The Carbon Report

Counting Carbon Costs: Climate Change and NZX Companies

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Governments, consumers, corporates and investors can no longer escape the reality of climate change, or its key driver, greenhouse gas (GHG) emissions. Investor mandates are becoming greener. Corporates are measuring, understanding and tackling their emissions profiles. Consumers are increasingly making decisions based on the environment, and Governments, including our own, are responding. In this report we consider the implications of GHG emissions for NZX listed companies.

- Low emissions companies, on average, have higher valuations than high emitters. Low emitting companies have outperformed higher emitting companies over the long-term.
- Institutional investors are increasingly focused on environmental issues in response to changing investment mandates. The weight of money into low emitting companies will increase relative to high emitters.
- The cost of carbon will have little financial impact for NZX companies for the foreseeable future given (1) carbon emissions are generally low, (2) the price of carbon is low, and (3) offset commitments/regulatory requirements continue to protect heavy emitters.
- While several NZX companies provide excellent emissions disclosure, the general standard is mixed. Many companies do not appear to currently measure their emissions; but plenty are planning to. In addition, reporting is not consistent making comparisons difficult.
- Some sectors will benefit. For example the higher the carbon price the more electricity is consumed, as transport and industrial processes switch to electricity as a form of energy.
- New Zealand's CO_2 emissions are largely irrelevant globally, accounting for less than 0.2% of global emissions. However, per capita emissions are high. With the exception of a small number of companies the NZX is a carbon light market.

Fonterra (FSF) is the most exposed NZX company to GHG emissions over the longer term, in our opinion, due to the risk to its farmer suppliers. Whilst there is some short-term margin pressure on **Genesis Energy** (GNE) and **Contact Energy** (CEN), in the long-term we expect them to benefit along with the other electricity generators from increased electricity demand. **Z Energy** (ZEL) and aviation-exposed companies **Air New Zealand** (AIR) and **Auckland Airport** (AIA) face risks to longer term volume growth.

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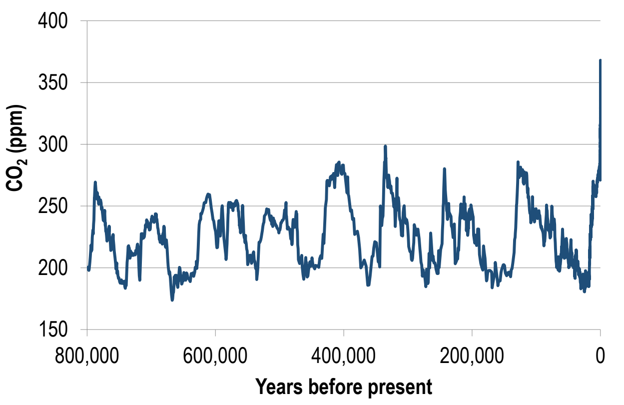
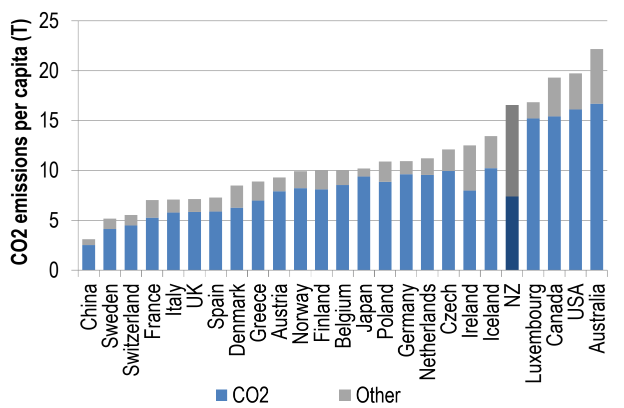
Six reasons why you should care about carbon

Figure 1. CO_2 atmospheric concentration has risen sharply during the past 50 years



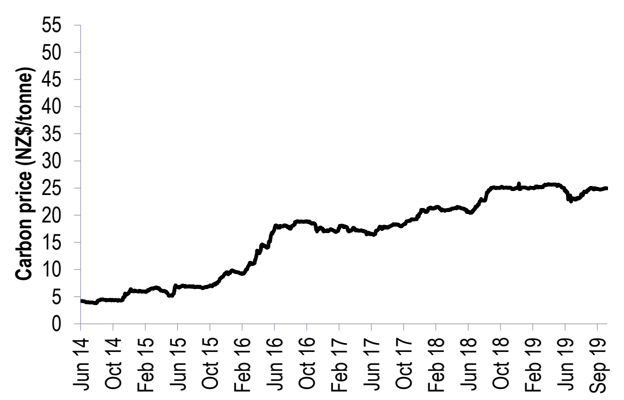
Source: NOAA, Forsyth Barr analysis

Figure 2. New Zealand is a high emitter on a per capita basis due to agricultural methane emissions



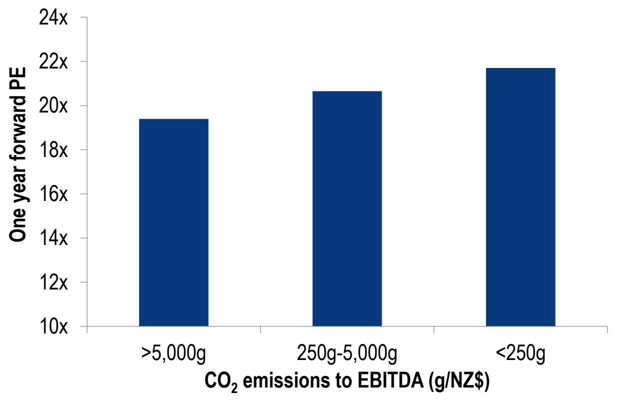
Source: OECD, World Bank, Forsyth Barr analysis Note: Other includes livestock related methane

Figure 3. Price of carbon in NZ is low… it needs to/will likely rise to have an impact on emitter behaviour



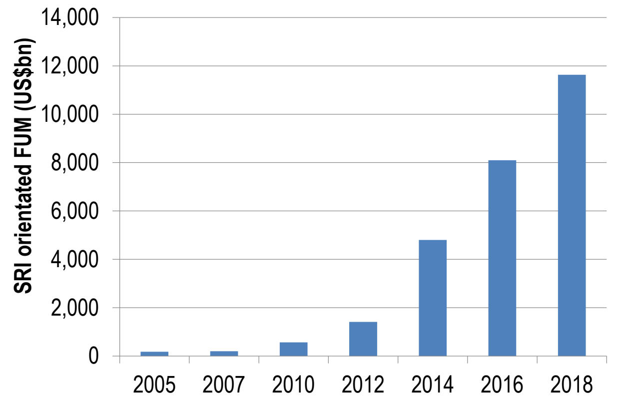
Source: Bloomberg, Forsyth Barr analysis

Figure 4. Lower carbon emitters trade at higher multiples than high emitters



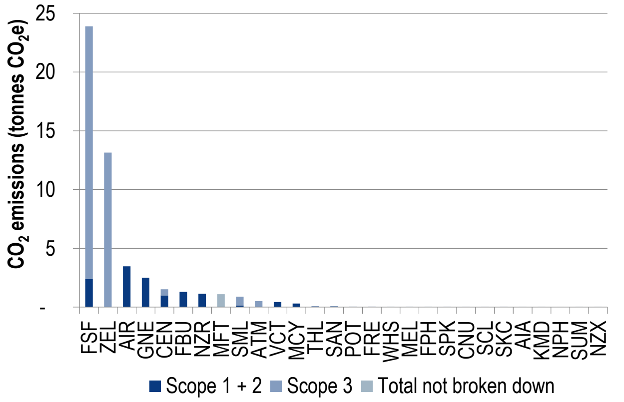
Source: Forsyth Barr analysis

Figure 5. Weight of SRI (socially responsible investing) mandated money will sustain or expand valuation divide



Source: SIF Foundation, Forsyth Barr analysis

Figure 6. High concentration of carbon emitters on NZX among those that disclose emissions



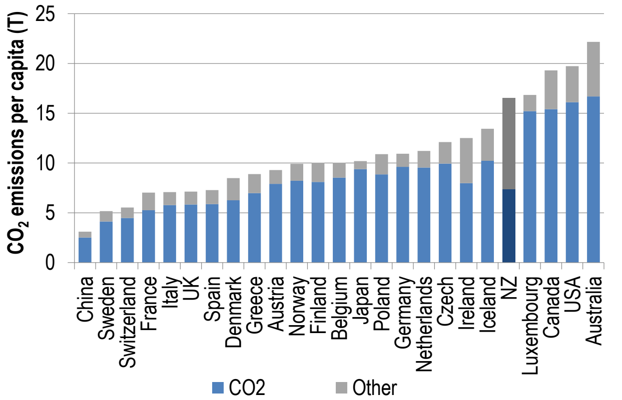
Source: Forsyth Barr analysis NOTE: Scope 1: direct emissions from owned or controlled sources. Scope 2: indirect emissions from the generation of purchased energy. Scope 3: all indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions. The impact of Scope 3 emissions will vary on a company by company basis.

Contents

New Zealand's emission profile

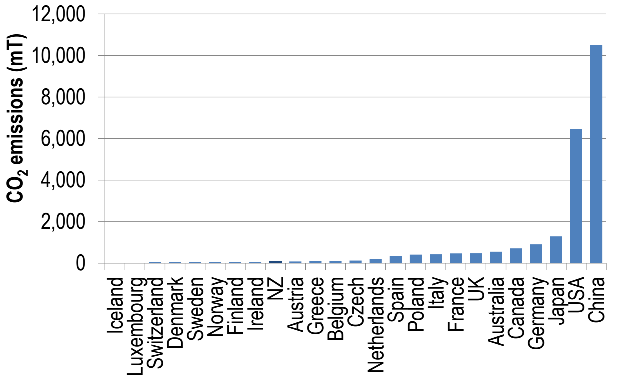
The latest available data for the Ministry for the Environment's Greenhouse Gas Inventory shows New Zealand's gross greenhouse gas (GHG) emissions totalled 81m tonnes CO_2e(quivalent) in 2017. On a per capita basis this amounts to 17 tonnes. A large proportion of New Zealand's emissions profile is from methane in the agricultural sector. CO_2 emissions in isolation account for ~7.4 tonnes per capita. By way of comparison a return flight to London from Auckland in Air New Zealand business class amounts to around ~8 tonnes per passenger.

Figure 7. Gross emissions per capita by OECD country (and China)



Source: OECD, World Bank, Forsyth Barr analysis Note: Other includes methane from livestock

Figure 8. Gross emissions by OECD country (and China)

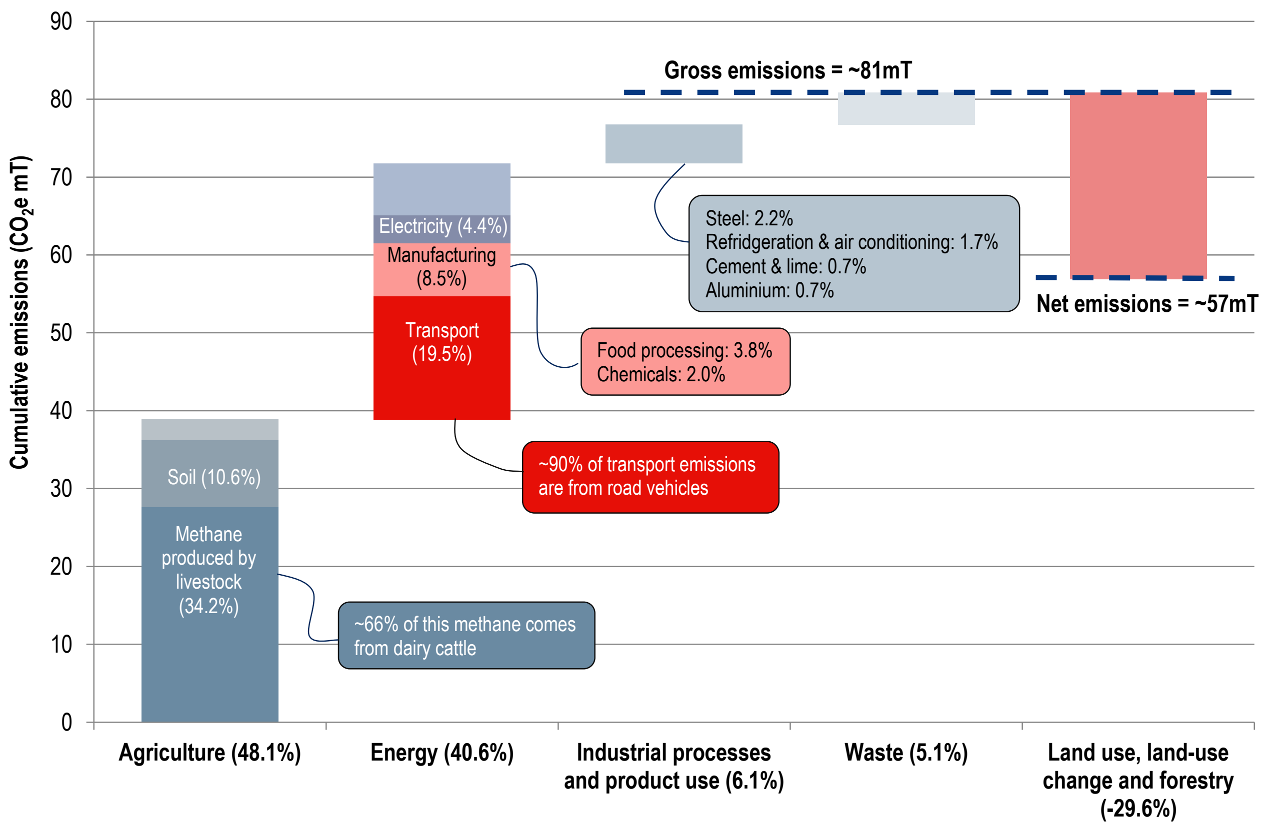


Source: OECD, World Bank, Forsyth Barr analysis

Agriculture is New Zealand's largest emitter

New Zealand's net emissions totalled 57m tonnes CO_2e in 2017. The agricultural sector is the largest contributor to New Zealand's gross emissions (largely methane from livestock digestion) accounting for ~48% of total gross emissions.

Figure 9. Emissions profile by sector – 2017

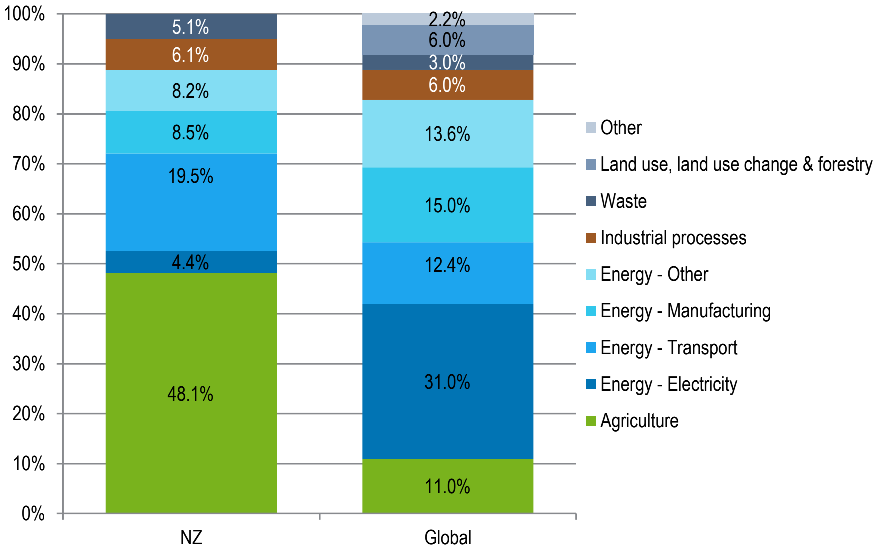


Source: Ministry for the Environment, Forsyth Barr analysis NOTE: analysis excludes international aviation and shipping as these are not covered by the Kyoto Protocol

The widely scoped energy sector is the second highest gross emitter, accounting for ~41% of gross emissions, which includes road transport, accounting for ~18%. Land use, land use changes and forestry (LULUCF) sector covers changes that occur to soil and vegetation through land management and is the only sector which both emits and removes GHG. In 2017 the LULUCF sector was a net emissions sink removing -24m tonnes CO_2e (~-30%) of New Zealand's gross emissions.

Relative to the rest of the world, the main differences are New Zealand's agricultural emissions are abnormally high, but New Zealand's electricity generation emissions are small. Other notable differences are transport emissions (high) and energy used in manufacturing (low).

Figure 10. Source of gross greenhouse gas emissions, NZ vs. the world



Source: Ministry for the Environment, ClimateWatch, Forsyth Barr analysis

Note: Land use change offsets New Zealand gross emissions, but has contributed to an increase in global emissions

Costs of emissions is manageable at economy wide level

If the total cost of New Zealand's net carbon emissions was based on the current NZ ETS price of ~NZ$25/T, the cost to the New Zealand economy would be ~NZ$1.4bn annually, relative to current GDP of ~NZ$330bn, or just ~0.5%. Even if compared against Government accounts, it would represent less than 2% of Government revenue.

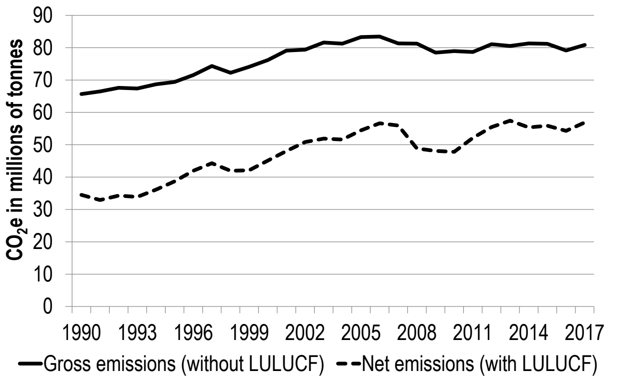
However, as we explore later in this report, we expect carbon costs to rise. If carbon costs reached ~NZ$250/T, as suggested by the Productivity Commission for New Zealand to become carbon neutral by 2050, the cost burden would become more material, but not overly penal.

Emissions have risen substantially since 1990

Since 1990, New Zealand's gross emissions have increased +23% (+15m tonnes CO_2e). This rise has largely been driven by an increase in agricultural emissions (+5m tonnes CO_2e) as a result of a doubling of the dairy herd and an increase in emissions from road transport (+7m tonnes CO_2e). Gross emissions have been reasonably stable over the past 15 years, having grown materially in the 15 years prior.

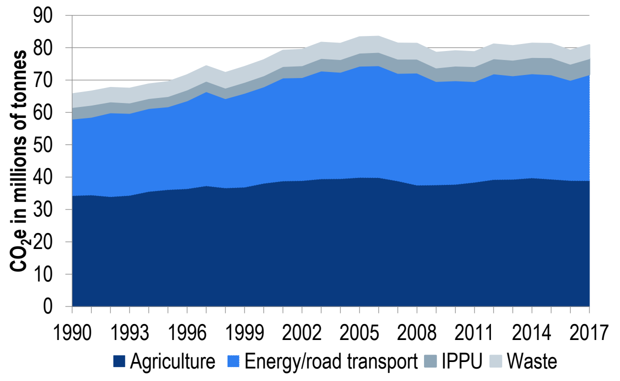
In contrast, New Zealand's net emissions have increased +65% (+22m tonnes CO_2e) since 1990. The relative increase in net emissions is due to a reduction in emissions removals from the LULUCF sector with higher forestry harvest rates and land conversions.

Figure 11. New Zealand's gross and net emissions 1990-2017



Source: Ministry for the Environment, Forsyth Barr analysis

Figure 12. Gross greenhouse emissions by sector 1990-2017



Source: Ministry for the Environment, Forsyth Barr analysis

New Zealand's emission reduction targets and the Zero Carbon Act

New Zealand has three emissions reduction targets as summarised in Figure 13. The most recent was a function of the Climate Change Response (Zero Carbon) Amendment Act (Zero Carbon Act or ZCA).

Figure 13. NZ's emissions targets

Introduced	Targeted reduction	When	Comments
2013	-5% below 1990 levels	2020	The Government chose to use this target under the UNFCCC rather than our conditional agreement to reduce emissions by -10% to -20% below 1990 levels as agreed upon as a signatory to the Kyoto Protocol. This target will be achieved albeit it is reliant on a convoluted methodology.
2015 (Paris Agreement	-30% below 2005 levels	2030	New Zealand is a signatory to the Paris Agreement which aims to limit the rise in global temperature to between +1.5°C and +2.0°C. The target is expressed against 2005 emission levels and covers the period of 2021-2030.
2019	Net zero emissions	2050	Prior to the ZCA the 2050 target (set in 2011) was to reduce greenhouse gas emissions to-50% below 1990 levels.

Source: Forsyth Barr analysis

The ZCA passed into law on 13 November 2019, and is designed to provide a framework by which New Zealand can develop and implement climate change policies. There are four key facets to the ZCA:

- Set a new greenhouse gas emissions target, to:
  - Reduce all greenhouse gases (except biogenic methane) to net zero by 2050
  - Reduce all emissions of biogenic methane (i.e. agricultural animal emissions) within the range of -24% to -47% below 2017 levels by 2050 including to -10% below 2017 levels by 2030
- Establish an independent Climate Change Commission (CCC) to provide expert advice and monitoring, to help keep successive governments on track to meeting long-term goals.
- Set a series of emissions budgets (in five yearly intervals under advice from the CCC) to act as stepping stones towards the long-term target.
- Require the Government to develop and implement policies for climate change adaptation and mitigation.

The ZCA received cross-party support, with only the Act Party voting against the Bill.

The economics of carbon pricing

Carbon pricing can take a number of different forms: (1) taxes and charges, (2) subsidies, and (3) tradable emissions permit schemes (sometimes called "cap and trade" or "emissions trading" schemes). The New Zealand Emissions Trading Scheme (NZ ETS) is a "cap and trade" scheme.

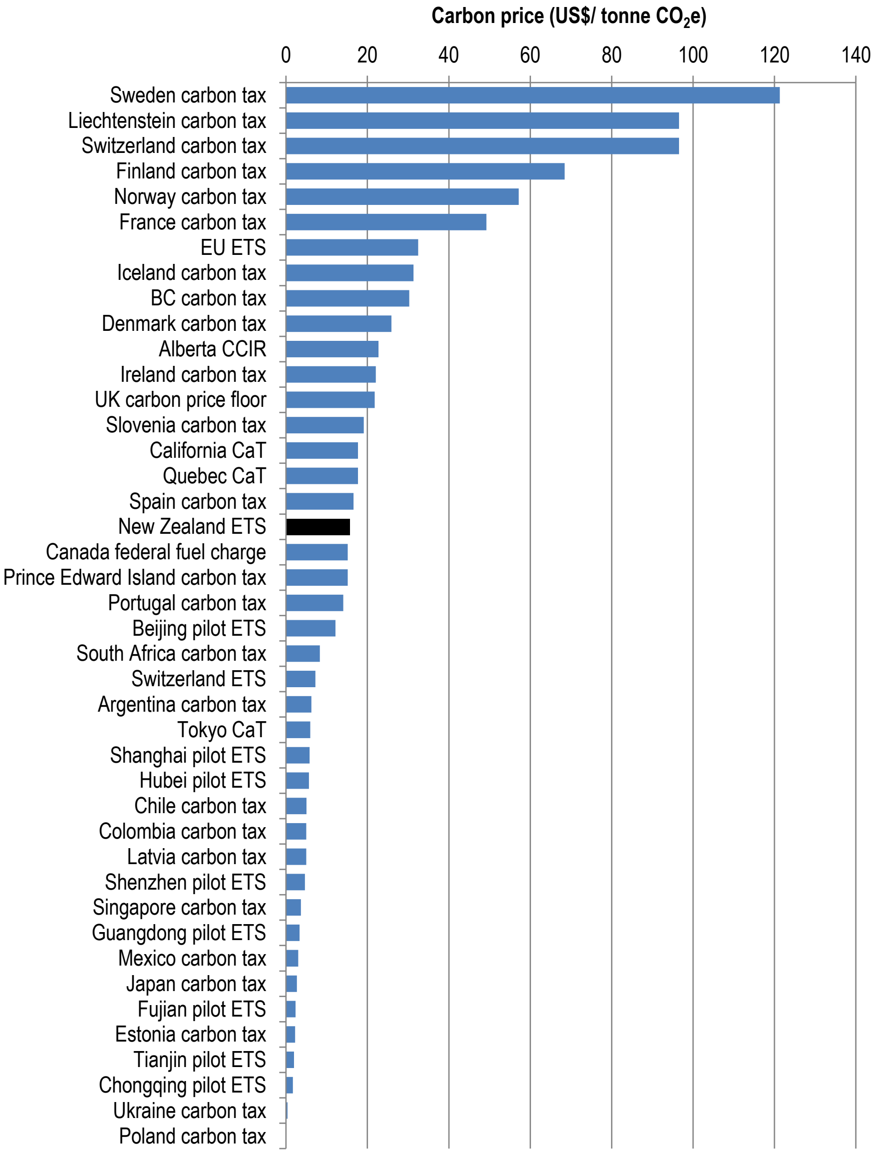
Key drivers of carbon prices

The economics of carbon prices are, and will continue to be, dictated by (1) international Government's willingness to tackle the issue (i.e. implement incentives to lower emissions), (2) the marginal cost of removing carbon from the atmosphere, and (3) the cost of alternative energy sources relative to fossil fuels.

Government action

The extent and level of carbon pricing differs materially by country. According to the World Bank there are 57 carbon pricing initiatives either implemented or scheduled for implementation, across 46 national jurisdictions.

Figure 14. Current carbon pricing by country/region



Source: World Bank, Forsyth Barr analysis NOTE: ETS = emissions trading scheme, CaT = cap and trade scheme

Currently carbon pricing is applied to less than 8% of global emissions, albeit with China (the largest emitter globally) due to implement an ETS next year, this percentage should rise to ~20%.

- **European Union:** The EU introduced an ETS in 2005 based on a cap and trade principle whereby a cap is set on the total amount of specific GHG that can be emitted while companies within the cap receive or buy emissions allowances which they can trade with each other. The cap reduces over time to reduce total emissions and currently operates in 31 countries (28 EU countries plus Iceland, Liechtenstein and Norway). The EU ETS covers ~45% of the EU's GHG emissions and allows limited use of international units.
- **Australia:** Australia has on-and-off investigated climate change policies for over a decade but has yet to implement any meaningful policies to reduce GHG aside from the Gillard Government's 'carbon tax', which was repealed two years later, and various schemes to encourage the development of renewable electricity generation. The 2019 Australian federal election was supposed to be a year of change with the Labour party campaigning heavily on climate change policies. However, the re-election of Prime Minister Scott Morrison seems to indicate Australia will stick to the status quo of little action on reducing emissions.

  However, at State Government level, the need to reduce carbon emissions has greater emphasis. For example, the Victorian State Government passed a law similar to New Zealand's ZCA in 2017, targeting net zero emissions by 2050.
- **US:** The US Government has been largely unwilling to tackle the issue of climate change. Advances to combat climate change made under previous administrations have been repealed or are in the process of being repealed with President Trump's denial of climate change and desire to withdraw from the Paris Agreement.

  However, at a State level policymakers are taking at least some form of lead on climate change with all 50 states deploying policies that could reduce emissions. There are currently two active ETS in the US which vary by scope and scale; the Regional Greenhouse Gas Initiative (covering nine states in the northeast) and a scheme in California. In addition, many corporates are pushing net zero carbon policies and seek to procure electricity from 100% renewable sources.
- **China:** China, the world's largest emitter producing ~27% of global GHG emissions, plans for its well-signalled 'cap and trade' ETS covering coal-fired utilities and some carbon-intensive manufacturers to begin in 2020 (the aluminium sector is excluded).

A global carbon price is possible over the longer term, in our opinion, but highly reliant on Governments working together, in particular the biggest emitting nations (i.e. the US and China).

The cost of carbon removal

If carbon pricing was applied to all emitters of greenhouse gases on a free market basis, in order to fully offset emissions, the price of carbon per tonne would increase to the marginal cost of removal. A higher cost of carbon incentivises the development of new technologies to sequestrate carbon or develop carbon-free processes.

Carbon sequestration

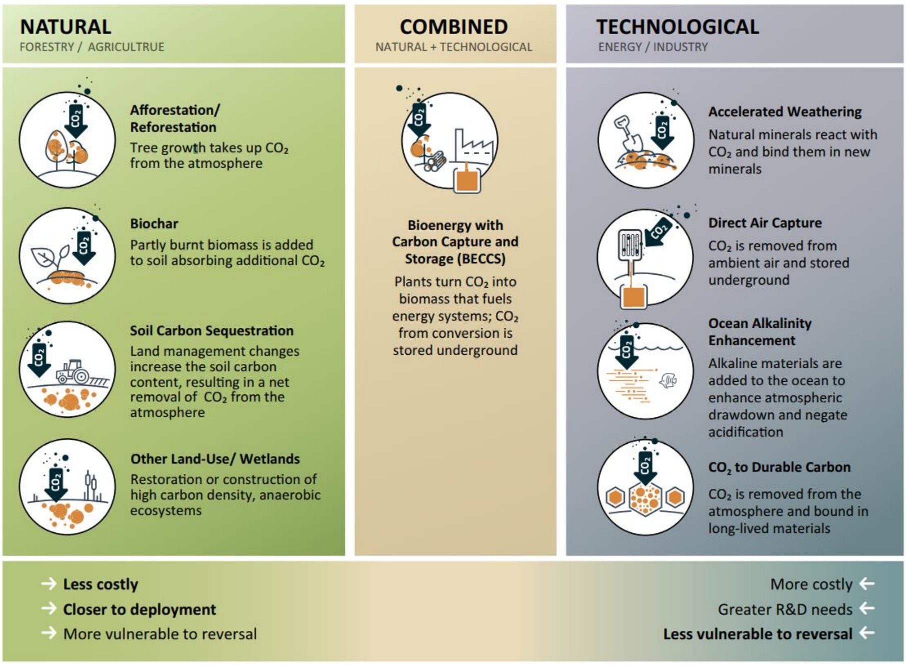
Key strategies for carbon removal include natural and technological solutions. We highlight several accepted means in Figure 15. While natural removal strategies come at a lower cost, they would require significant tracts of land, which would otherwise be utilised for alternative land uses.

Alternative zero-carbon energy sources

~50% of global CO_2 emissions come from electricity generation and heat production, with coal-fired processes being the main contributor. Transport is the next largest sector at ~20%. Globally, policies encouraging emission free forms of generation (such as hydro power stations, wind and solar) and electric vehicles are common, particularly in Europe, China and parts of the USA.

In New Zealand, it has been recognised that the easiest way to reduce carbon emissions is using our renewable electricity advantage. ~85% of New Zealand's electricity is produced from renewable sources, hence electrifying transport and process heat is currently the easiest and most cost effective way for New Zealand to decarbonise.

Figure 15. Carbon removal strategies



Source: The Emissions Gap Report

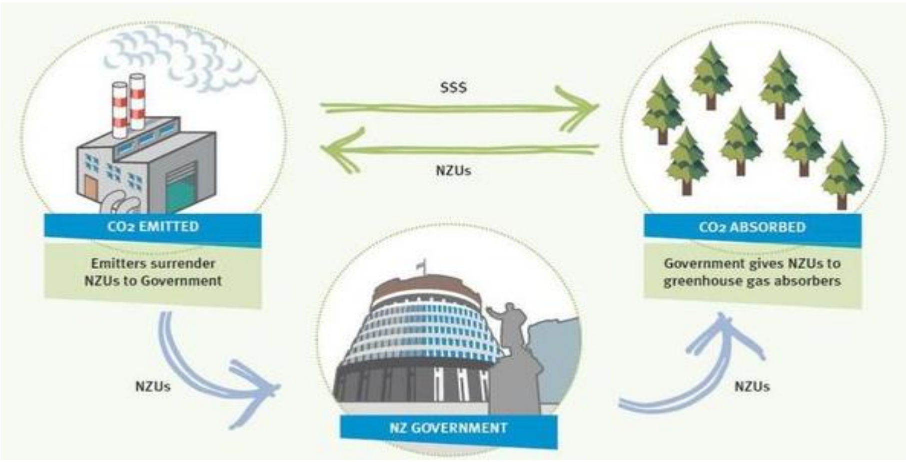
Emissions trading in New Zealand

The NZ ETS was introduced in 2008 and is the Government's main tool for reducing GHG emissions and assisting New Zealand to meet its international obligations under the UNFCCC. The NZ ETS is a carbon credit trading scheme which places a price on GHG emissions. In 2018 ~51% of New Zealand's gross emissions were covered by the NZ ETS.

Key features of the NZ ETS include:

- **Units**: Under the NZ ETS the only emissions unit accepted is the New Zealand Unit (NZU). Prior to 2015 international units could be used, but an influx of cheap foreign emissions units artificially suppressed the price of emissions.
- **Sector coverage**: All sectors are notionally included in the ETS, however, the agriculture sector is currently only required to report their GHG emissions so that New Zealand can track its emissions profile in accordance with its international obligations.
- **Gases covered**: The system covers carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). One NZU represents one metric tonne of carbon dioxide-equivalent and covers both emissions and removals.
- **Free allocation**: Free allocation is provided to forestry owners and trade exposed industries. High emissions-intensive trade exposed industries (for example aluminium smelting and cement production) currently receive 90%, with moderately emissions-intensive producers receiving 60% (for example tomato growers and glass container manufacturers). Trade exposed industries receive free allocations to help preserve international competitiveness and prevent emissions leakage offshore. In 2017, ~5.6m NZUs (~7% of gross emissions) were provided to trade-exposed industrial producers.
- **Price cap**: The NZ ETS has a price ceiling function whereby market participants can purchase an unlimited amount of NZUs from the Government at a fixed price of NZ$25/NZU.

Figure 16. Simplistic representation of the NZ ETS



Source: Ministry for the Environment

Ineffective to date

At the current capped price levels of NZ$25/NZU the NZ ETS has been relatively ineffective in encouraging households and businesses to change behaviour. This is shown by the fact that since the NZ ETS was introduced in 2008 gross emissions have remained flat. The price of NZUs will need to rise for New Zealand to transition to a net-zero emissions economy by 2050, in our opinion.

While we do not know the precise emissions price needed for this transition, in its modelling the Productivity Commission believes a carbon price rising to between NZ$75–NZ$150/tonne is required for New Zealand to transition to a low-emissions economy, while to achieve net-zero emissions the carbon price needs to rise to between NZ$150–NZ$250/tonne.

Possible reform

The Government has proposed several changes to the NZ ETS through the Climate Change Response (Emissions Trading Reform) Amendment Bill (ETS Bill) with the aim of strengthening it so it can better encourage the reduction of GHG.

Figure 17. Key changes to the NZ ETS in the ETS Bill

	Current ETS	Proposals for future ETS
Price cap	NZ$25/unit fixed priced option (FPO)	Proposal to change NZ$25/unit FPO to a cost containment reserve (CCR). A CCR is also a price cap with reserve units auctioned when the price cap is hit. It is likely the price cap for the CCR would be set above NZ$25 and continue to increase over time. The FPO will be removed when auctioning begins or no later than the end of 2022. However, the NZ$25/unit price cap may be adjusted before 2020 to better reflect the cost of emissions.
International linkage	The use of international units was stopped in June 2015	The Government proposes to allow for the re-opening of the NZ ETS to international carbon units, within certain limits.
Industry allocation phase-down	Free allocation of units to firms that carry out eligible industrial activities to mitigate competitiveness impacts	Between 2020 and 2029, free allocation to reduce -1% p.a. That increases to -2% p.a. between 2030 and 2039 and -3% p.a. between 2040 and 2049. By 2050 it is intended there will be no free allocation. The CCC will be able to recommend a slower rate from 2030.
Compliance and penalties	NZ$30/unit penalty when there has been a failure to repay or surrender units by the due date	Penalty will increase to 3x the market price.
Sectors excluded	Agriculture	Agricultural emissions will be priced from 2025. There is provision for emissions to be included in the NZ ETS, but there is also the opportunity for the sector to arrive at an alternative approach.

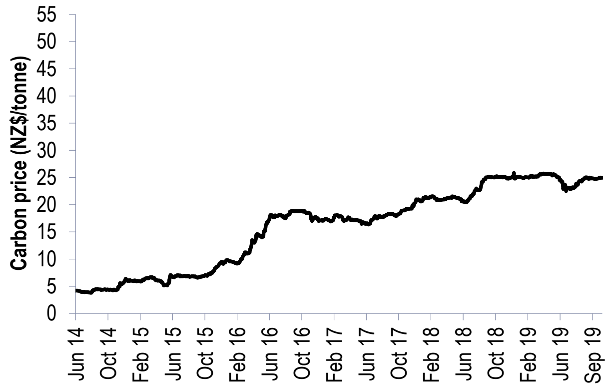
Source: Forsyth Barr analysis

The ETS Bill entered Parliament on 24 October 2019, and had its first reading on 5 November 2019. The ETS Bill is currently at the Select Committee stage, with submissions closing on 17 January 2020.

Carbon related costs will likely rise

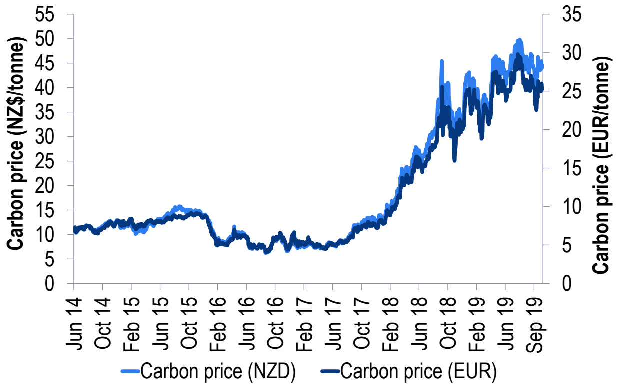
Carbon costs are impacted by (1) policy and regulatory issues, and (2) supply and demand. In recent years carbon prices in the New Zealand and European trading schemes have increased as shown in Figure 18 and Figure 19. The New Zealand carbon price has been sitting around the $25/tonne cap since August 2018 as the sector awaits ETS reforms which are expected to remove the cap from 2022.

Figure 18. Price of one tonne of carbon in New Zealand



Source: Bloomberg, Forsyth Barr analysis

Figure 19. Price of one tonne of carbon in the EU



Source: Bloomberg, Forsyth Barr analysis

We think over the medium term costs in relation to carbon emissions (direct and indirect) will continue to rise due to policy and regulatory issues, and supply and demand:

- **Regulatory settings will become more onerous** globally given the threat posed by climate change. Carbon taxes will rise. For example, in 2019 the Market Stability Reserve came into effect in the EU, which will remove excess carbon permits from the EU market over the next few years, therefore driving up the price given less supply.
- **More countries and more industries** will be captured within the net of carbon pricing. In the near term this will create higher carbon costs as more countries have a price on carbon. However, over the longer term the prospect of a global carbon market could achieve a lower carbon price than a fragmented or partial market, because of higher possibilities of equalising sequestration costs.
- There will be **greater demand for alternative zero or low-carbon energy** sources (as organisations seek to reduce their carbon footprints for a variety of reasons), which are more expensive than carbon emitting fossil fuels.
- The **price of fossil fuels will decline** given lower demand exacerbating the cost differential between "clean" and "dirty" fuels.

We do not attempt to forecast future carbon prices given the many different factors that could have significant influences. However, it is clear that current prices are insufficient to have a meaningful impact on consumer and corporate behaviour. Therefore, we think higher carbon prices are inevitable.

Implications for companies

The relationship between carbon emissions and the corporate landscape is changing rapidly. There is (increasingly) strong rationale for corporates to measure, understand and respond to their carbon footprints:

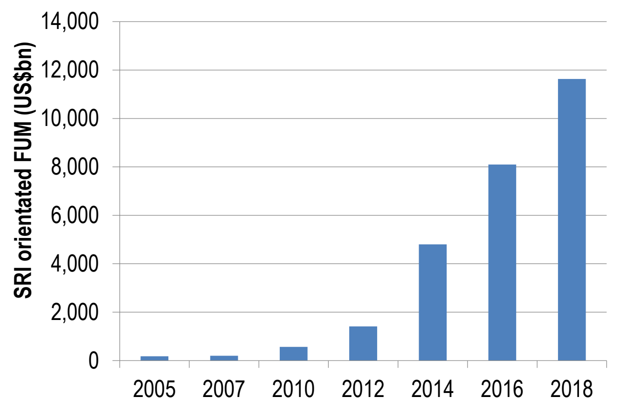
- **Investment mandates are changing**: The growth in sustainable investing has been significant in recent years. We suggest below that there are valuation consequences for heavy carbon emitters.
- **Carbon costs will likely rise**: There will be an additional cost burden as outlined in page 11 of this report. However, we do not believe the financial burden on NZX listed companies will be significant.
- **Regulatory actions in addition to carbon pricing**: Governments and regulators could impose stricter controls on emissions; including limiting the activities of heavy emitters.
- **Climate change will impact business**: The impact of climate change includes damage and disruptions caused by powerful storms, wildfires, heatwaves, floods, droughts and other extreme weather related events.
- **Consumers will be more carbon aware**: Purchasing behaviour will increasingly be influenced by carbon perception and reality. Carbon neutral businesses will promote their sustainable credentials. The flight shaming phenomena may impact other industries than airlines.
- **Social conscience**: Some companies have a genuine desire to make planet Earth a better place.
- **Litigation threat**: High carbon emitters may be subject to legal liability risks. In recent years a number of lawsuits have been filed against oil and gas companies in relation to climate change costs.

According to a recent study by the World Bank, over 1,300 companies, including more than 100 Fortune Global 500 companies, now use internal carbon prices or plan to do so within the next two years. About two thirds of these companies currently use internal carbon pricing as a risk management tool. The reported corporate carbon prices in use are diverse, ranging from US$0.01/$TCO_2e$ to US$909/$TCO_2e$. The UN Global Compact has called for businesses to adopt an internal carbon price of at least US$100/$TCO_2e$ by 2020.

Valuation benefits for low(er) emitters

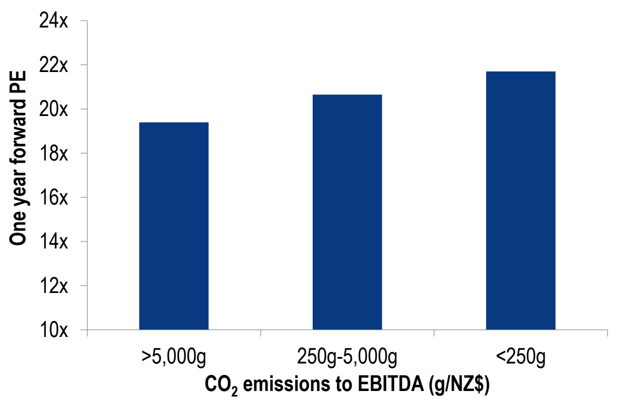
Investor decision making is increasingly being influenced by sustainability issues both in New Zealand and internationally. Investment mandates in the US with a sustainability focus are rapidly growing as highlighted in Figure 20.

Figure 20. Growth of socially responsible investing in the US



Source: SIF Foundation, Forsyth Barr analysis

Figure 21. Valuation benefit for lower carbon emitters



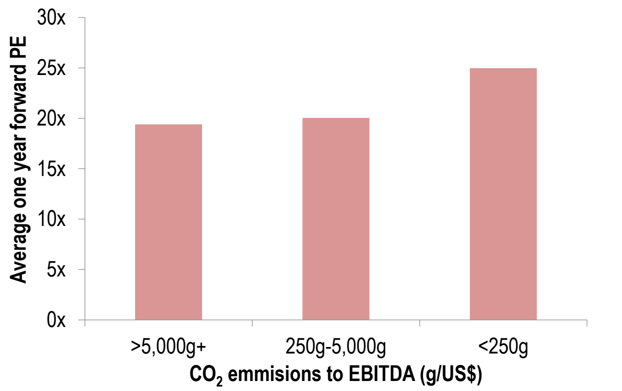
Source: Forsyth Barr analysis

Is there a valuation benefit to be gained from this for low emitters? While we recognise this may be coincidental the data suggests there is. In Figure 21 we show three groups of NZX companies based on their emissions intensity (emissions relative to EBITDA). The first group emits more than 5kg of CO_2e per NZ$1 of EBITDA. These are New Zealand's most intensive emitters and trade on an average ~19x one year forward PE. The second group emits between 250g and 5kg of CO_2 per NZ$1 of EBITDA and trade on a higher PE multiple of ~21x. The lowest CO_2 emitters trade at the highest PE multiple (~22x).

Our analysis shows a similar relationship can be observed in international markets. Heavy emitters have lower multiples and vice versa. Emissions are clearly not the only driver of valuation; however, the broad relationship across different markets suggest investors are willing to pay more for low emitters.

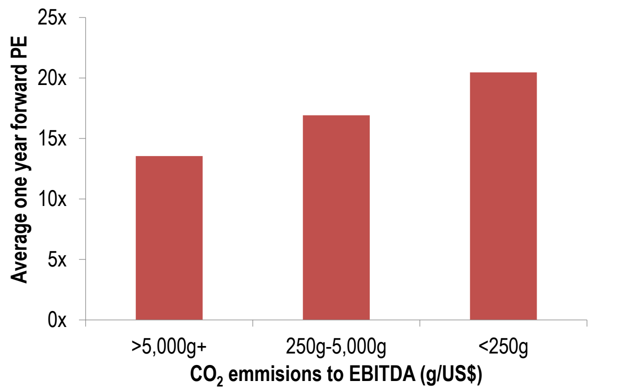
Moreover, as companies reduce their emissions we expect valuation benefits to arise.

Figure 22. Valuation benefit for lower carbon emitters – S&P500



Source: Eikon, Forsyth Barr analysis

Figure 23. Valuation benefit for lower carbon emitters – FTSE100

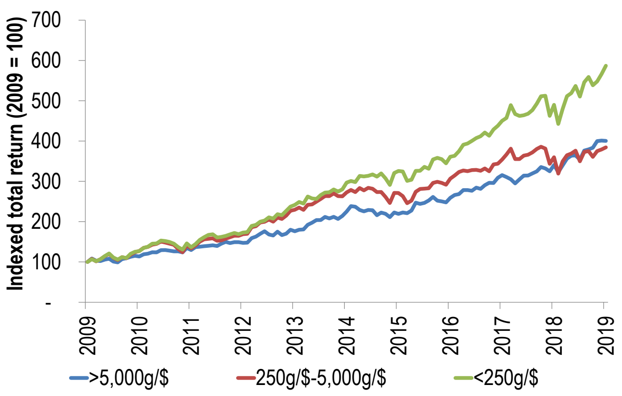


Source: Eikon, Forsyth Barr analysis

Low(er) emitters have outperformed over long term

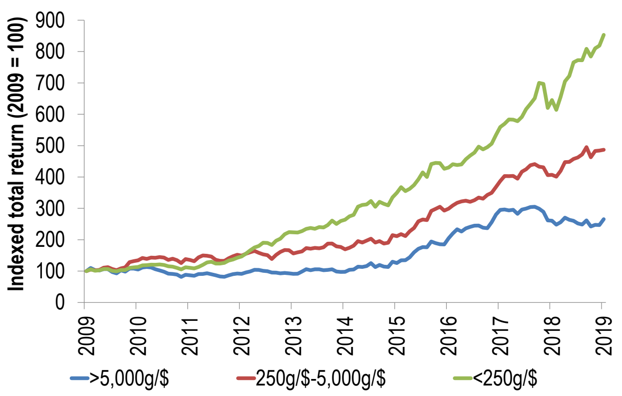
Our analysis of the performance of companies with differing emissions profiles on different exchanges suggests that lower emitting companies have historically outperformed higher emitting companies over the longer term.

Figure 24. Lower emitters have outperformed – S&P500



Source: Eikon, Forsyth Barr analysis

Figure 25. Lower emitters have outperformed – ASX200



Source: Eikon, Forsyth Barr analysis

We think there are a number of reasons why low emissions companies have outperformed over the longer term. First, higher emitters are subject to asset stranding risk, as has been the case for many coal based power generators in Europe. Second, regulatory and financial risk for higher emitters will likely impact future earnings and valuations. Third, the weight of money as identified above.

Good, bad and mixed disclosure hinders assessment

A full analysis of the carbon footprint of NZX companies is not possible. Carbon and other greenhouse gas disclosures across the NZX50 is, at best, mixed. Our analysis shows that 46% of NZX 50 companies do not provide disclosures for their Scope 1 and Scope 2 emissions. While the majority of these companies will be relatively low emitters, we believe it will become increasingly important for listed companies to provide better carbon disclosure than is currently provided. Many have acknowledged to us that they are in the process of measuring their emissions.

We recognise that many of the companies that currently don't report their emissions reside in low emitting sectors and therefore the financial and regulatory risk to them is low. However, there are a number of companies in high emitting sectors that don't report (yet) — these include Mainfreight (MFT), Steel & Tube (STU), and Metro Performance Glass (MPG). We recognise that the emissions of all three of these companies will be dominated by upstream Scope 3 emissions.

There is currently no mandatory requirement for New Zealand based or NZX listed companies, to report their carbon emissions, albeit there is a trend of improving disclosure and more questions are being asked by investors around disclosure levels.

In response to one of the Productivity Commission's recommendations, the New Zealand Government is currently undertaking consultation via its discussion document "*Climate-related financial disclosures*" (note that submissions close on 13 December 2019). If the current proposals are passed into legislation companies will be required to report carbon emissions (or explain why not).

Emissions reporting in other jurisdictions

Elsewhere momentum is building with regards to greater uniformity of emission disclosures:

- **France**: Mandatory carbon disclosure exists for listed companies as does carbon reporting for asset owners and investment managers.
- **UK**: All listed companies and large asset owners will likely be required to disclose emissions in line with the Task Force on Climate-related Financial Disclosures (TCFD) by 2022. This builds on existing requirements for all quoted and unquoted companies and limited liability partnerships to report on energy use, GHG emissions and emissions intensity.
- **Canada**: A recent report from its Expert Panel on Sustainable Finance has multiple recommendations relating to the TCFD and how its sought outcomes can be best achieved in a Canadian context.
- **EU**: The EU is considering reopening the EU Non-Financial Reporting Directive (NFRD), which would likely make TCFD disclosure mandatory. Its non-binding guidelines already include strong ties to the TCFD recommendations.
- **Australia**: The Australian Securities Exchange (ASX) and the Australian Accounting Standards Board (AASB) have released guidelines that make it clear they expect the TCFD recommendations should be considered and followed and the Reserve Bank of Australia (RBA) and the Australian Prudential Regulation Authority (APRA) have also strongly endorsed TCFD implementation.

Carbon reporting: Scopes of emissions

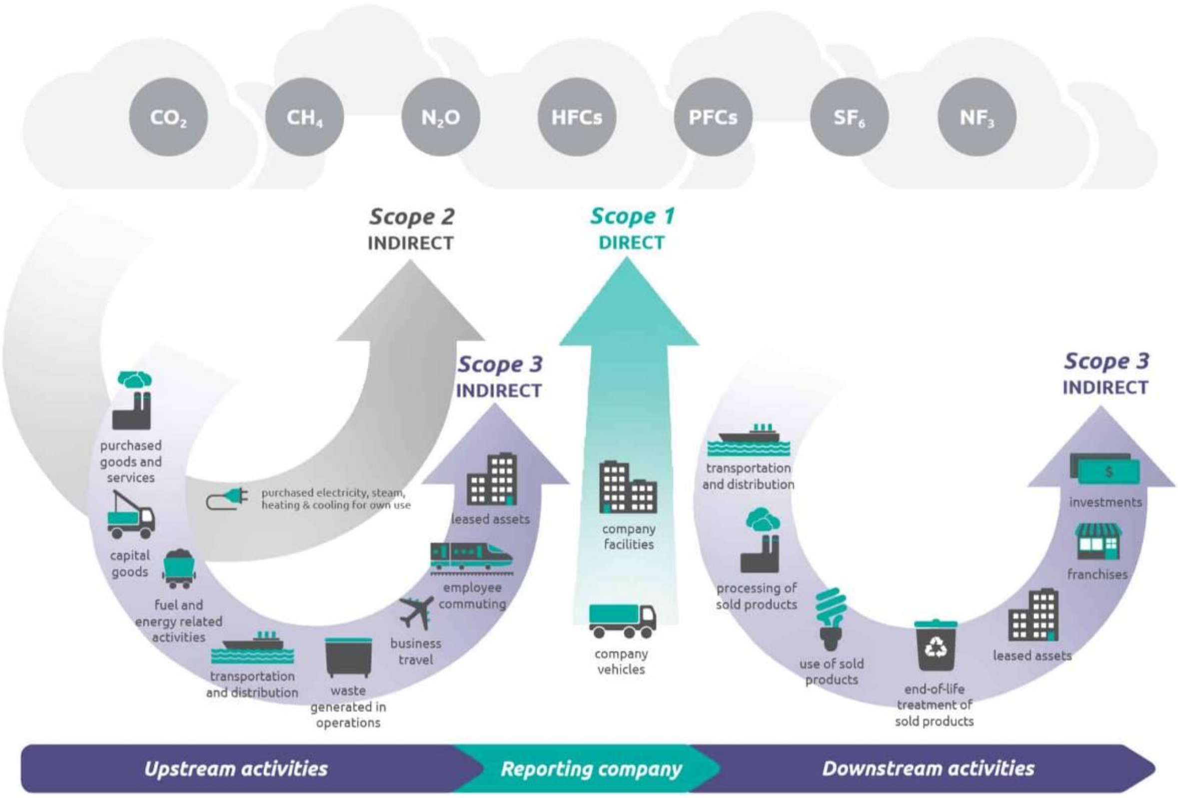
The Greenhouse Gas Protocol (a joint initiative by the World Resources Institute and the World Business Council for Sustainable Development) has been largely adopted by corporates as the framework to report their emissions. It breaks down emissions into three scopes as follows:

- Scope 1: direct emissions from owned or controlled sources.
- Scope 2: indirect emissions from the generation of purchased energy.
- Scope 3: all indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions. The impact of Scope 3 emissions will vary on a company by company basis.

Some Scope 3 emissions will result in increased costs for companies (for example Fonterra's Scope 3 emissions include the methane from its farmer suppliers' dairy herds). However, other Scope 3 emissions will be a step removed from the company (for example Tourism Holdings' Scope 3 emissions include all customer journey emissions from the fuel they purchase although this has no impact on its P&L).

The nature of Scope 2 and Scope 3 emissions means that double counting of emissions may occur.

Figure 26. The different scopes



Source: GHG Protocol, Forsyth Barr analysis

(In)consistency of disclosure

Only 46% of NZX50 companies (excluding the Australian banks ANZ and Westpac) provide aggregate Scope 1–3 emissions disclosure. This percentage rises to 56% of companies providing some emissions disclosure.

Figure 27. NZX50 emissions disclosure summary

	Scope 1 & 2 disclosed	Scope 3 disclosed	Total emissions disclosure	Companies with some disclosure
No. of companies	26	22	22	27
Percentage of total*	54%	46%	46%	56%

Source: Forsyth Barr analysis *NZX50 less the two Australian listed banks

Of the 26 companies that disclose their emissions, eight have received either a CEMARS (Certified Emissions Measurement and Reduction Scheme) or CarboNZero certification (Auckland Airport, Fisher & Paykel Healthcare, Freightways, Kathmandu, Ryman, SkyCity, Summerset, and The Warehouse Group) which involves a third-party audit of their emissions data. TIL Group and Scales' Mr Apple subsidiary have also received a CEMARS certification. CEMARs and CarboNZero have been recently replaced by Toitū carbonreduce and Toitū carbonzero certification.

Several other companies have had theirs disclosures audited by third parties (for example Synlait by Deloitte, and Fonterra by Bureau Veritas).

Examples of excellent disclosure

A number of companies provide excellent emissions disclosures. These include, but are not limited to:

- **Synlait Milk** — sustainability report; very detailed greenhouse gas inventory report
- **Z Energy** — detailed sustainability reporting including; breakdown of GHG emissions and emission reduction targets
- **Air New Zealand** — sustainability report; greenhouse gas inventory report; specific reduction targets
- **Contact Energy** — sustainability report; published emission reduction targets

The financial risk is limited across the NZX

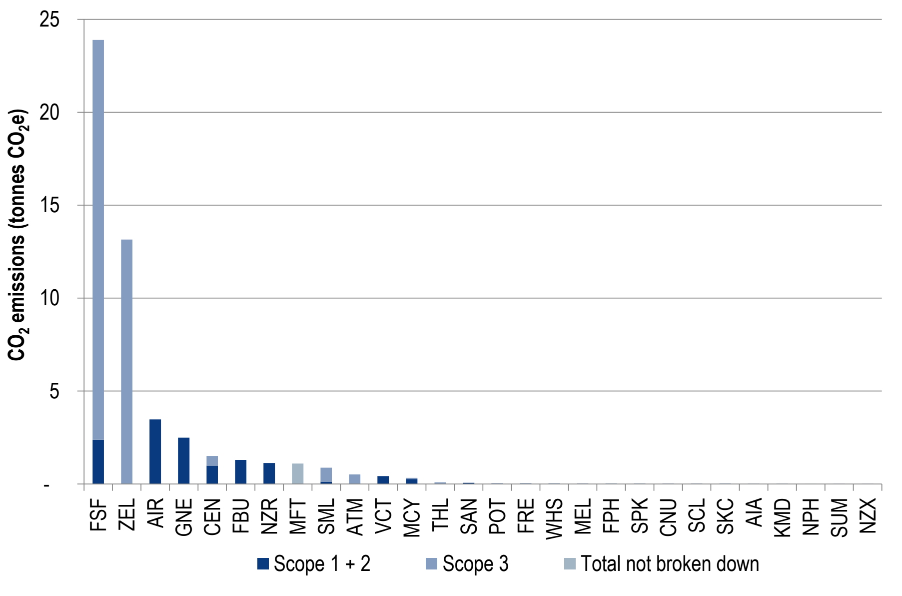
The top 10 emitters in the NZX50 account for ~97% of the total emissions that are disclosed by NZX companies (in reality the percentage will be lower for the overall market as not all companies make disclosures but we expect still above 90%). These 10 emitters account for ~27% of the index weight of the NZX50.

Most carbon intensive companies/sectors

The majority of total NZX emissions (>70%) stem from just two companies — Fonterra and Z Energy. Both emissions profiles are dominated by Scope 3. Fonterra from the methane produced by its farmer suppliers. Z Energy from the fuel that is burnt by its customers (the carbon price of which is encapsulated within the cost of the fuel). If we exclude Scope 3, then Air New Zealand and Genesis Energy are the largest emitters.

We consider the five largest emitting sectors in more detail later in this report.

Figure 28. Carbon emissions are concentrated for NZX50 companies (we only include those companies that disclose their emissions plus Mainfreight)

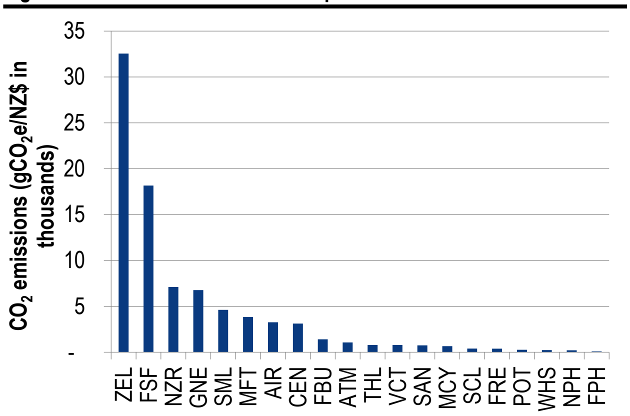


Source: Forsyth Barr analysis NOTE: MFT emissions are estimated as the company does not disclose its global emissions

Assessing financial risk

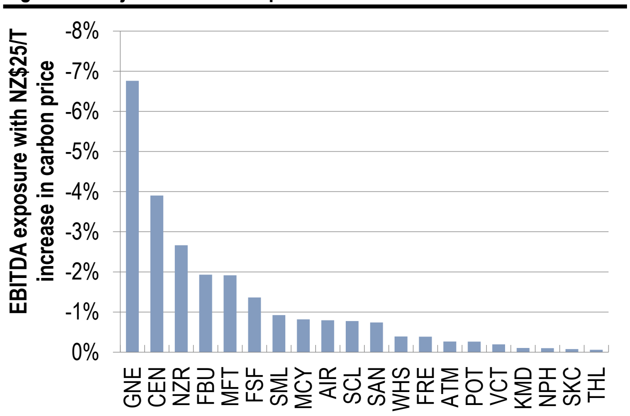
Considering GHG emissions as a proportion of company profitability, the top 10 companies in the NZX50 are the same as the heaviest emitters identified above, but in a different order (refer to Figure 29).

Figure 29. Total disclosed carbon exposure relative to EBITDA



Source: Forsyth Barr analysis

Figure 30. Adjusted carbon exposure relative to EBITDA



Source: Forsyth Barr analysis

More importantly, the financial risk to these companies from (1) greater cut-through of the existing ETS regime, and (2) a higher carbon price in future, mitigated by their ability to pass on carbon related costs to their customers. In Figure 30 we adjust the financial exposure for pricing power and the exposure to carbon pricing in light of geographic considerations (i.e. many jurisdictions do not price carbon currently).

On the surface, Genesis Energy (GNE) appears most exposed, followed by Contact Energy (CEN), and Refining NZ (NZR). However, GNE and CEN are currently recovering more than the carbon price risk through elevated wholesale electricity prices and both are members of the Drylandcarbon project which will reduce carbon price risk. In addition, we expect the emissions profile of both companies to diminish over time as base load thermal generation is replaced with more renewable generation. NZR has no carbon cost exposure at present due to its Negotiated Greenhouse Agreement (which expires at the end of 2022), after which we expect it to be treated as a trade-exposed industry (i.e. it will have a 13% exposure under proposed legislation from 2023).

We recognise our analysis in Figure 30 is highly subjective given the adjustments we make. The adjustments do not reflect any of the volume considerations that may impact, either positively or negatively, companies. The volume impact may reflect elasticity influences or the wider industry volume consequences of higher carbon prices. Potential material volume impacts include:

- Dairy's supply base (i.e. farmers) could be significantly negatively impacted by the future financial implications of their emissions.
- Electricity generators (including GNE and CEN) that will benefit from greater electricity use as other industries transition away from fossil fuels.
- Z Energy (ZEL) will be subject to increasing road vehicle switching to electric vehicles and therefore reduced demand for petro/diesel.
- Aviation (airlines and airports) will be impacted by the elasticity impact of higher air fares together with the potential adverse influence of flight shaming.

We believe Fonterra (FSF) will ultimately be the most exposed of the NZX50 companies given the risk to its supply base over the longer term.

Carbon offset programmes will limit exposure further

The Drylandcarbon project offers a good example of the initiatives that listed NZX companies are undertaking. Drylandcarbon is a partnership between Air New Zealand (AIR), Contact Energy (CEN), Genesis Energy (GNE) and Z Energy (ZEL) to invest in the establishment of a diversified forestry portfolio. The prime objective of the partnership is to produce a stable supply of NZUs to support the partners in meeting their requirements under the NZ ETS.

The partnership aims to target marginal land suited to forestry. The majority of the forestry portfolio will comprise permanent forest, with some production forests. Drylandcarbon is managed by a third-party so AIR, CEN, GNE and ZEL do not have day-to-day involvement in the running of the partnership.

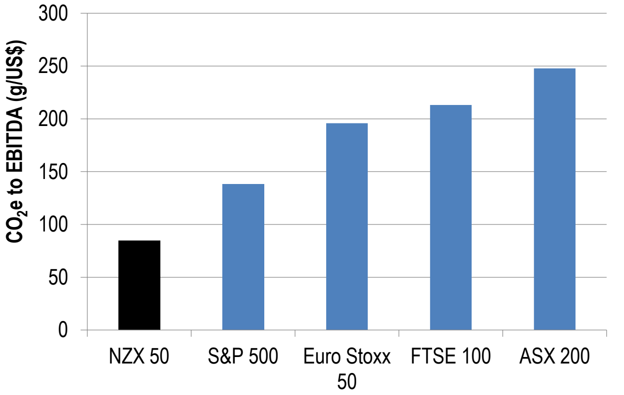
We understand that Drylandcarbon has yet to make any investments. However, it is likely targeting a carbon abatement price below the current carbon market price of NZ$25/tonne and we estimate the target cost of carbon abatement is ~NZ$20/tonne. We expect this will increase over time and should trend towards the market price of carbon as the cost of carbon abatement is capitalised into land prices.

The NZX is a relatively low emitting market

Our analysis in Figure 31 suggests that the NZX is a low emissions market relative to other stock exchanges globally. This may have valuation benefits as highlighted above.

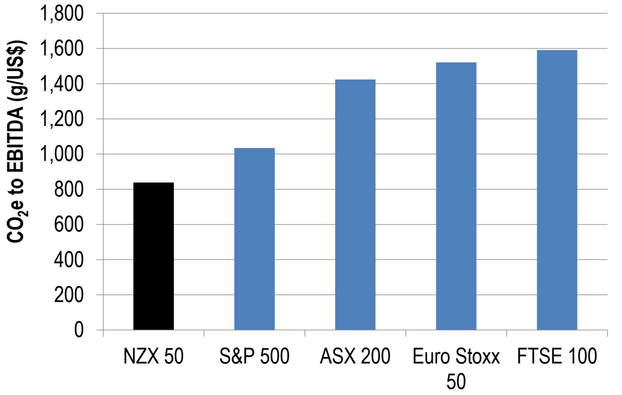
We recognize this analysis is only as good as the quality of data provided by Datastream (it is not wholly consistent when we look at the NZX50 data compared to what we have collected on a company by company basis) for all exchanges; however, we believe the analysis picture provides a broad view on the relative carbon intensity of each exchange.

Figure 31. Median carbon emissions per dollar of profit



Source: Datastream, Forsyth Barr analysis

Figure 32. Mean carbon emissions per dollar of profit



Source: Datastream, Forsyth Barr analysis

Key sector analysis

Utilities sector

The electricity sector is at the heart of New Zealand's efforts to decarbonise. With current electricity generation ~85% renewable, the easiest and most cost efficient way for New Zealand to decarbonise is by electrifying transport and industrial processes. Whilst this represents a strong positive tailwind for the sector (from increased electricity demand), electricity generators also emit carbon, hence, there are some direct implications for the sector. In FY19, total Scope 1 emissions from the listed generators were ~3.75m tonnes, or ~4% of New Zealand's total carbon emissions.

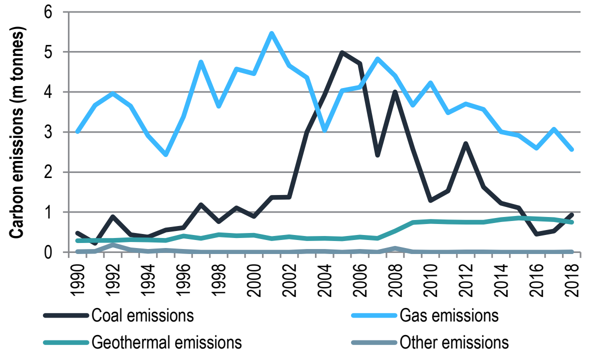
Generation emissions (Genesis Energy, Contact Energy, Mercury) — Scope 1 emissions

Generation carbon emissions come from three electricity generation technologies:

- Coal-fired thermal
- Gas-fired thermal
- Geothermal

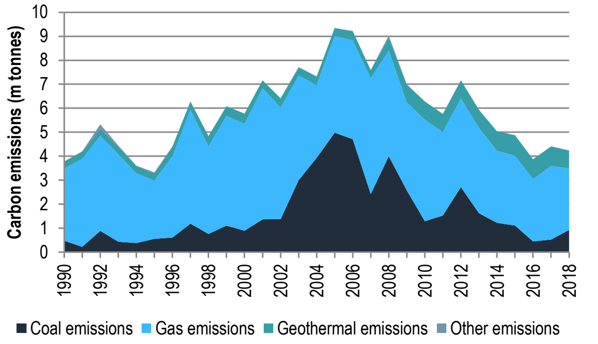
Over the past 30 years, New Zealand's electricity carbon equivalent emissions have fluctuated markedly. Most of the emissions are gas related, although when electricity generation emissions peaked in 2005, coal emissions were briefly the largest contributor.

Figure 33. Electricity generation emissions by technology



Source: MBIE, Forsyth Barr analysis

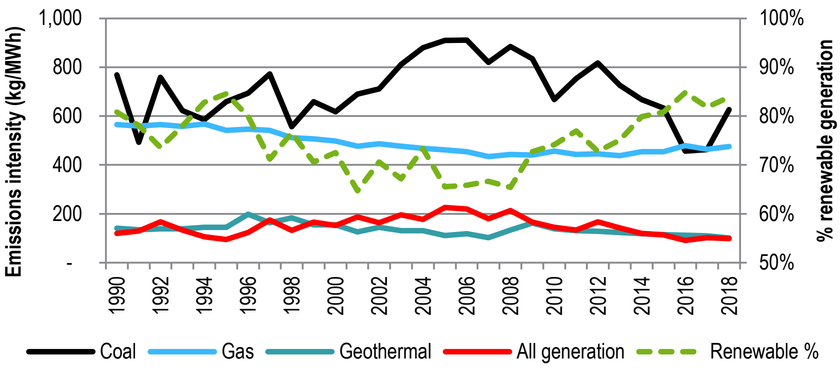
Figure 34. Total electricity generation carbon emissions



Source: MBIE, Forsyth Barr analysis

The increase in geothermal and wind generation over the past decade has displaced coal and gas generation volumes; hence, the decline in total emissions. Emission intensity (the amount of carbon emitted/MWh of generation) has declined in line with increased renewable generation and in 2018 was 99kg/MWh, up slightly on 2017 because of increased use of coal generation.

Figure 35. Electricity generation carbon emissions intensity



Source: MBIE, Forsyth Barr analysis

Geothermal emissions vary depending on the geothermal field. In 2018 Ohaaki emitted 341kg/MWh, only -15% less than a typical combined cycle gas turbine generation unit. At the other end of the spectrum, New Zealand's oldest geothermal power station, Wairakei, only emitted 21kg/MWh. The weighted average geothermal emissions were 101kg/MWh. As geothermal fields get older and degas, emissions decline, hence, the gradual decline in the geothermal emissions intensity.

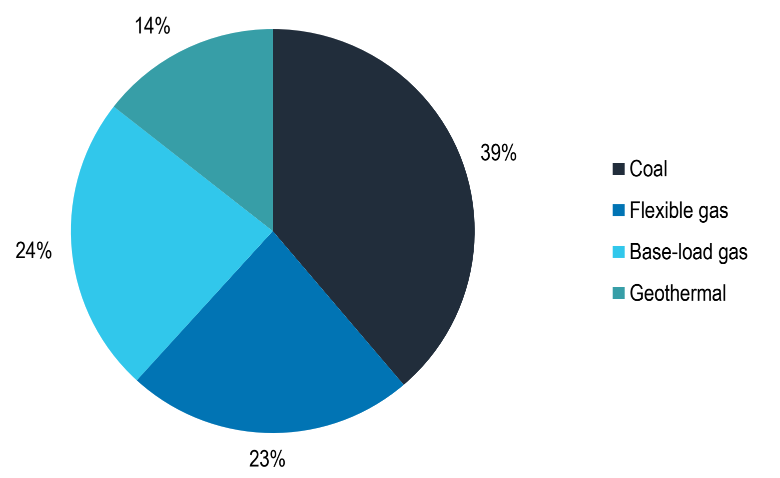
Generation carbon emissions cost recovery

Generators are generally unable to directly pass through carbon costs to electricity users, although there are certain contracts that include cost recovery. Recovery of carbon costs depends on the type of generation. In FY19, 38% of carbon emissions came from "must-run" generation and 62% from "flexible" generation.

Generation that is offered into the market as "must-run" generation (i.e. it is typically bid into the market at NZ$0/MWh to ensure it is used for generation) does not price in carbon costs — although the generator may recover its carbon costs if wholesale electricity prices are high enough. Geothermal generation and the gas-fired Unit 5 at Huntly (due to GNE's take-or-pay gas contract and the fact GNE is long gas) are examples of "must-run" carbon-emitting generation.

"Flexible" thermal generation, such as gas-peaking generation and the Huntly Rankine units, typically include carbon costs in their offer prices into the market, hence, get direct carbon cost recovery.

Figure 36. Source of electricity carbon emissions

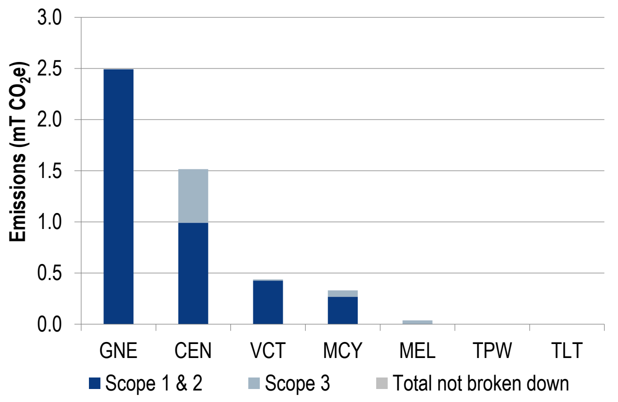


Source: Company reports, Forsyth Barr analysis Note: The base-load gas emissions from Unit 5 at Huntly equates to all generation. In reality GNE has some flexibility above a minimum generation level; hence, this is a conservative figure.

Wholesale electricity prices are currently high enough to cover the costs of carbon from all forms of generation (above NZ$100/MWh). Nevertheless, carbon emissions represent a cost of generation; hence, increased carbon costs represent a loss of margin when wholesale electricity prices are not set by flexible thermal generation. However, it is a margin increase for "must-run" carbon emitting generation when wholesale prices are set by flexible thermal generation because "must-run" carbon emitting generation is more carbon efficient.

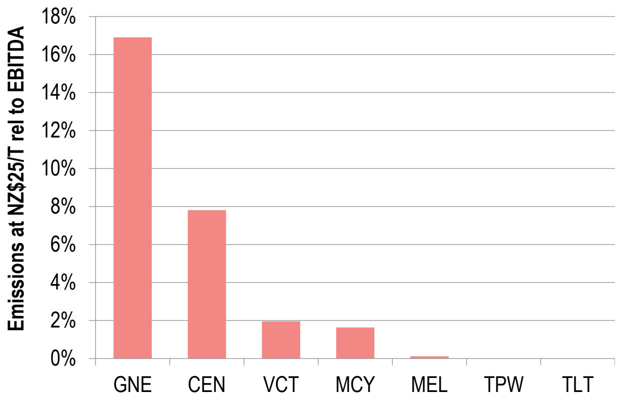
At 4m tonnes of emissions and NZ$25/tonne, the cost to the sector of carbon emissions is NZ$100m per annum. The largest emitter of carbon amongst the electricity generators is GNE, followed by CEN and MCY. On a simplistic basis they are, therefore, the most exposed to increases in carbon prices. However, as noted above, the actual exposure is limited to "must-run" generation and whilst there is some margin at risk from higher carbon prices, the current high wholesale electricity prices more than offset any carbon price downside risk.

Figure 37. Latest annual carbon emissions for utilities



Source: Company reports, Forsyth Barr analysis Note: GNE does not measure Scope 3 emissions (yet). TPW and TLT do not measure carbon emissions, but Scope 1 and 2 emissions will be immaterial as both are 100% wind / hydro generators (like MEL).

Figure 38. Profit exposure to carbon (assuming no cost recovery)



Source: Company reports, Forsyth Barr analysis

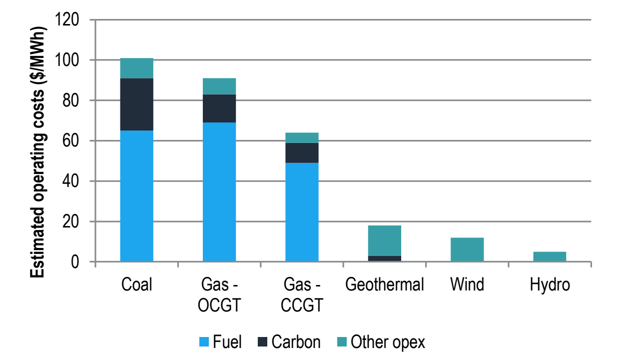
Temporary increase in wholesale electricity prices (which flows into retail prices)

To the extent that carbon prices are factored into the marginal spot price of wholesale electricity, there is a benefit for all low/no emission generators. However, over the long-term, the average wholesale electricity price should equal the long-run marginal cost of new generation. Currently the cheapest new build generation technologies are wind and geothermal.

In other words, if carbon prices are factored into spot wholesale electricity prices that incentivises the building of lower operating cost renewable generation. The construction of low/no emission generation will then force the retirement of high carbon-emitting generation. We are already seeing this, with GNE's long-term offtake contract to buy the electricity from Tilt Renewable's (TLT) wind farm in Taranaki. Over time we expect GNE will change the role of its Unit 5 generator from being a base-load generator to a more flexible back-up generator. Similarly, CEN is looking to replace its combined-cycle gas generation unit with geothermal generation.

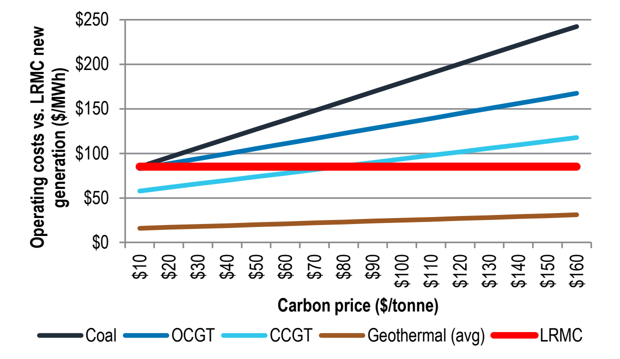
However, whilst the long-run wholesale electricity price does not directly factor in carbon costs, short-term spot prices do when "flexible" carbon-emitting generation sets the wholesale electricity price. Increasing carbon prices will, therefore, exacerbate volatility in the wholesale electricity market.

Figure 39. Estimated operating cost of generation



Source: Forsyth Barr analysis Note: assumes coal fuel cost of NZ$125/tonne and gas fuel cost of NZ$6.50/GJ

Figure 40. Operating costs vs. cost of new generation



Source: Forsyth Barr analysis

Over time, as renewable generation increases, we expect carbon emissions from the electricity sector to continue declining. GNE will "benefit" the most, as firstly Unit 5 shifts from base-load generation to back-up generation and then, in time, the Rankine coal units close.

Indirect effects on the electricity sector

Sales of other products (Scope 3 emissions)

Most of the electricity retailers also sell LPG and natural gas. However, carbon costs are passed through directly to end consumers, hence, there is no direct impact on the energy retailers. There is an indirect demand effect if carbon prices were to result in changes in consumer behaviour. However, with carbon costs less than 4% of the average natural gas and LPG bill, we do not expect carbon prices to dramatically impact household energy consumption.

Figure 41. Carbon costs in residential energy bills

	Unit	kg CO2e/ unit	Retail cost ($)/ unit	% of bill (@$25/tonne)	Annual cost
Electricity	kWh	0.0977	$0.29	1.0%	$22
Natural gas	GJ	54.1	$39.93	3.9%	$39
LPG	kg	3.03	$2.61	3.3%	$43

Source: MBIE, Gas Industry Council, Forsyth Barr analysis

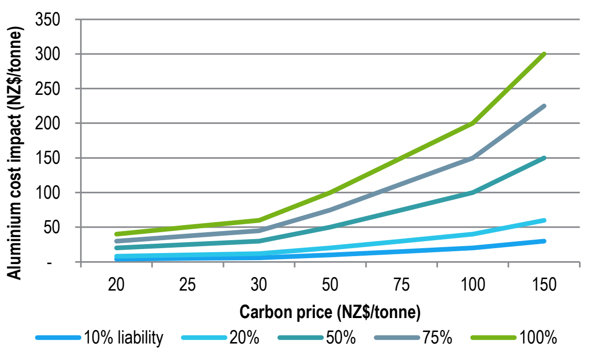
Note: Gas and LPG have direct pass through of carbon costs. There is no direct pass through of electricity carbon emissions from generation.

Implications for Tiwai Point aluminium smelter (NZAS)

The Tiwai aluminium smelter is one of the larger industrial emitters of carbon in New Zealand. It directly emits a little under 2 tonnes of carbon for every tonne of aluminium produced, which equates to ~600,000 tonnes CO_2 per annum. At present industrial carbon emitters in trade exposed industries are only required to pay for 10% of their carbon costs, hence, at NZ$25/tonne, NZAS's exposure is NZ$5/tonne of aluminium (vs. a sales price of ~NZ$2,700/tonne).

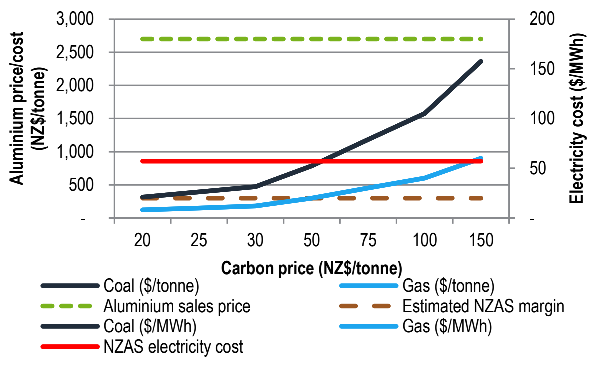
However, if NZAS were to become 100% liable for carbon emissions and its overseas competitors did not face a similar charge, it could threaten the future of NZAS. We estimate that over the past 6-months, NZAS's EBITDA/tonne has fluctuated between NZ$100/tonne and NZ$400/tonne. A carbon price of NZ$75/tonne and a 100% liability would increase the carbon impost to NZ$150/tonne of aluminium, severely impacting on NZAS profitability.

Figure 42. Impact of carbon price on direct aluminium emissions



Source: Forsyth Barr analysis

Figure 43. Impact of carbon price on cost of coal/gas fired electricity



Source: Forsyth Barr analysis

Rio Tinto strategic review of NZAS puzzling in the context of a de-carbonising world

The irony is that NZAS aluminium is produced using electricity from a largely renewable low carbon system. Compared to overseas smelters, including the carbon emitted from electricity, NZAS should be one of the most carbon efficient smelters in the world — the regulatory setting for trade exposed industries is, therefore, critical.

Rio Tinto is currently undertaking a strategic review, threatening closure. We are of the view that NZAS is more likely to stay open than not. One of the key reasons supporting that view is the carbon position of NZAS. 61% of global aluminium production is made using coal-fired electricity. A further 10% uses gas. At NZ$25/tonne, an aluminium smelter using coal-fired generation should face an indirect carbon cost of ~NZ$400/tonne vs. nil for NZAS. Put another way, at NZ$25/tonne, the carbon cost in electricity equates to NZ$26/MWh, a little under 50% of the price that NZAS currently pays for the energy component of its electricity.

RIO is cognisant of this, noting the same point in its October 2019 Investor Day. In addition, RIO has been marketing RenewAl branded aluminium for several years, and in conjunction with Alcoa has developed a smelting technology that is emission-free (although the economics are unknown).

In our view, a global carbon price materially strengthens NZAS's competitive position, reducing the chance of closure.

Vector exiting Kapuni

Vector's (VCT) carbon emissions come from its ownership of the Kapuni processing facility. Kapuni gas has very high CO_2 content, ~+50% more than other gas fields. VCT faces no margin threat from increased carbon costs as they are passed on to the customer. However, the high CO_2 content means over time it will become less attractive as a source of natural gas.

We estimate the current CO_2 cost/GJ is less than 10% of the total cost of gas, so the impact is minor at present, but could become more material in time. That said, VCT's earnings from its Kapuni processing facility are minor compared to its regulatory and smart meter earnings.

VCT has recently announced the sale of its Kapuni interests to Todd Energy. Todd Energy will be acquiring the majority of VCT's carbon exposure, with completion of the deal expected before June 2020. However, the financial arrangement means the extent to which Kapuni volumes are impacted by higher carbon prices, VCT will also take a financial hit.

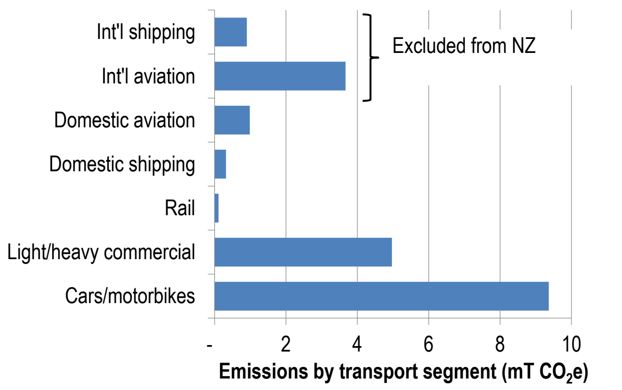
Transport sector

The transport sector accounts for ~20% of New Zealand's total gross emissions. It is a sector heavily reliant on fossil fuels as the key source of energy. This excludes international aviation emissions for flights departing New Zealand, and bunker fuel related emissions for international shipping vessels departing New Zealand ports, which in combination add a further ~5% on to New Zealand's gross emissions.

A large proportion of transport sector emissions reflect private vehicle journeys as illustrated in Figure 44. A material proportion of these will be recorded within Z Energy's Scope 3 emissions, given its ~45% share of the liquid fuel market.

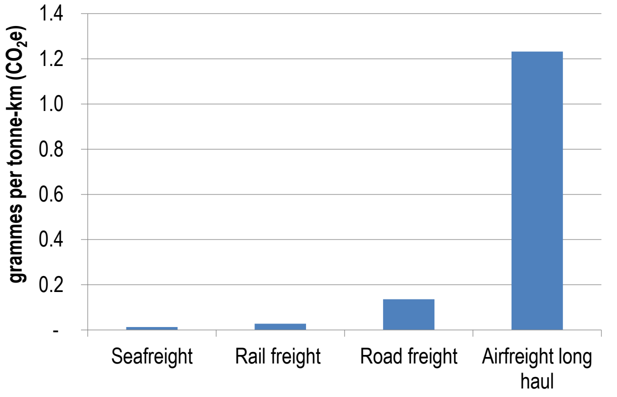
The transport segment most exposed to carbon is aviation, given the high proportion of fuel within its cost base and the limited use of low-carbon technologies, at least over the near term.

Figure 44. Split of transport sector emissions



Source: Ministry for the Environment, Forsyth Barr analysis

Figure 45. Unit emissions for different freight modes



Source: Ministry for the Environment, Forsyth Barr analysis

Aviation has the highest emissions intensity

Until aviation biofuels are readily available and/or electric aircraft technology developed for commercial use, the aviation sector is unlikely to deliver significant carbon emissions savings through existing operations beyond further introduction of more fuel efficient aircraft. Consequently, to achieve lower overall net emissions airlines will need to purchase carbon units and invest in projects that can generate emissions savings.

Domestic aviation

Carbon emissions from domestic aviation are incorporated into the NZ ETS.

International aviation

Carbon emissions from international aviation are excluded from New Zealand's target within the Paris Agreement (see page 6) and are dealt with separately by the International Civil Aviation Organization (ICAO). The international aviation industry (through IATA) has committed to several targets, including:

- 1.5% annual fuel efficiency improvements between 2009–2020 (AIR will comfortably achieve this target)
- Achieving carbon neutral growth from 2020
- Halving 2005 emissions by 2050

The global mechanism for achieving carbon neutral growth in the international aviation sector is the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). Airlines are to monitor, verify and report their emissions on all international flights from 1 January 2019. Moreover, operators will be required to purchase "emissions units" from 1 January 2021 to offset the growth in CO_2 emissions covered by the scheme.

The implementation of CORSIA is phased. The pilot phase (2021–2023) and first phase (2024–2026) are voluntary. The second phase (2027–2035) is mandatory with exemptions for some smaller emitters, which can join voluntarily.

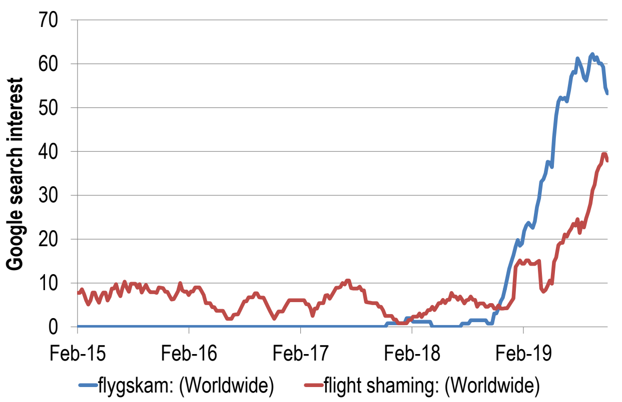
Currently 81 countries, representing ~77% of international aviation activity, intend to voluntarily participate in CORSIA from the outset. Notably China, Argentina, Hong Kong, Taiwan, the Cook Islands, Samoa, Tonga and Fiji are not signatories or are exempt. Although China has not stated that it intends to participate in the initial phase, it is actively monitoring aviation emissions.

The cost of emissions

There are a number of implications for the airline industry given its emissions profile:

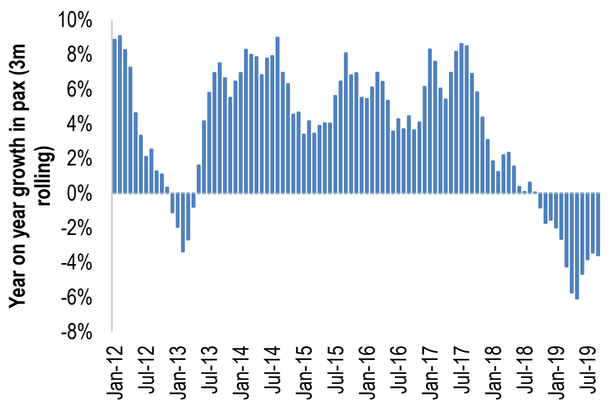
- **Direct financial cost** — airlines will have a direct financial cost of their carbon emissions in New Zealand given the NZ ETS and through CORSIA from 2021 for flights between New Zealand and other volunteer nations. The added cost to an airline ticket will have elasticity implications on demand.
- **Flight shaming** — "*I think it's our biggest challenge*" says the CEO of Air France recently. The movement, which first gained momentum in Sweden where it is known as "*flygskam*", has pushed individuals to reassess the necessity of flying and consider alternatives, like the train. The impact on an island nation (i.e. New Zealand) with no alternative access is likely to be less pronounced than in Europe, however, it cannot be ignored and is likely to have some negative impact on longer term demand. We suspect the impact will be greater on corporate travel than consumer travel given the former will increasingly be keen to impress upon their stakeholders that they are carbon neutral.

Figure 46. Google searches for flight shaming has increased



Source: Google Trends, Forsyth Barr analysis

Figure 47. Air passenger numbers are declining in Sweden



Source: Swedavia, Forsyth Barr analysis

Road has the highest footprint

The majority of road transport emissions stem from private car use, where carbon costs are reflected in fuel pump prices.

Emissions from road freight largely reflect the burning of diesel. ~70% of the emissions from the road transport sector, excluding cars, stem from light commercial vehicles (i.e. courier drivers, tradies). The remainder is from heavy trucks and buses.

The cost of carbon is unlikely to be a driver of switching to electric or other low carbon technology vehicles. At the current NZ$25/T carbon cost the impact on a litre of diesel is just 7.7 cents per litre.

Sea is the least intensive

As shown in Figure 45 the shipping industry has very low unit emissions when measured on a per tonne-km basis. However, the carbon footprint of the sector as a whole is large as ~90% of world trade is carried by sea. Container shipping represents ~70% of total maritime trade by value.

Figure 48. Carbon reduction strategies by transport mode

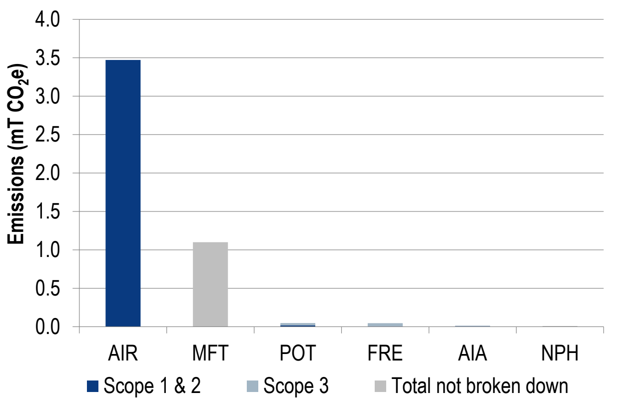
Strategy	Air	Road	Rail	Sea
Electric potential	Short haul only	Battery size issue for large trucks	Only 506km of 4,128km network electrified in New Zealand	Hybrid only given battery size, cost (although there are some short-haul ferry operations going fully electric)
Alternative fuels	Biofuels, hydrogen	Biofuels, LNG, hydrogen, ammonia	Biofuels, LNG, hydrogen, ammonia	Biofuels, LNG, hydrogen, ammonia, nuclear
Renewable energy	No	Solar for battery recharging	No	Solar, wind
Operational	More point-to-point routes, larger aircraft, changing consumer behaviour	"Feebate" scheme/government incentives, loading efficiency and truck utilisation	Greater back-haul	Ship size, lower speeds, localised supply chains
Technological	Lower weight aircraft	Engine efficiency	Hyperloop?	Slender design, propulsion efficiency, air lubrication

Source: Forsyth Barr analysis

Implications for transport companies

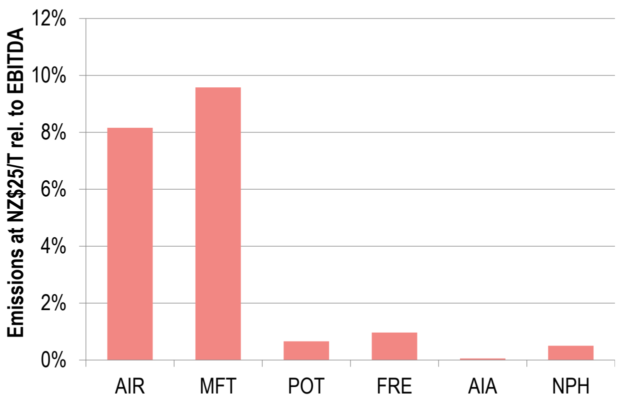
The high level of unit emissions and consolidated nature of aviation mean Air New Zealand (AIR) is New Zealand's highest emitter of Scope 1 and 2 emissions. Mainfreight (MFT) is also a large emitter of greenhouse gas emissions, albeit its use of third party owner-drivers, shipping carriers and airlines will mean most of its exposure is Scope 3.

Figure 49. Latest annual carbon emissions for transport companies



Source: Company reports, Forsyth Barr analysis Note: MFT's emissions are estimated

Figure 50. Profit exposure to carbon costs



Source: Forsyth Barr analysis

Air New Zealand most exposed in transport

Jet fuel currently comprises ~99.5% of Air New Zealand's (AIR) total Scope 1 and 2 emissions. AIR's carbon footprint leads the NZX in Scope 1 emissions. In FY19 it emitted ~3.5m tonnes CO_2e from its global operations with ~84% of emissions from jet fuel for its international operations.

Figure 51. AIR's split of emissions (FY19) — CO_2e in tonnes

	Domestic	International	Group	Total
Scope 1	556,404	2,903,146	9,162	3,468,712
Scope 2	-	-	3,098	3,098
Scope 3	n/a	n/a	n/a	n/a
Total	**556,404**	**2,903,146**	**12,260**	**3,471,810**
Split	16%	84%	0%	100%

Source: AIR, Forsyth Barr analysis

Domestic emissions cost <1% of revenue

AIR participates in the NZ ETS; as a result it must surrender 1 NZU for every tonne of CO_2 emitted from fuel purchased for domestic operations. Prior to 1 January 2019 it had to surrender units for 87% of its domestic emissions. This percentage has been steadily increased in recent years by the New Zealand Government.

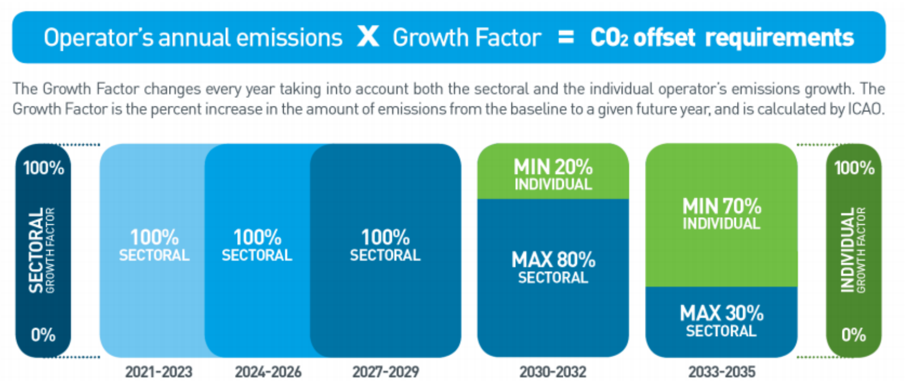
In CY19, for example, we estimate AIR's domestic emissions to be 550,000T CO_2e. This will equate to a cost on the business of ~NZ$14m. Not overly material on a domestic revenue base of NZ$1.6bn.

International emissions cost will grow from 2021

The financial cost for AIR will increase from 1 January 2021 given its participation in CORSIA, but not materially. While AIR's services to Shanghai, Hong Kong, Taiwan, the Cook Islands, Samoa, Tonga and Fiji are not subject to the CORSIA requirement, we estimate that ~80% of AIR's international business (by ASK or available seat km) will be, including its growing North American operations.

AIR's carbon emission offset requirement will be, at least for the next 10 years, a function of its own annual emissions and the growth in emissions for the global airline industry (the "growth factor"), as illustrated in Figure 52. The growth factor represents the global average growth in emissions in a given year, relative to the base line year (the average of 2019 and 2020 emissions).

Figure 52. Offsetting requirement for AIR



Source: CORSIA, Forsyth Barr analysis

For example if the global emissions increase by +4% in 2021, and AIR's international emissions for CORSIA affected services are around 2.3m tonnes, we estimate its additional carbon offset requirement at NZ$25/T will amount to just ~NZ$2m.

In future years this annual cost will increase incrementally given likely growth in global aviation emissions.

Figure 53. AIR's potential CORSIA offset requirement cost in 2021

	mT/CO_2	Growth factor	Carbon offset
Total international emissions - 2021	3.0		
CORSIA impacted emissions as proportion of total	80%		
CORSIA related emissions	2.3		
Growth factor		4%	
Carbon offset requirement (T/CO_2)			92,800
Carbon offset cost (NZ$m)			2

Source: Forsyth Barr analysis

Carbon related initiatives

AIR has two key carbon related goals: (1) generating carbon neutral growth from 2020, and (2) reducing emissions to 50% of 2005 levels by 2050. Although with Qantas joining IAG (owner of British Airways plus other airlines) in targeting net zero emissions by 2050, we expect AIR may follow suit.

In the meantime AIR is pursuing a number of initiatives to meet its goals:

- **FlyNeutral** — AIR has a voluntary carbon offsetting function within its online booking engine, so customers can identify the emissions associated with their travel and then purchase certified carbon emissions units. In FY19 183,624 retail customer journeys were covered by the scheme, up by +41% from FY18. In tandem with corporate and government customers, total carbon offsets amounted to 52,000 tonnes of carbon, or

~1.5% of total emissions. This voluntary programme reduces AIR's direct cost exposure to its emissions.

- **New Zealand Native Forest Restoration Trust** — AIR's voluntary contributions currently support permanent forestry sink initiative projects with the New Zealand Native Forest Restoration Trust. The non-profit trust has purchased >7,000 ha of land to restore with native trees, and covenants the land in perpetuity via Queen Elizabeth II Trust.
- **Hybrid aircraft** — AIR is collaborating with aircraft manufacturer ATR on hybrid aircraft, which would be used within its regional network. Currently its regional fleet contribute around 40% of its domestic emissions, or 6% of total emissions.
- **Biofuels** — AIR is working with Z Energy, Refining NZ, SCION and Auckland International Airport to investigate how it could transition aviation fuel into biofuel and whether setting up an aviation biofuel plant in New Zealand is feasible.
- **Drylandcarbon** — AIR is one of the investors in the Drylandcarbon abatement investment vehicle.

Mainfreight yet to report on its emissions

Mainfreight (MFT) does not yet measure its carbon emissions across its global business. While it does measure them in New Zealand and Europe, it doesn't publish the results. We, therefore, estimate its emissions based on (1) its freight tonne km footprint across its key business segments, and (2) its size relative to other freight forwarding businesses that do. Consequently, we estimate that its Scope 1-3 emissions total ~1.1mTCO_2e (shown in Figure 54), though recognise that >90% of its emissions will be Scope 3 relating to airfreight, shipping lines and owner-drivers.

Currently MFT incurs a financial cost for emissions in New Zealand and Europe.

As more jurisdictions impose carbon pricing mechanisms, MFT's carbon related cost will increase. However, given its cost is largely third party related, we expect it to be passed onto customers within its pricing mechanisms. Therefore, the direct financial implications will be limited, in our opinion.

Figure 54. Estimate of MFT's global greenhouse gas emissions

	FY19 volume (tonnes'000)	Carbon# (g/tonne-km)	Average weight (tonnes)	Average distance (km)	CO_2 (T)
Airfreight	127.4	588.5	1.0	8,000	599,799
Seafreight (kTEU)	342.7	6.1	14.0	8,000	234,160
Transport					
New Zealand	2,447		1.0		
- road	2,447	71.5	0.8	400	55,987
- rail	2,447	28.0	0.2	1,000	13,703
Australia	1,142	71.5	1.0	300	24,496
Americas	210	71.5	1.0	4,000	60,070
Europe	3,549	71.5	1.0	400	101,507
Warehousing (m^2)*	678.7				35,000
Total					**1,124,723**

Source: MFT, Forsyth Barr analysis * DHL has 6.0% share of EU215.9bn global market and emits 2.1MT of CO_2. MFT has NZ$346m of warehousing revenue globally = EU200m, or 0.1% market share # unit emissions based on DSV's 2019 disclosures rather than materially higher average data provided by the New Zealand Ministry for the Environment.

MFT's key emissions reduction strategies are:

- Maintaining modern low emissions fleets
- Improving intensification
- Ensuring contractors are well positioned to invest in new technology when they are available
- Trial small non-fossil fuel variants where it makes sense

Auckland Airport impact a function of airlines

Auckland Airport (AIA) facilitates carbon intensive airlines to arrive and depart New Zealand but has a relatively small carbon footprint itself. Its disclosed emissions do not incorporate in-flight or surface airline emissions within its Scope 3 disclosure. However, there is an argument that AIA should include airline emissions within its Scope 3 and an interest in doing so.

AIA does acknowledge that it has a role to play in helping reduce airline emissions at the airport (along with Airways) through:

- Optimising approach and take-off
- Minimising taxi time / distance
- Providing ground power
- Providing preconditioned air

If AIA included airline emissions (surface and in flight for departing airlines) then we estimate its Scope 3 emissions would increase by 3.3mT CO_2e (see Figure 55).

While the level of its airline related emissions is largely irrelevant from an immediate financial impact perspective, AIA is heavily exposed to the longer term implications on airlines. Any reduction in air travel as a result of the industry's emissions profile could have a significant impact on AIA.

Figure 55. Estimating airline emissions for flights departing AIA (millions of tonnes)

	Air New Zealand (latest emissions disclosure)	Auckland Airport (departures only)
International services		
Capacity (ASK, 2019)	37,510,143,199	39,746,481,968
Scope 1 emissions (a)	2,903,146	3,076,230
Emissions per ASKm	77.4	77.4
Domestic services		
Capacity (ASK, 2019)	7,109,283,098	3,395,481,931
Scope 1 emissions (b)	556,404	265,745
Emissions per ASKm	78.3	78.3
Total AIA emissions		**3,341,976**

Source: OAG, Forsyth Barr analysis

Other transport companies

Freightways (FRE) has been reporting on its carbon emissions since 2014. While it has a large fleet of owner-drivers, which are on the road typically for c.12 hours per day, and uses aircraft and heavy vehicles for line-haul, its Scope 1–3 carbon emissions are relatively low (~45,000T).

Nonetheless, the perception of couriers being heavy emitters is something FRE will need to manage. In this regard its NZ Couriers and Kiwi Express operations are CarboNZero certified organisations and both offset 100% of emissions with verified New Zealand carbon credits.

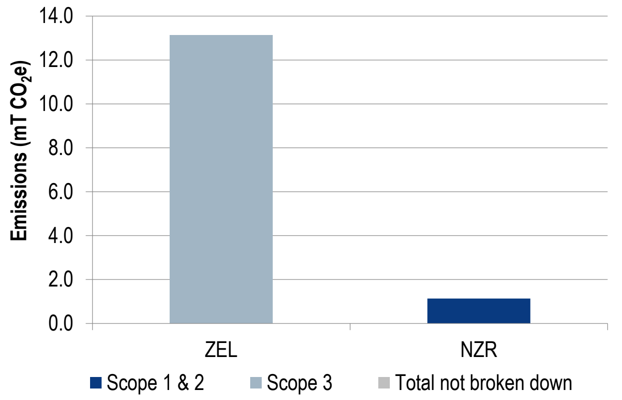
Port of Tauranga's (POT) emissions largely reflect (1) diesel emissions from diesel powered container handling equipment (such as straddle carriers) and floating plant (tug vessels), (2) rail freight emissions (from Metroport trains), and (3) waste to landfill associated with disposing of contaminated log yard sweepings. Like AIA its Scope 3 emissions do not include bunker fuel emissions from vessels departing the port. POT is targeting net zero emissions by 2050.

Napier Port's (NPH) carbon footprint is small though its reported carbon emissions for Scopes 1–3 of 8,428T in FY19 exclude rail freight emissions from the rail services it facilitates for exporters.

Oil & gas sector

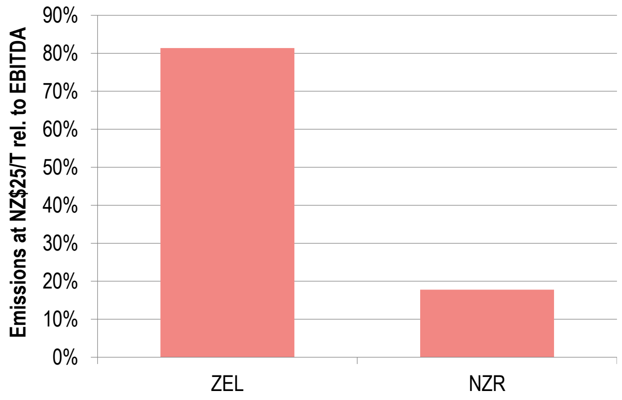
The long-term prognosis for the oil and gas sector is not great in a de-carbonising world. The electrification of transport will, in time, reduce demand for fossil fuels. Whilst Z Energy (ZEL) has some of the highest carbon emissions in the market (#2 behind Fonterra on a total emissions basis), they are largely Scope 3 emissions. In contrast, Refining NZ's (NZR) emissions are all Scope 1 and 2 and the potential impact from rising carbon prices is more material.

Figure 56. Latest annual carbon emissions for oil & gas companies



Source: Forsyth Barr analysis

Figure 57. Profit exposure to carbon costs



Source: Forsyth Barr analysis

Z Energy — Big emissions, limited direct impact

Land transport fuel emissions account for ~19% of New Zealand's gross carbon emissions. With ZEL's market share of land transport fuels at ~45%, it sells products that have a material impact on New Zealand's carbon footprint.

Whilst at one level it is counter-intuitive, ZEL has been a market leader in promoting sustainable practises, having invested in bio-fuels and investigated other low emissions technologies. In a large part this is because it recognises that a head-in-the-sand approach to fossil fuel emissions will lead to eventual extinction for the business.

ZEL's Scope 1 emissions are immaterial at 0.03% of its total FY19 reported emissions. Downstream customer use of its products was 11.6m tonnes CO_2 in FY19, 88.5% of total emissions, with a further 1.5m tonnes from upstream activities (refining and supply chain).

Figure 58. ZEL FY19 CO_2 emissions

	CO_2 tonnes
Scope 1	3,837
Scope 2	4,195
Scope 3 - customer emissions	11,640,509
Scope 3 - other (mainly supply chain related)	1,500,512
Total	**13,149,053**

Source: ZEL, Forsyth Barr analysis

Whilst ZEL does not emit much carbon directly, it is one of the businesses required to relinquish carbon units because of the product it sells. Carbon costs are a 100% pass through as all of its competitors face the same charges and fuel is a commodity.

The long-term impact from carbon comes from falling demand. However, the carbon cost is a relatively small part of the underlying cost of the product — ~3% for petrol and ~5% for diesel (excluding road user charges, including road user charges and the carbon cost is also ~3%). The high level of Government levies and taxes is the main reason carbon costs are such a small component of the overall pump price.

Figure 59. Cost of carbon at the pump

	CO_2 emissions kg/litre	CO_2 cost/litre (incl GST) cpl	% of pump price
Regular petrol	2.34	6.7	3.1%
Premium petrol	2.36	6.8	2.9%
Diesel	2.67	7.7	5.1%

Source: Forsyth Barr analysis

The main reason we expect fuel demand to decline isn't because carbon costs will increase making fossil fuels uneconomic, it's the expectation that electric vehicles will fall in price such that they are more economic than fossil fuelled vehicles (on a lifetime cost basis).

Overall impact for ZEL

ZEL is able to pass on carbon costs to its end users, hence, there is no direct exposure to earnings from higher carbon costs. Over time, carbon costs are likely to remain a small percentage of total fuel costs, hence, carbon prices are unlikely to directly influence demand. It is the lower cost of electricity as a transport fuel (~30c/litre equivalent) that will result in reduced demand for fossil fuels.

Refining NZ — Legacy agreement provides protection, but only in the short-term

NZR emits ~1m tonnes of carbon per annum as part of the refining process. However, it has not disclosed other GHG emissions.

NZR currently does not have any direct carbon exposure, due to its Negotiated Greenhouse Agreement (NGA). The NGA between NZR and the Crown, signed in 2003, is a remnant of New Zealand's first attempts to price carbon. The NGA required NZR to reduce carbon emissions and expires at the end of 2022. NGAs became redundant when the ETS regime was put in place and NZR is the only company still with an NGA.

NZR is currently negotiating with the Government to enter the ETS from the end of 2022 as a "trade-exposed" industry. Whilst it is expected NZR will be treated as a trade-exposed industry, as yet there has been no decision by the Government. If NZR is not treated as a trade-exposed industry, it will need to provide carbon units for 100% of its ~1m carbon emissions. At 10% exposure, carbon costs are ~NZ$2.5m, immaterial in the context of ~NZ$190m EBITDA. However, 100% exposure increases carbon costs to ~NZ$25m, which would have a material effect on NZR's underlying value.

This is an important issue, as carbon costs are a cost of production for NZR and cannot be passed onto its three customers. If NZR is exposed to 100% of its carbon emissions, and its offshore competitors are not, it will be at a competitive disadvantage.

Longer-term, we expect NZR to be impacted by a gradual decline in demand for liquid fossil fuels. At some stage (post-2040) we expect it will convert to an import terminal — which will only be brought forward if NZR is unable to be treated as a trade-exposed business.

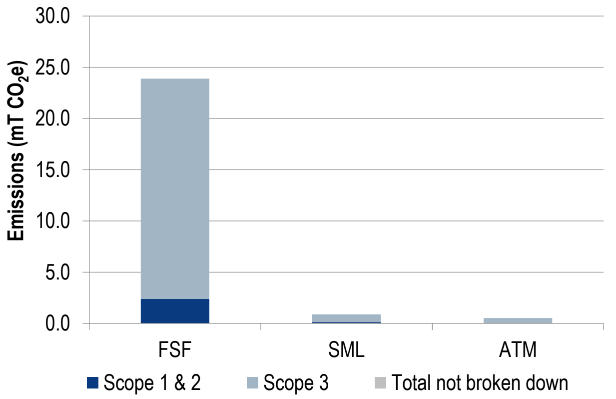
Dairy sector

The dairy industry accounts for about half of New Zealand's agricultural emissions, or 23% of New Zealand's total GHG emissions (Dairy NZ). This is predominantly produced on-farm (~85%), with the remainder through processing (~10%) and transport (~5%). Agricultural production is already facing significant disruption from changes to climate and increased variability of weather patterns. This, and growing public/government/consumer scrutiny, means changes must be made to reduce its impact on the environment.

Over the last 25 years farmers have become more efficient and reduced emissions intensity, however, significantly more progress is needed in our opinion. The sector appears cognisant of the need to change, but the roadmap and measures to achieving its own ambitious goals are still being worked through.

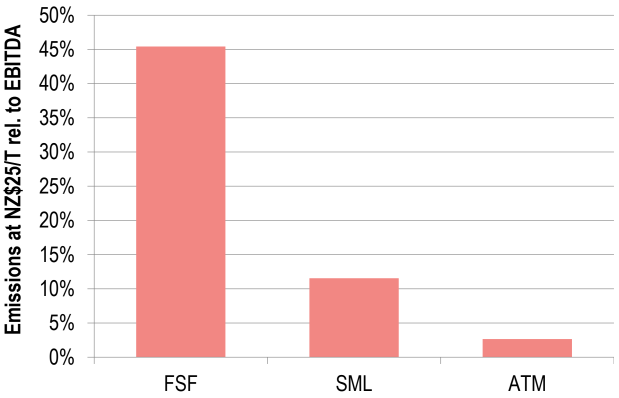
The NZ listed dairy companies are being proactive with bold targets, good disclosure on their current GHG emissions and various initiatives underway to reduce emissions. Fonterra is unsurprisingly most exposed, while the biggest challenge for the sector is reducing natural animal emissions.

Figure 60. Latest annual carbon emissions for dairy companies



Source: Forsyth Barr analysis, Company reports

Figure 61. Profit exposure to carbon costs



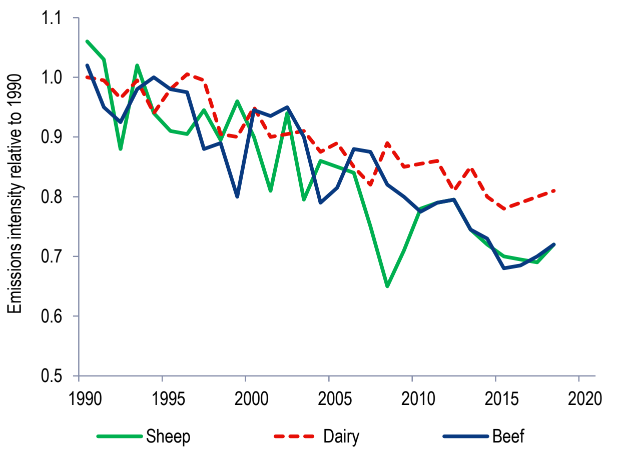
Source: Forsyth Barr analysis, Company reports

Trajectory — emissions intensity improving, but emissions still increasing

Although emissions intensity (the emissions required to produce a kilogram of meat or milk powder) has improved, overall emissions from agriculture continue to climb because farmers are producing more.

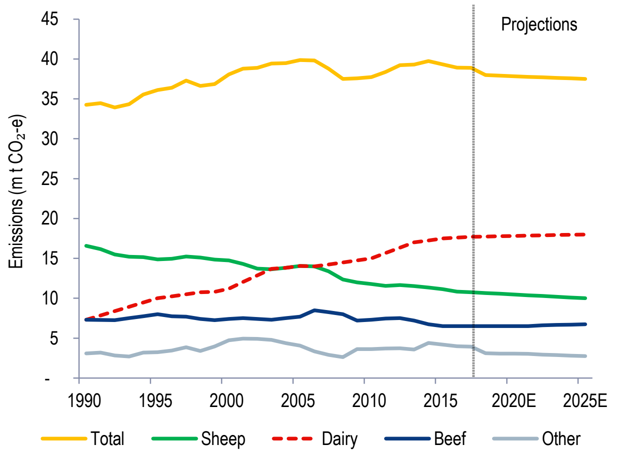
- **Reduced emissions intensity:** Over the last 25 years, farmers have become more efficient and have reduced emissions intensity by about -1% each year. Initiatives include:
  - Selective animal breeding,
  - Improved pasture & feed management,
  - Fencing off marginal land and planting
  - Improved animal health, and
  - More effective use of fertiliser.
- **Despite this, emissions have still increased:** Total emissions from agriculture have increased +13.5% from 1990 to 2017. Emissions from the dairy sector have more than doubled over the same time period.

Figure 62. Emissions intensity (i.e. emissions per unit of product)



Source: Forsyth Barr analysis, Ministry for the Environment, Statistics NZ

Figure 63. NZ's actual and projected agricultural emissions



Source: Forsyth Barr analysis, Ministry for the Environment (done in 2017)

New Zealand dairy sector compares favourably globally

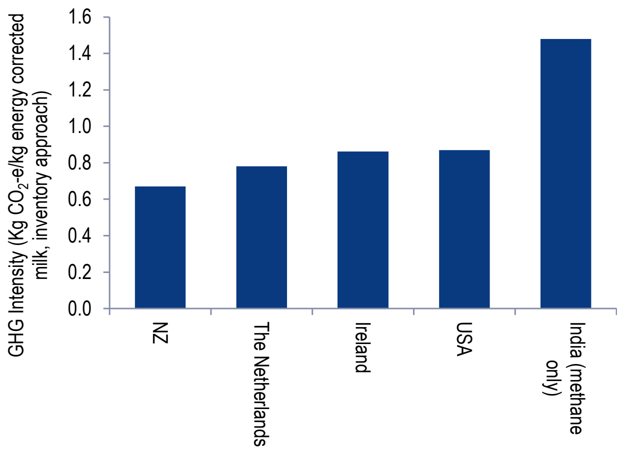
New Zealand's pasture-based farming systems have lower GHG emissions than most of the meat and milk produced around the world. While reducing our dairy production would lower emissions, there are unintended environmental consequences if this is simply replaced with production elsewhere.

GHG intensity — New Zealand compares favourably

Comparing GHG emission intensity across countries is not a simple exercise, but various methodologies indicate NZ's dairy-based GHG emissions are best in class on an intensity basis[1]. Emissions are an estimated 40% lower per litre of milk than the global average.

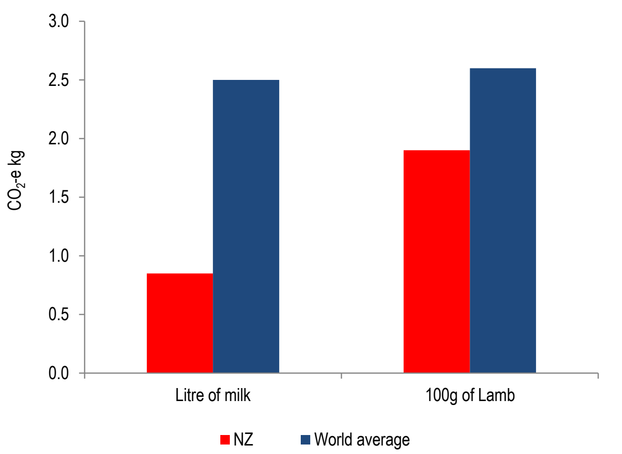
- Method 1: New Zealand's GHG intensity measured as 0.67 kg/energy corrected milk vs various other countries ranging from 0.86 to 1.48.
- Method 2: Using kg CO_2e per kg of milk for a full pre-farm gate life cycle assessment, New Zealand is also at world-best levels at 0.89 (including land-use change). This compares to the global average of 2.4 (range 1.0 and 7.5 kg CO_2e per kg of milk produced).

Figure 64. Dairy emissions, GHG intensity – NZ vs global peers



Source: Fonterra's Jeremy Hill analysis. Based on publically available emissions data from UNFCCC and industry milk product data. Emissions intensity expressed in CO_2e (CH_4 = 25, N_2O = 298). NB some on-farm emissions are excluded, notably from nitrogen fertiliser, and methodologies also vary by country which limits comparability

Figure 65. Emissions efficiency of NZ meat and milk



Source: Forsyth Barr analysis, Food and Agriculture Organisation of the United Nations, Massey University

New Zealand production supports global dairy consumption…

New Zealand produces a large amount of milk relative to the size of the population. Circa 90% of dairy emissions are associated with consumption of that dairy in other countries.

[1] https://www.interest.co.nz/rural-news/88406/fonterras-jeremy-hill-points-out-if-worlds-dairy-producers-were-emissions-efficient

…hence simply reducing our dairy could see unintended consequences

Even with relatively long distribution chains, the consumption of milk produced by New Zealand in some export markets can result in a much lower global carbon footprint than if that milk had been produced locally.

Reducing carbon emissions by lowering dairy production would contribute to New Zealand meeting its Nationally Determined Contribution under the Paris Agreement, however would also result in an increase in global GHG emissions if that milk were simply to be replaced by more emissions-intensive production elsewhere.

What does this mean in terms of cost?

It is apparent that reducing the sector's impact on the environment will increase the cost of doing business on farm and through the supply chain. What is less clear is how the cost burden will be spread.

No 'silver bullet' and impact of initiatives vary by farm

Various modelling and scenarios have been trialled which clearly shows each farm is different — hence, the impact of any system change can vary considerably depending on the starting point. While a reduction in stocking rate is often proposed as a 'silver bullet' mitigating strategy, the resultant impact on farm profitability can vary, depending on where the farm sits on its profitability curve.

Figure 66. Scenario modelling of dairy on-farm system change

	Change in GHG	Change in EBIT
Reduce stocking rate by 10%		
Farm 1 (pre: 2.7 cows/ha, 4.9 tDM/cow offered)	-6%	12%
Farm 2 (pre: 2.8 cows/ha, 5.4 tDM/cow offered)	-7%	-4%
Farm 3 (pre: 2.3 cows/ha, 5.0 tDM/cow offered)	-8%	-3%
Farm 4 (pre: 2.9 cows/ha, 5.9 tDM/cow offered)	-6%	11%
Replace N fertiliser with bought-in feed	-11%	-18%
In-shed feeding with increased cow numbers	11%	12%
In-shed feeding, no increase in cows	10%	9%
Grow maize instead of buying in PKE	-4%	0%
Limit N fertiliser to 100 kgN/ha	-5%	-12%
Shift to once-a-day milking	3%	21%

Source: Forsyth Barr analysis, New Zealand Agricultural Greenhouse Gas Research Centre

Farmers ~3% lift in break-even milk price, at today's carbon price

The current breakeven price for the average dairy farmer is NZ$5.88/kgMS (Dairy NZ). Under a scenario where emissions are priced (at $25 per CO_2e tonne) it is estimated this would lift the breakeven milk price to >NZ$6.00/kgMS. Using an average farm (433 cows at peak milk), this implies an additional cost of NZ$21,650 or c. 3% lift in expenses.

~35% of New Zealand's dairy debt is tied up in farms that require a break-even price, before the inclusion of GHG, of $6.20/kgMS, the addition of GHG emissions would create meaningful pressure. Particularly when considered relative to the FY19 Farmgate milk price of NZ$6.35 and initial FY20 forecast of NZ$6.55–7.55.

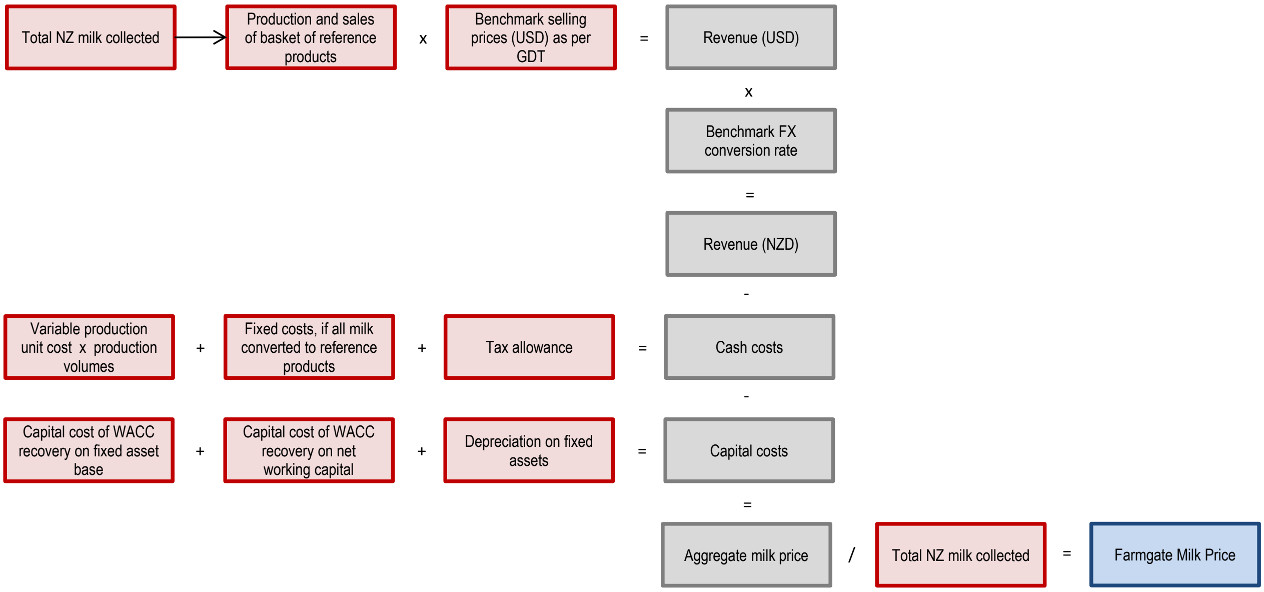
The Productivity Commission believes a carbon price rising to between NZ$75-150/tonne is required for New Zealand to transition to a low-emissions economy while to achieve net-zero emissions the carbon price needs to rise to between NZ$150-250/tonne. This would materially dent farm economics (all else equal).

Processors — milk price manual limits direct exposure

The price paid for milk in New Zealand is set based on the Fonterra Farmgate Milk Price Manual (and linked to it for processors other than FSF) — consistent with Fonterra earning an appropriate risk-adjusted rate of return on its manufacturing assets, subject to achieving benchmark performance targets. Under this framework, it would limit the processors' direct exposure to additional opex/capex associated with reducing emissions.

However in reality, we expect the cost burden will need to be spread across the supply chain to support wide-spread change and given commercial realities. As an example, SML already provides a premium payment to incentivise various on-farm behaviours — which help provide some offset for farmers' additional costs.

Figure 67. Summary of the Farmgate Milk Price methodology



Source: Forsyth Barr analysis, Fonterra

Other considerations

- **Consumer preferences:** Consumer demand and preferences is a key driver of supply over time. With growing awareness and focus on carbon emissions, there is risk around perception of the dairy sector and its associated consumer products. This could also be influenced by relative pricing of substitute products as various countries work through how to price emissions.
- **Pricing relativity:** With each country currently taking different approaches to pricing carbon, this can impact pricing relativity. Should we reach a point of a global carbon price, the New Zealand dairy sector would likely see a lift in its competitive advantage versus global dairy, given lower GHG intensity.
- **'Peak cow'?:** Commentators all tend to agree that the New Zealand dairy industry is past its growth phase — with focus continuing to shift from volume to value. NZX's Dairy Outlook forecasts cow numbers will decline from 2020 to 2025, with forecasts for average milk production to ease -1.7% per annum over that period. This is helpful in terms of overall GHG from the sector.
- **Land use:** Debate about the best use of land will likely continue, particularly as New Zealand looks for ways to offset its emissions.

Policy — slow change for the sector

While emissions from all other sectors are priced through the New Zealand Emissions Trading Scheme (NZ ETS), the agricultural sector is currently exempt. The Climate Change Response (Zero Carbon) Amendment Bill — as it relates to the dairy sector — is currently set to reduce biogenic methane emissions to -10% below 2017 levels by 2030 and -24% to -47% below 2017 levels by 2050.

Policy intent is to price livestock emissions at the farm level and fertiliser emissions at the processor level from 2025. There is some flexibility should farm-level pricing not be deemed cost-effective or feasible, with the back-stop being pricing this at processor level.

In the interim, there is a commitment from the industry to work collectively with government and iwi. Including to:

- Design a practical and cost-effective system for reducing emissions at farm level
- Design a farm-level pricing mechanism/scheme
- Ensure farmers and growers are equipped with knowledge and tools to deliver emissions reductions

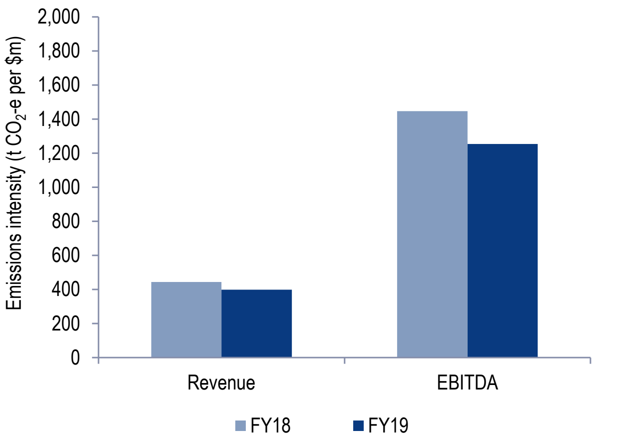
The a2 Milk Company — reliant on third parties

ATM's disclosure on carbon, and sustainability more broadly, increased materially in its FY19 Annual Report. Unsurprisingly ATM's GHG emissions are predominantly outside of its direct control being almost entirely Scope 3 and predominantly on-farm emissions. Any changes are thereby reliant on its third party manufacturers (i.e. SML and FSF) to influence their third party suppliers (i.e. farmers). Despite the obvious challenge this creates, the company is making a pointed effort to understand the full extent of its broader carbon footprint, alongside offsetting this through purchasing carbon credits.

Key points of note

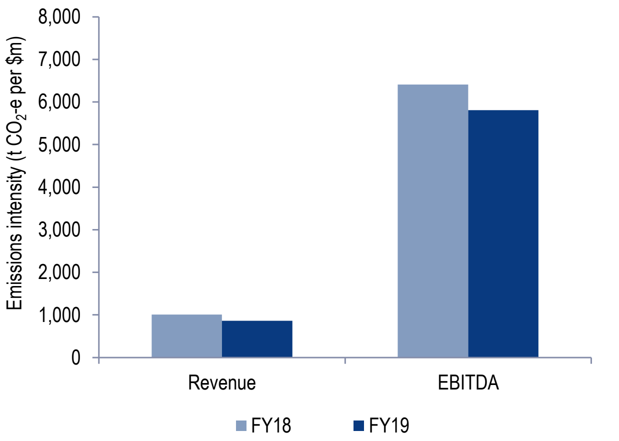
- **A commitment to remain carbon neutral across its supply chain:** With emissions to be offset via purchasing carbon credits. ATM first achieved carbon neutral in FY19.
  - Direct and indirect emissions to be offset through purchasing carbon credits sourced from projects in its key markets (ANZ, US and China).
  - Assuming a price of NZ$25/tonne for carbon (used currently in New Zealand), we estimate this would cost ~NZ$13m, or ~1% of ATM's revenue. Given China's cost of carbon is currently materially lower than that of New Zealand, the reality will likely be significantly lower. The price would need to lift to >NZ$125/tonne (all else equal) before its commitment to carbon neutral becomes of materiality (5% threshold) on its NZ$1.3bn revenue base.
  - In FY20 its goal is to link these offset investments back to environmental farming programmes and projects which can directly assist farmers.
- **Highly dependent on third parties:** Any change is reliant on its supply chain partners, particularly Synlait, and their initiatives to drive on-farm changes.
- **Target for all farms supplying ATM to have environmental plans by 2021** covering the four material issues of GHG emissions, soil quality, water quality and biodiversity. Currently 78% of farms have this plan (at FY19).
- **Difficult to exactly measure, data quality a work in progress:** ATM's GHG emissions data is predominantly reliant on estimates (using the approach recommended by The GHG Protocol), with Scope 3 "a conservative estimate". The company has a focus on improving data quality moving forward.

Figure 68. Emissions intensity - ATM



Source: Forsyth Barr analysis, Company reports

Figure 69. Emissions intensity - SML



Source: Forsyth Barr analysis, Company reports

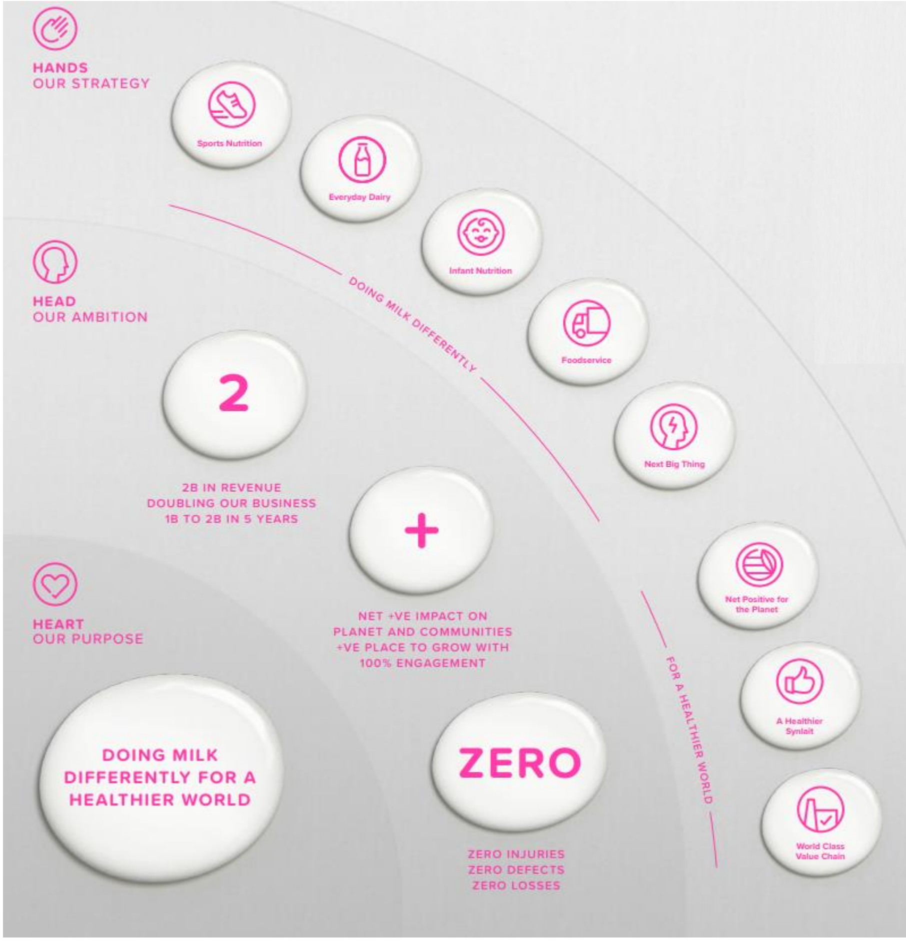
Synlait Milk — *"doing milk differently for a healthier world"*

SML represents ~4% of New Zealand's milk pool, however >1% of its total footprint for GHG. While small in the context of the farming industry, the company wants to take a leading position and educational role for what is possible.

SML provides particularly impressive disclosure around its carbon footprint, broken down by line-item. This includes a Sustainability Report and separate Greenhouse Gas Inventory Report. Recent strategy shows a growing emphasis on sustainability, with a range of self-defined 'bold' 10-year targets set in 2018 and reinforced by the company by-line "doing milk differently for a healthier world".

SML is taking a proactive approach on addressing the challenges in its sector. A number of its initiatives underway see SML take some (or all) of the capex/opex risk from changes to support carbon reductions. How the burden of cost is eventually shared is unclear, however, front-footing the necessary change is sensible, particularly for a premium processor.

Figure 70. Sustainability right through SML's strategy



Source: Forsyth Barr analysis, Company reports

SML 10yr targets around carbon

Within its sustainability strategy, SML has 10 year climate change reduction targets as follows (off an FY18 base-line):

- Off-farm: 50% reduction in CO_2e per kg of product
- On-farm: 35% reduction in CO_2e per kg of milk solids
  - 50% reduction in N_2O per kg of milk solids
  - 30% reduction in CH_4 per kg of milk solids
  - 30% reduction in CO_2 per kg of milk solids

The company has indicated the rationale for these targets are (1) responding to New Zealand's demand for improvement from the dairy industry, (2) its global customers (and their consumers) rapidly changing expectations around caring for the planet.

Initiatives underway

- **Pursuing B Corp certification:** SML has been working towards this for ~18 months.
- **Incentive programmes in place:** SML's Lead with Pride programme offers incentives to farmers for "doing the right thing" in terms of best standards of animal welfare, milk quality, environmental sustainability and staff and community wellbeing.
  - As at FY19, 49% of its suppliers are certified Lead with Pride (vs. 28% in FY18).
  - The company has added a financial incentive for farmers who understand measure and mitigate on-farm emissions.

- **All farms supplying SML have an Environment Plan:** Awareness is cited as one key barrier to change. SML has been working with farmers, with all suppliers having an individual Environment Plan and data on GHG emission inventory since FY17 (i.e. three years of data).
- **Its climate change targets are to be reviewed by the end of FY20**
- **Commitment not to install another coal boiler:** SML installed New Zealand's first large-scale electrode boiler in Dunsandel in early 2019. Capacity will initially be 6 MW, with the ability to lift this to 12 MW.
  - The boiler operating costs are around double that of a coal burner over a 10yr period. The boiler is up to 30% more efficient vs coal burners, with carbon equivalent saving of 13,714 tonnes CO_2e/year
- **Working towards setting an internal cost of carbon**
- **SML believes it can meet its ambitious targets with today's technology:** The company is trialling an array of technology and solutions to support its targets.
  - This includes initiatives around Pastural Robotics (designed to dissipate end loss and spread out urination patches in soil), soil irrigation probes (to inform irrigating decision making — with nitrous oxide mainly from over-irrigating)

Cost of doing business rises, key question is who will bear the cost?

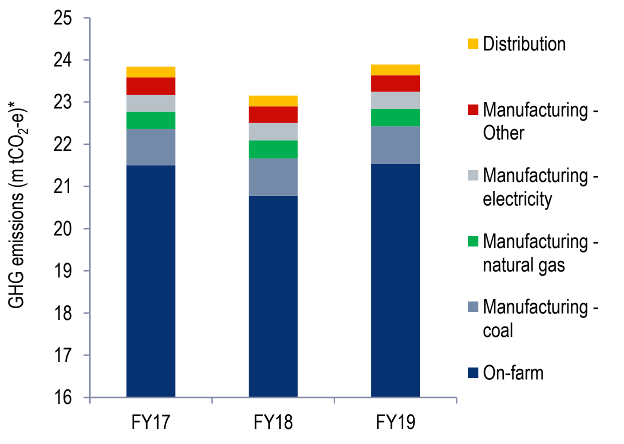
SML is already implementing and making decisions on more than just economics / profitability (with the recent electrode boiler the most obvious example). Our analysis of its strategy points to SML choosing to take at least some of the capital/cost risk (i.e. capex and/or through incentive payments to farmers to cover at least some of their costs) from front-footing changes required to lower its emissions. We view SML's proactivity as sensible, particularly given its premium positioning. However — how the burden of higher cost is eventually shared between the various supply chain participants (i.e. farmers, processors, transport, brand, customer) is less clear. Early indications also suggest some of the lift in cost of doing business can be mitigated via efficiencies.

Fonterra — near the beginning of the uphill battle

For Fonterra and its farmer owners the challenge of climate change and addressing GHG emissions is significant. Fonterra makes up ~20% of New Zealand's emissions, broken down into 90% on-farm, 9% from manufacturing and the remaining 1% from distribution.

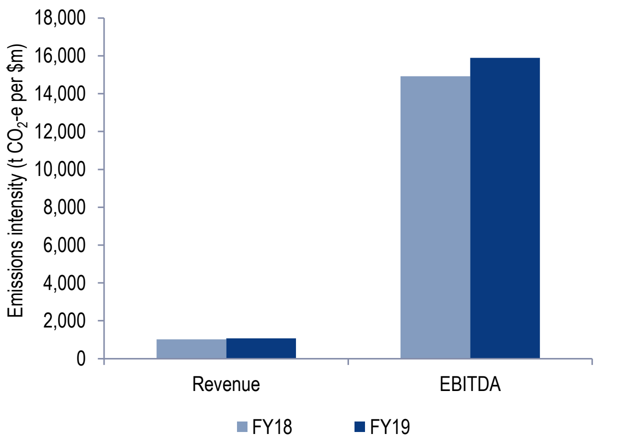
While the co-op has started on the journey, there is considerable work to do to reach its targets. A comprehensive array of mitigating activities will be required, including some which don't currently appear technically and/or commercially viable.

Figure 71. Emissions breakdown



Source: Forsyth Barr analysis, Company disclosures *Axis started at 16m for better appreciation of movementments outside of on-farm emissions (which make up ~90% of emissions)

Figure 72. Emissions intensity



Source: Forsyth Barr analysis, Company reports

FSF targets around carbon

- 20% reduction in manufacturing energy intensity (energy per tonne of production) by 2020 from an FY03 baseline.
  - Current status: 19.5% reduction as at FY19 (FY18 19.3%; FY17 17.8%)

- 30% reduction in absolute manufacturing emissions by 2030 from an FY15 baseline
  - Current status: 3.5% reduction as at FY19 (FY18 2.5%; FY17 4.6%)
- Neutral net change in GHG emissions from dairy farming to 2030 from FY15 base
  - Current status: 864,000 reduction as at FY19 (FY18 1,174,000). Underlying emissions intensity on farm is 2% higher than the FY15 baseline.

Initiatives underway

- **Measuring success through "triple bottom line reporting":** This includes measuring the health of: (1) its staff (injuries at work), (2) the environment (% of farms with a Farm Environment Plan), and (3) the business (NPAT)
- **Independent Sustainability Advisory Panel:** The six member panel (established in 2018) is in place to advise the board and senior leadership team on "Fonterra's roadmap towards a sustainable future"
- **Farm Environment Plan progress:** 23% of Fonterra farms currently have a plan, with the co-op targeting to lift this to 100% by 2025.
- **Transitioning from coal:** Early trials are being undertaken at small sites through converting the boiler (to shift away from coal towards wood biomass)
  - **Brightwater:** The boiler was converted to allow a co-firing approach with wood biomass and coal. It went live on November 2018 and is expected to save ~2,400 tonnes of CO_2e per annum.
  - **Te Awamutu:** The coal boiler was tested exclusively running on wood pellets instead of coal. This highlighted some practical challenges, including security and quality of wood pellet supply on a cost effective basis. If full conversion proceeds it would save ~84,000 tonnes of CO_2e per annum.

Key challenges include:

- Finding economically viable alternatives to coal, at scale. One third of FSF's New Zealand manufacturing sites, particularly in the South Island, still rely on coal. The key challenge is security and quality of supply for alternatives, specifically wood biomass
- The time, cost and complexity of implementing new initiatives across its vast supply chain
- Identifying breakthrough technologies that can provide a step reduction in biological emissions from cows, particularly without unintended consequences (such as moving away from pasture-fed systems and cows spending more time in a shed)
- As discussed above, the Farmgate Milk Price Manual for setting milk price (FSF's key input cost) limits its direct exposure to additional opex and capex associated with reducing emissions. However we expect commercial reality and FSF's co-op structure will mean at least some of the cost burden will be shared.

Building sector

Fletcher Building — dominated by cement

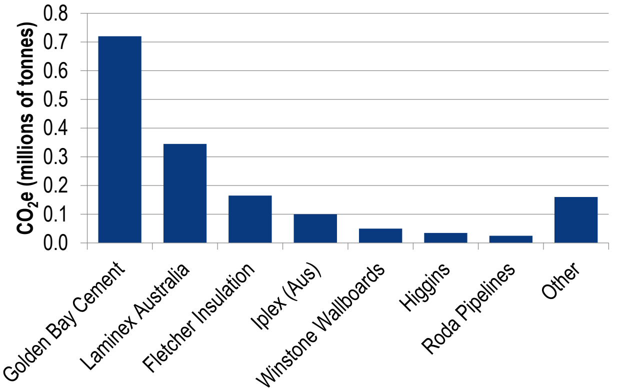
The majority of Fletcher Building's (FBU) Scope 1 and 2 emissions are from (1) its Golden Bay Cement plant in New Zealand (c.47% of total emissions), and (2) direct and indirect energy across its Australia businesses, most notably Laminex, Fletcher Insulation, and Iplex (c.43% of total).

Figure 73. Fletcher Building carbon emissions (tonnes CO_2e)

	FY17	FY18	FY19
Scope 1	988,066	1,070,669	962,623
Scope 2	336,788	347,423	335,643
Total	**1,324,854**	**1,418,092**	**1,298,266**
Total (excl. divested international)	1,238,380	1,146,788	1,298,266

Source: Company reports, Forsyth Barr analysis

Figure 74. Fletcher Building carbon emissions



Source: Company reports, Forsyth Barr analysis

Cement production is a carbon intensive process which produces c.8% of global carbon emissions. c.70% of cement's emissions comes from the decarbonisation of limestone, and c.30% from the use of thermal fuels in the process. Current technology initiatives to reduce carbon emissions from cement production are largely limited to the reduction of thermal fuels.

FBU has committed to achieving a 30% reduction in its Scope 1 and 2 emissions by 2030, which is aligned with the Paris Accord. Specific near-term initiatives include: (1) alternative fuels at Golden Bay — a project to introduce tyre-derived fuel is planned to be commissioned in 1H CY20, and will replace 20% of coal and 40% of iron sand consumption, and (2) cogeneration energy at Laminex Australia's Gympie site. FBU continues to explore other fuel alternatives at Golden Bay such as biomass and natural gas.

Many of FBU's businesses including Golden Bay Cement, Laminex, and Fletcher Insulation compete against imports. The extent to which any cost escalation is able to be recovered through pricing will depend on consistency of carbon pricing across countries and jurisdictions, including transport costs. There is a risk of "carbon arbitrage", of substituting production in a high carbon priced country for production in a low priced country.

Longer-term, there is risk of technology change including in concrete, which could leave the Golden Bay cement plant obsolete. Globally there is a significant amount of research and development focussed on reducing the carbon footprint of concrete, including options of creating concrete using less or no cement. An increasing cost of emissions will incentivise innovation and make alternative options more cost competitive.

Other building sector companies

Neither **Steel & Tube** (STU) nor **Metro Performance Glass** (MPG) disclose their emissions. We expect Scope 1 and 2 emissions from both are relatively modest; however, the upstream (Scope 3) emissions by suppliers who produce steel and glass will be significant.

Given STU, MPG, and their competitors all face a similar global price for inputs, we expect any escalation in cost due to carbon emissions will effectively be passed through to customers.

Appendices

Appendix 1: The different greenhouse gases

There are four main GHG that tend to be focussed on due to humans ability to have a direct impact on them:

- **Carbon dioxide (CO_2):** Carbon dioxide enters the atmosphere through burning fossil fuels, solid waste, trees and other biological materials and also certain man-made chemical reactions such as cement manufacturing.
- **Methane (CH_4):** The main human source of methane is from the extraction, production, transportation and use of fossil fuels. Other sources of human made methane include livestock farming and landfills.
- **Nitrous oxide (N_2O):** The main source of man-made nitrous oxide emissions is from agriculture (fertilising soil and livestock manure) and the use of fossil fuels.
- **Fluorinated gases:** Fluorinated gases differ from the other main GHG as they are almost entirely human-made. Fluorinated gases are used in products like refrigerators, air-conditioners and aerosols. New Zealand has made a large effort in completely phasing out some fluorinated gases such as chlorofluorocarbons (CFC's) while it is in the process of phasing out the substitute for CFCs, hydrofluorocarbons.

Carbon dioxide, methane and nitrous oxide are also all emitted through natural sources, however, the Earth has natural sinks, such as forests and oceans which partially offset these natural emissions and keep the world in balance.

The effect each gas has on climate change depends on three main factors: how much is in the atmosphere, how long it stays in the atmosphere and how strongly it impacts the atmosphere. Global warming potential (GWP), a standard reporting metric adopted by the United Nations measures the ability of a GHG to trap heat in the atmosphere over time relative to carbon dioxide. Multiplying GWP by the weight of the gas gives a carbon dioxide equivalent (CO_2e) and enables a common scale to compare and report GHG emissions.

Figure 75. Global warming potential of main GHG

	Atmospheric lifetime (years)	GWP (100-year time frame)
Carbon dioxide	50-200	1
Methane	9-15	20-30
Nitrous oxide	120	280-300
Fluorinated gases	2-50,000	Typically >1000

Source: United States Environmental Protection Services, Forsyth Barr analysis

Appendix 2: Glossary

Figure 76. Glossary

Term	Comment/explanation
CaT	Cap and trade scheme
CCC	Climate Change Commission
CCGT	Combined-cycle gas turbine
CCR	Cost containment reserve
CO_2e	Carbon dioxide equivalent
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
Drylandcarbon	A limited liability partnership that will see Air New Zealand, Contact Energy, Genesis Energy and Z Energy, invest in the establishment of a geographically diversified forest portfolio to sequester carbon.
ETS	Emissions trading scheme
FPO	Fixed price option
Free allocation	The New Zealand Government provides free NZUs to some sectors to reduce the cost impacts of the NZ ETS on those sectors.
GHG	Greenhouse gas emissions
Gross GHG	Total amount of GHG before offsets
LULUCF	Land use, land-use change and forestry
Net GHG	Total amount of GHG less offsetting factors
NGA	National Greenhouse Accounts
NZ ETS	New Zealand emissions trading scheme
NZU	New Zealand (emissions offset) unit
OCGT	Open-cycle gas turbine
TCFD	Task Force on Climate-related Financial Disclosures
Trade-exposed	Industries where NZ ETS costs are unable to be passed on to consumers
UNFCCC	United Nations Framework Convention on Climate Change
ZCA	Zero Carbon Act

Source: Forsyth Barr analysis

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