produce a Reference scenario for 2050. It is similar to the CPR scenario in the Climate Change Commission’s report<sup>2</sup>, but with a slightly higher carbon price to acknowledge the likelihood that the price will rise from its current \$35 or so per tonne of CO<sub>2</sub>e. Nevertheless the scenario is a theoretical construct of what the economy could look like at a future point in time with the continuation not only of existing policies, but also of other trends such as falling prices of electric vehicles, and without any large exogenous economic shocks. The function of the Reference scenario is to act as a point of comparison against which other scenarios can be compared.

Two key assumptions for the Reference scenario and all other scenarios are:

1. New Zealand population is projected to be 6.2 million in 2049/50. (StatsNZ 50<sup>th</sup> percentile).
2. Real oil price in 2049/50: US\$80/bbl.

More detail on the assumptions is given in the section on scenario specification.

### Model Closure

The following model closure rules are adopted for the alternative scenarios, consistent with generally accepted modelling practice:

1. The current account balance is fixed as a percentage of GDP. This means for example that if New Zealand needs to purchase international emissions units to

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<sup>1</sup> Australian Treasury. (2008). *Australia’s low pollution future: the economics of climate change mitigation*. Online at <http://www.treasury.gov.au/lowpollutionfuture/report/default.asp>

<sup>2</sup> <https://www.climatecommission.govt.nz/get-involved/our-advice-and-evidence/>

meet an emissions responsibility target, that liability cannot be met simply by borrowing more from offshore with indefinitely deferred repayment.

2. The post-tax rate of return on investment is unchanged between scenarios. This acknowledges that New Zealand is part of the international capital market and ensures consistency with the preceding closure rule.
3. Any change in the demand for labour is reflected in changes in wage rates, not changes in employment. This prevents the long run level of total employment being driven more by emissions policy than by the forces of labour supply and demand, which we consider unlikely.
4. The fiscal balance is fixed across scenarios. This means for example that if the government needs to purchase overseas emission units it must ensure that it has matching income. If it earns insufficient income from the sale of domestic emission units (because of free allocation for example) it would have to adjust tax rates. Generally net household effective income tax rates are the default equilibrating mechanism, although changing government expenditure or other tax rates are alternative options that may also be used.

In the Carbon Dividend scenario the equilibrating mechanism is the value of the dividend.

## 3. Carbon Dividend Scenario

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Aligning the modelling to that published by the Commission has proved tricky, partly because the scenarios in the report are produced by the partial equilibrium ENZ model but, apart from the Current Policy Reference (CPR) scenario, have no corresponding scenario in the C-PLAN general equilibrium modelling – and even there are differences.

Emissions in our Reference scenario are somewhat lower than in the Commission's CPR scenario owing to our assumption of an \$80 price on long-lived gases rather than the \$35 used by the Commission, which seems particularly low for 2050, even for Reference scenario.

Our second scenario is close to the Commission's TP1 and TP2 scenarios produced by the C-PLAN model.

### Input Assumptions

In the Reference scenario for 2050 there is a modest carbon price of \$80/tonne CO<sub>2e</sub> for long lived gases and no price on biogenic methane (CH<sub>4</sub>). Although this scenario is not intended to exactly replicate the Commission's CPR scenario, it does include a number of identical exogenously stipulated features from the ENZ model, the most significant of which are:

- Progressive penetration of electric vehicles (without any explicit policy changes).
- Closure of methanol production and aluminium smelting.
- No growth in steel production.
- No domestic oil refining.
- More electricity generation from renewable sources, but some gas for dry years or peak demand.
- Reduction or limited increase in cattle and sheep numbers.

A second scenario, the Carbon Dividend scenario, is designed to meet the government's net zero target for long-lived gases (CO<sub>2</sub> and N<sub>2</sub>O) by 2050, by whatever carbon price is required. This is denoted as the ETS1 price. A lower price is assumed for biogenic methane, also with the aim of meeting the target of 24-47% below 2017 by 2050. This is denoted as the ETS2 price.

The other key difference between the two scenarios is that in the Reference scenario revenue from the ETS is allocated to general government consumption (so not including transfers), after payment for any international emission units needed to meet New Zealand's Nationally Determined Contributions. In contrast under the Carbon Dividend scenario most of the ETS revenue is available to allocate to households as a carbon dividend.

The key input assumptions are summarised in Table 1. In the Commission's modelling with C-PLAN, in scenarios T1 and T2, the price under ETS1 is around \$337, while the ETS2 price is around \$53. All carbon prices are expressed in 2020 dollars.

**Table 1: Input Assumptions for 2050**

	Reference scenario	Carbon Dividend scenario
ETS1 price	\$80	\$400
ETS2 price	\$0	\$50
International price	\$250	\$250
ETS recycling	mostly to govt spending & purchase of international units	mostly to household dividend
Net forestry	-19.5Mt	-19.5Mt

## Output

The main results are summarised in Table 2. They demonstrate that a high price on long-lived gases plus revenue recycling to households, does not entail a macroeconomic cost and may indeed produce a macroeconomic benefit. Although GDP declines slightly relative to Reference, this is more than offset by the increase in real gross national disposable income. The latter is a better measure of economic benefit than GDP as it allows for changes in the terms of trade (a higher price for a tonne of milksolids means we can buy more imports) and for changes in payments for overseas emission units.<sup>3</sup>

With no need to purchase international units, more of the nation's income is available for domestic consumption which increases by 1.9% over the reference scenario. In other words, the average household obtains 1.9% more goods and services.

**Table 2: Summary of Model Output**

	Carbon Dividend v Reference	Notes
Private Consumption	1.9%	
Exports	-4.5%	less required to pay for overseas units
Imports	-1.0%	
GDP	-0.2%	
RGNDI	0.8%	
Total CO <sub>2</sub> e	-25.1%	43.1 Mt v 57.6 Mt in Reference scenario
Biogenic CH <sub>4</sub>	-9.3%	24.0 Mt v 26.5 Mt
Long-lived CO <sub>2</sub> e	-38.6%	19.1 Mt v 31.1 Mt

Two caveats should be noted:

1. It is possible that aligning the domestic carbon price with the international carbon price would generate an even more favourable macroeconomic picture, but our intention with the Carbon Dividend scenario is to be consistent with the Commission's other scenarios – namely to achieve net zero in long-lived gases without purchasing international units.
2. The macroeconomic effects might also be more favourable if the higher carbon price leads to additional technological advances such as a methane vaccine or cement production without CO<sub>2</sub> emissions. No such innovations have been assumed so as to maintain a cleaner comparison with the Reference case.

<sup>3</sup> Technically emissions units may be treated as a stock (asset) rather than a flow, but this does not change the essence of the argument, given the closure assumptions.



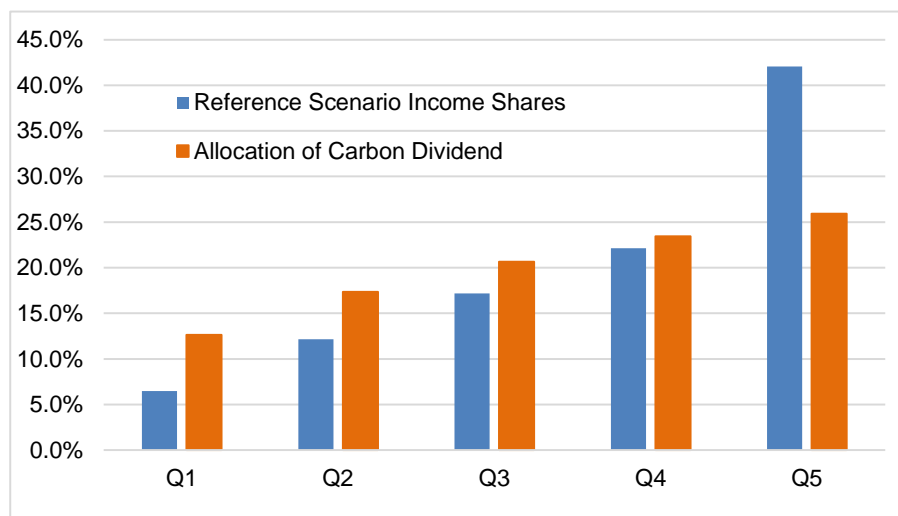
## Carbon Dividend

In the Carbon Dividend scenario the revenue available for a dividend in 2050 is \$6200m (in constant 2020 dollars) . Allocation could be as follows:

- The projected population in 2050 (Stats NZ; 50<sup>th</sup> percentile) is 6.20m, of which,
  - Under 18 years of age: 1.15m
  - 18 years and over: 5.05m
- So assuming that those under 18 get 50% of the adult dividend, the adult dividend is \$1100 per annum. (An alternative option is pay 50% to dependent children, but a simple age boundary is operationally more straightforward).
- The implied average dividend per household is about \$2400, allowing for people who do not live in private households, for example those in residential care homes.

Figure 1 illustrates the allocation of the dividend by household income quintile compared to the quintile shares of total income in the Reference scenario.

**Figure 1: Incidence of Carbon Dividend and Reference Scenario Income by Household Income Quintile**



Bearing in mind that the number of people in each quintile increases through the quintiles, the Carbon Dividend shows a marked distributional effect. For example the lowest quintile (Q1) has 6.4% of all household income, but 12.7% of the dividend. In contrast the top quintile (Q5) has 42.1% of all household income, but only 25.9% of the dividend.

A carbon price of \$400/tonne would raise the price of petrol by about 97c/litre. From the model's results it is estimated that Q1 households would spend about \$94m (excluding tax) on petrol and diesel (in 2050) in the Carbon Dividend scenario. However, this is more than absorbed by the approximately \$780m that Q1 households would receive from the Carbon Dividend.

## Comment

The core message from these results is that increasing the carbon price and recycling the revenue through a Carbon Dividend produces a small increase in national income and an associated improvement in economic wellbeing. The social/political message (which cannot be demonstrated with a general equilibrium model) is that to secure community buy-in for a high carbon price and lower emissions, people have to see that it is not about making them poorer and that the impacts are equitable.

The point of a carbon price is to change relative prices in favour of low carbon goods and services. This should not make consumers worse off (or at least minimise any loss) and one way to ensure that is via a lump sum dividend. An additional benefit is that it assists those with lower incomes, meeting the government's aim of a 'just transition'.

Furthermore, a price on carbon should not be an excuse to increase government spending. If there is a case for that, other funding mechanisms should be analysed so that the mechanism of a carbon price is not further complicated by political taxation considerations.

# Appendix A: ESSAM Model

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The ESSAM (Energy Substitution, Social Accounting Matrix) model is a general equilibrium model of the New Zealand economy. It takes into account the main inter-dependencies in the economy, such as flows of goods from one industry to another, plus the passing on of higher costs in one industry into prices and thence the costs of other industries.

The ESSAM model has previously been used to analyse the economy-wide and industry specific effects of a wide range of issues. For example:

- Analysis of the New Zealand Emissions Trading Scheme and other options to reduce greenhouse gas emissions
- Changes in import tariffs
- Public investment in new technology
- Funding regimes for roading and wider economic benefits
- Release of genetically modified organisms

Some of the model's features are:

- 55 industry groups, as detailed in the table below.
- Substitution between inputs into production - labour, capital, materials, energy.
- Four energy types: coal, oil, gas and electricity, between which substitution is also allowed.
- Substitution between goods and services used by households.
- Social accounting matrix (SAM) for tracking financial flows between households, government, business and the rest of the world.

The model's output is extremely comprehensive, covering the standard collection of macroeconomic and industry variables:

- GDP, private consumption, exports and imports, employment, etc.
- Demand for goods and services by industry, government, households and the rest of the world.
- Industry data on output, employment, exports etc.
- Import-domestic shares.
- Fiscal effects.

## Model Structure

### Production Functions

These equations determine how much output can be produced with given amounts of inputs. For most industries a two-level standard translog specification is used which distinguishes four factors of production – capital, labour, and materials and energy, with energy split into coal, oil, natural gas and electricity.

### **Intermediate Demand**

A composite commodity is defined which is made up of imperfectly substitutable domestic and imported components - where relevant. The share of each of these components is determined by the elasticity of substitution between them and by relative prices.

### **Price Determination**

The price of industry output is determined by the cost of factor inputs (labour and capital), domestic and imported intermediate inputs, and tax payments (including tariffs). World prices are not affected by New Zealand purchases or sales abroad.

### **Consumption Expenditure**

This is divided into Government Consumption and Private Consumption. For the latter eight household commodity categories are identified, and spending on these is modelled using price and income elasticities in an AIDS framework. An industry by commodity conversion matrix translates the demand for commodities into industry output requirements and also allows import-domestic substitution.

Government Consumption is usually either a fixed proportion of GDP or is set exogenously. Where the budget balance is exogenous, either tax rates or transfer payments are assumed to be endogenous.

### **Stocks**

The industry composition of stock change is set at the base year mix, although variation is permitted in the import-domestic composition. Total stock change is exogenously set as a proportion of GDP, domestic absorption or some similar macroeconomic aggregate.

### **Investment**

Industry investment is related to the rate of capital accumulation over the model's projection period as revealed by demand for capital in the horizon year. Allowance is made for depreciation in a putty-clay model so that capital cannot be reallocated from one industry to another faster than the rate of depreciation in the source industry. Rental rates or the service price of capital (analogous to wage rates for labour) also affect capital formation. Investment by industry of demand is converted into investment by industry of supply using a capital input-output table. Again, import-domestic substitution is possible between sources of supply.

### **Exports**

These are determined from overseas export demand functions in relation to world prices and domestic prices inclusive of possible export subsidies, adjusted by the exchange rate. It is also possible to set export quantities exogenously.

### **Supply-Demand Identities**

Supply-demand balances are required to clear all product markets. Domestic output must equate to the demand stemming from consumption, investment, stocks, exports and intermediate requirements.

### **Balance of Payments**

Receipts from exports plus net capital inflows (or borrowing) must be equal to payments for imports; each item being measured in domestic currency net of subsidies or tariffs.

### **Factor Market Balance**

In cases where total employment of a factor is exogenous, factor price relativities (for wages and rental rates) are usually fixed so that all factor prices adjust equi-proportionally to achieve the set target.

### **Income-Expenditure Identity**

Total expenditure on domestically consumed final demand must be equal to the income generated by labour, capital, taxation, tariffs, and net capital inflows. Similarly, income and expenditure flows must balance between the five sectors identified in the model – business, household, government, foreign and capital.

### **Industry Classification**

The 55 industries identified in the standard ESSAM model are defined on the following page. Industries definitions are according to Australian and New Zealand Standard Industrial Classification (ANZSIC06).

### **Input-Output Table**

The model is based on Statistics New Zealand's latest input-output table which relates to 2012/13.

## Model Industries

	Abbrev	Description
1	HFRG	Horticulture and fruit growing
2	SBLC	Sheep, beef, livestock and cropping
3	DAIF	Dairy and cattle farming
4	OTHF	Other farming
5	SAHF	Services to agriculture, hunting and trapping
6	FOLO	Forestry and logging
7	FISH	Fishing
8	COAL	Coal mining
9	OIGA	Oil and gas extraction, production & distribution
10	OMIN	Other Mining and quarrying
11	MEAT	Meat manufacturing
12	DAIR	Dairy manufacturing
13	OFOD	Other food manufacturing
14	BEVT	Beverage, malt and tobacco manufacturing
15	TCFL	Textiles and apparel manufacturing
16	WOOD	Wood product manufacturing
17	PAPR	Paper and paper product manufacturing
18	PRNT	Printing, publishing and recorded media
19	PETR	Petroleum refining, product manufacturing
20	CHEM	Other industrial chemical manufacturing
21	FERT	Fertiliser
22	RBPL	Rubber, plastic and other chemical product manufacturing
23	NMMP	Non-metallic mineral product manufacturing
24	BASM	Basic metal manufacturing
25	FABM	Structural, sheet and fabricated metal product manufacturing
26	MAEQ	Machinery and other equipment manufacturing
27	OMFG	Furniture and other manufacturing
28	EGEN	Electricity generation
29	EDIS	Electricity transmission and distribution
30	WATS	Water supply
31	WAST	Sewerage, drainage and waste disposal services
32	CONS	Construction
33	TRDE	Wholesale and retail trade
34	ACCR	Accommodation, restaurants and bars
35	ROAD	Road transport
36	RAIL	Rail transport
37	WATR	Water transport
38	AIRS	Air Transport
39	TRNS	Transport services
40	PUBI	Publication and broadcasting
41	COMM	Communication services
42	FIIN	Finance and insurance
43	HIRE	Hiring and rental services
44	REES	Real estate services
45	OWND	Ownership of owner-occupied dwellings
46	SPBS	Scientific research and computer services
47	OBUS	Other business services
48	GOVC	Central government administration and defence
49	GOVL	Local government administration
50	SCHL	Pre-school, primary and secondary education
51	OEDU	Other education
52	MEDC	Medical and care services
53	CULT	Cultural and recreational services
54	REPM	Repairs and maintenance
55	PERS	Personal services

## Appendix B: Carbon Dividend

The proposal is that the Carbon Dividend is allocated uniformly to every adult aged 18 years and over, with those under 18 receiving 50% of the adult amount. The disaggregation of the household sector in the model is limited to income quintiles, so it is necessary to estimate how the dividend allocation rule maps to household income quintiles.

Table B1 is estimated using data from three sources; the 2018 Census, the 2016 Household Economic Survey and a customised table from the 2017 Household Net Worth Statistics, all from Statistics New Zealand. The projected age distribution of the population in 2050 is allocated to household income quintiles according to the 2017-18 age-by-income quintile distribution.

Note that about 12% of the population is not resident in private households.

Given the aging of the population and smaller families, there will likely be smaller households by 2050, but any effect on the dividend shares is not readily apparent.

**Table B1: Allocation of the Carbon Dividend**

	Q1	Q2	Q3	Q4	Q5	All
<u>No. people in households in 2018</u>						
No. Children	90	143	218	265	309	1025
No. Adults	434	585	673	755	827	3275
Total number	524	729	891	1020	1136	4300
<u>Children weighted at 50% in 2018</u>						
Total number	479	657	782	888	982	3787
Shares	12.7%	17.3%	20.6%	23.4%	25.9%	100.0%
<u>Reference scenario</u>						
Income shares	6.4%	12.1%	17.2%	22.1%	42.1%	100.0%