**Resource Economics**

# Potential for emissions leakage from selected industries in the ETS

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Disclaimer

# Contents

# Summary

This report examines the expected impacts of emission prices on four industries that have previously been identified as emissions intensive and trade-exposed (EITE). We compile available data to analyse the extent to which they would be at financial risk if they faced the full costs of their emissions under the Emissions Trading Scheme (ETS), either directly as obligations to surrender New Zealand Units (NZUs) for process emissions or indirectly via increased energy prices which include the costs of NZUs.[1] The analysis uses financial and emissions data for the three financial years 2016/17, 2017/18 and 2018/19.

Table S1 sets out the percentage allocation of emission units the individual industries are currently entitled to, as a percentage of obligated emissions.[2] It also shows estimates of the historical allocations as a percentage of their emissions (including those from purchased energy fuels). All activities appear to be over-allocated with emission units, particularly cucumber production.

Table S1 Emission unit allocations

| Activity | Entitled allocation percentage | Estimated average actual allocation percentage |
|---|---|---|
| s 9(2)(b)(ii) | s | 105% |
| s 9(2)(b)(ii) | s | 98% |
| s 9(2)(b)(ii) | s | 124% |
| s 9(2)(b)(ii) | s | 305% |

The analysis here examines the impacts of zero free allocation to identify the risk of emission leakage. Leakage occurs when production falls in New Zealand but rises in some other country, meaning total emissions do not fall and may rise. Because these industries are all included in the NZ ETS, reductions in their emissions would not be expected to lead to reductions in total New Zealand emissions, rather they would be offset by increases in emissions of other activities covered by the ETS. Emissions leakage (and an increase in global emissions) is therefore expected when production shifts to another country in which emissions from these industries are not included within an emissions cap, as they are in New Zealand.

Financial risk is estimated as when the additional costs of emission units is greater than current estimated profit. The report compares emission costs, ie the costs of purchasing New Zealand Units (NZUs) to cover 100% of direct and indirect emissions from the individual activities in comparison with two estimates of profit:

- earnings before interest and tax (EBIT). If a plant or firm facing full emission costs is no longer estimated to achieve a positive EBIT, the activity would be expected to close at some time, ie to start to wind down production in New Zealand. This is because they would still be able to cover their unavoidable costs but could continue to obtain a profit by avoiding capital replacement; and

[1] The assumption in analysis is that NZU costs are fully passed on in energy prices.
[2] Under the ETS, NZU surrender obligations have increased from 50% of estimated emissions prior to 2017, to 67% in 2017, 83% in 2018 to 100% from 2019.

- earnings before interest, tax and depreciation of assets (EBITDA). If they are no longer able to achieve a positive EBITDA, they would be expected to close fairly immediately because they would no longer be able to cover their unavoidable costs.

Tables S2 shows our estimate of the emissions price at which the different thresholds would be reached; the numbers are rounded values (to the nearest $5/t) of those included in the text and analysis in the report.

Table S2 Approximate NZU price ($/t $CO_2$-e) at which different industry specific thresholds would be met

| **Criterion** | s 9(2)(b) [redacted] | s 9(2)(b)(ii) [redacted] | s 9(2)(b)(ii) [redacted] | s 9(2)(b)(ii) [redacted] |
|---|---|---|---|---|
| EBIT falls to zero: activity expected to wind down | $35/t | $20/t | $30 - $80 | $265 - $595 |
| EBITDA falls to zero: activity expected to stop | $50/t | $30/t | $130/t | $4[illegible]0 - $760 |

s 9(2)(b)(ii) [redacted]

# 1 Introduction

## 1.1 Objective of the Report

This report examines the expected impacts of New Zealand Unit (NZU) prices on four industries that have previously been identified as emissions-intensive and trade-exposed (EITE). Currently these industries are protected from the full costs of their emissions through free allocations of NZUs. The market value of the free NZU allocations is expected to partially compensate these industries for the costs they face either directly, when they have surrender obligations, or indirectly in the increased costs of energy inputs, assuming emission costs are fully passed on in increased energy prices.

We compile available data to analyse the extent to which there is a risk of emission leakage, ie for production to fall in New Zealand but rise in some other country, meaning total emissions do not fall and may rise. The four industries examined are producers of:

- Cement;
- Burnt lime
- Cartonboard; and
- Cucumbers.

## 1.2 Methodological Issues

The analysis in this report compiles data to improve the understanding of the risk of emissions leakage. Here we first set out the outcomes that might produce result in leakage and the data that might be used to estimate the risks.

### 1.2.1 What is Leakage?

Emissions leakage occurs where a measured reduction in emissions in one country is associated with an increase in emissions in another. Emissions from fossil fuel combustion and industrial processes in New Zealand are included in the Emissions Trading Scheme (ETS). Total emissions across all sources included in the ETS are determined by the aggregate supply of New Zealand Units (NZUs). Under a shrinking emissions cap (and thus shrinking NZU supply) emission reductions will occur in response to the NZU price, which would be expected to rise unless there is a change in demand for units.

Total emissions in New Zealand will decline within the shrinking cap. These reductions will be global emission reductions in most cases. For example, if there are improvements in the energy efficiency of production (eg more efficient industrial motors), fuel switching (eg increased use of electric vehicles) or overall reduction in consumption (eg less domestic air travel). However, if industrial production in New Zealand is replaced by production in some other country, this can lead to emissions leakage when those emission sources do not operate under an emissions cap in the other country. Leakage occurs regardless of whether production is more or less emissions-intensive than it is in New Zealand. The key factor is whether emissions from that industry are under a cap.

### 1.2.2 Risk Analysis

The risk of leakage is assessed as being likely if production is no longer viable in New Zealand when producers face the full costs of emission units, either directly (because they have surrender obligations) or indirectly in the costs of energy inputs. The full analysis of leakage would require an estimate of whether production would shift to another country which did not have a cap on total emissions. This would require a level of analysis of the individual production markets that is beyond this report.

Production is assessed as being no longer viable if the costs of production, including the costs of emission units, are greater than the estimated revenue from sales. This is also equivalent to the increased costs of emission units being greater than current estimated profits.

Production costs differ over the short and long run. A company would be expected to make different decisions on production, depending on the relationship between revenues and these costs. Below we explore these issues with a hypothetical business activity with the following costs:

- Variable costs of production, such as material and energy costs. These costs are unavoidable if the company wants to keep producing to earn revenue. They can be avoided if the plant stops production temporarily, eg because of spikes in input prices.

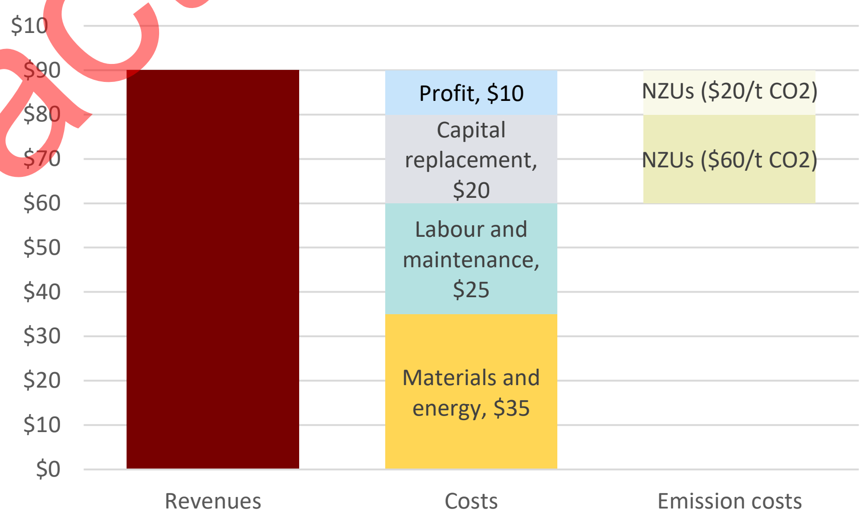
- Fixed annual costs, such as those for labour and plant maintenance. These are unavoidable costs.

- Capital replacement costs – these are required for the activity to continue in the long run. They may be pushed out in time or avoided by running down the plant before future closure.

For analysis, we assume that firms are responding to predicted future average prices of NZUs rather than price variability (price spikes) and that these prices would be expected to rise over time and not fall.

For example, imagine a company with costs and revenues as shown in Figure 1. It makes an average pre-tax profit of $10/t with costs of $80/t and revenues of $90/t.

Figure 1 Hypothetical costs and revenues ($/t product)



Simplistically, we could assume the activity would continue in the long run (and continue to invest in capital stock) if it had to pay the full costs of emissions, provided that its emission costs were no higher than \$10/t of product, ie the point at which average profit reduces to zero. If the emission rate from the activity was, say, 0.5t $CO_2$-e per tonne of product, this threshold cost would be equivalent to an emissions cost of \$20/t $CO_2$-e.

However, because some of these costs can be avoided temporarily, production may continue for some time even if NZU costs are greater than \$10/t product. Capital replacement might be postponed such that these costs were not faced for several years, so long as the costs are no higher than \$30/t product (\$10/t of initial profit + \$20/t capital replacement costs), equivalent to \$60/t $CO_2$. Above this price, revenues would be insufficient to cover other unavoidable costs (materials, energy, labour and maitenance). From this we might assume two thresholds

- An NZU price above which profits would be insufficient to pay for the costs of capital replacement. If the price was expected to continue in the long-run at this level or above, production in New Zealand would be expected to wind down. This NZU price threshold would be equal to average profit per unit of output (eg per tonne of cement or kg of cucumbers), estimated as average revenue per unit of output minus average costs, divided by the emission rate per unit of output

$$P_1 = \frac{AR - AC}{ER} = \frac{AP}{ER}$$

Where:

$P_1$ = Price threshold 1
AR = Average revenue (per unit of output, eg the average sale price)
AC = Average costs (per unit of output)
AP = Average profit (per unit of output)
ER = Emission rate (per unit of output)

- A higher NZU price which would mean revenues were less than average annual unavoidable costs and production would be expected to cease immediately. This NZU price threshold would be equal to marginal profit per unit of output, estimated as average total annual revenue minus average total annual costs, excluding the costs of capital replacement (equivalent to average annual profit plus the costs of capital replacement), divided by the emission rate per unit of output.

$$P_2 = \frac{AP + CRC}{ER}$$

Where:
$P_2$ = Price threshold 2
CRC= Capital replacement cost (average per unit of output over the long run)

***Data Available***

The analysis is limited by the data available. Specifically, we do not have access to data on production costs and the individual cost components. The data more readily available are for profits estimated either as:

- earnings before interest and tax (EBIT); or
- earnings before interest, tax and depreciation of assets (EBITDA).

EBIT calculations are revenues minus all costs apart from interest payments and tax. This is equivalent to the estimate of average profit in the hypothetical discussion above. Tax is only payable if there is a profit so can be ignored for the analysis approach we have used which identifies when profit falls to zero (and no tax is payable). Interest payments reflect the capital structure of the company, ie whether they have used debt to fund their activities. By ignoring interest payments we are assuming no debt funding such that we are only analysing the business fundamentals. EBIT is thus a useful estimate of long run average profit and EBIT divided by emission rate (ER) might be regarded as equivalent to $P_1$ above.

EBITDA excludes the costs of depreciation also. Depreciation costs are used to spread capital costs over time in company accounts, largely for taxation purposes. However, they are equivalent to an estimate of annualised capital costs. EBITDA is more of a short-run estimate of profitability, excluding the costs of capital replacement. EBITDA divided by emission rate (ER) might be regarded as equivalent to $P_2$ above.

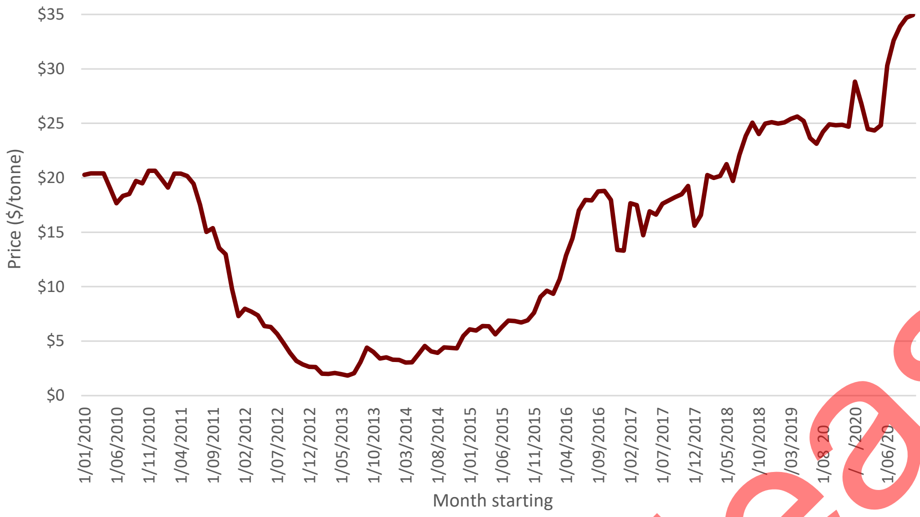
If a plant or firm facing full emission costs is no longer estimated to achieve a positive EBIT, the plant would be expected to close at some time, ie to start to wind down production in New Zealand. If they are no longer predicted to achieve a positive EBITDA, they would be expected to close fairly immediately. This is the analysis we use in this report.

## 1.3 Historical Emission Prices

The industries will have been affected by emission prices (as NZUs) in the past when they have purchased fuel and produced process emissions. They will have been compensated for this by allocations of emission units to cover the NZU component of energy costs and to cover their surrender obligations with respect to industrial process emissions. Historical NZU costs paid by producers directly or in fuel prices are uncertain, however we use average data compiled from published sources. This is required in some instances to extract NZU costs from estimates of historical EBIT and EBITDA.

Figure 2 shows NZU price data for the last 10 years compiled by MfE. The data are obtained from Carbon Match or OMF, both NZU brokers.

Figure 2 NZU Price Estimates




Source: MfE

Table 1 shows the average daily prices (for June years) for the years for which we have data for analysis in this report. The average price across all three years is $20/

Table 1 Average NZU Price (June years) ($/tonne)

| Year | Weekly average price |
|---|---|
| 2017 | $16.78 |
| 2018 | $18.74 |
| 2019 | $24.45 |

The surrender obligation for firms has varied over the time of analysis (Table 2). For estimates of future risk a 100% obligation is assumed. The lower historical obligations are used, where necessary, for analysis of historical financial data. For analysis of financial impacts, we assume that the costs of NZUs are fully passed on in input prices, ie in the costs of fossil fuels and electricity.

Table 2 Surrender obligations for obligated parties

| Year | Surrender obligation | % obligation |
|---|---|---|
| Prior to 2017 | 1 NZU for 2 tonnes of emissions | 50% |
| 2017 | 1 for 1.5 | 67% |
| 2018 | 1 for 1.2 | 83% |
| 2019 onwards | 1 for 1 | 100% |

Source: MfE (2016)

# 2 Cement

## 2.1 The Production Plant and Process

Following the closure of the Holcim (NZ) cement works in Westport in 2016, the Golden Bay Cement (GBC) plant in Portland, near Whangarei, is New Zealand's only production facility. GBC is part of Fletcher Building Ltd (FBL).

Manufacture by GBC uses a four-step dry process that includes quarrying (of limestone and cement rocks), raw material preparation by grinding to small sized particles, clinkering (in which the material is heated at high temperature) to form clinker and milling.[3] $CO_2$ is produced particularly in the clinkering stage from the burning of fossil fuels to produce heat and as process emissions during calcination ($CaCO_3 \rightarrow CaO + CO_2$).

## 2.2 Production Levels and Emissions

The GBC plant has a capacity of 967,000 tonnes.[4] Production levels for the three years to 30 June 2019 (FY19) and the average are shown in Table 3. s 9(2)(b)(ii) [redacted]

Table 3 Golden Bay Cement production and emissions (tonnes)

| Unit | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| **Production** | s 9(2)(b)(ii) [redacted] | | | |
| Clinker | | | | |
| Cement | | | | |
| **Emissions** | | | | |
| Clinker | | | | |
| Cement | | | | |
| Total | | | | |
| Emission rate (t $CO_2$/t clinker) | | | | |
| Emission rate (t $CO_2$/t cement) | | | | |
| Surrender obligation | | | | |
| Estimated allocations | | | | |
| % of emissions | | | | |
| % of requirement | | | | |

Source: Production and Emissions data from Golden Bay Cement, with updated electricity emission factor (EEF) - an EEF of 0.537 t $CO_2$/MWh is used; Surrender obligations are calculated as 58% = (1/2 + 1/1.5)/2; 75% = (1/1.5 + 1/1.2)/2; 92% = (1/1.2 + 1)/2; allocations calculations – see text.

Table 3 also records the emission levels, the average emission rate (t $CO_2$/t clinker and cement) and NZU allocations. Emission rates are higher in FY18 because of the reduced availability of biomass fuels, meaning greater proportional use of coal.[6]

[3] NZ Institute of Chemistry (2017b)
[4] https://www.goldenbay.co.nz/about-us/our-profile/
[5] Fletcher Building Limited (2019)
[6] *Ibid*, p19

Unit allocations are made for calendar years, but the numbers in Table 3 are the assumptions for financial years. Rather than distributing actual allocation numbers[7] across the financial years, they are calculated using the allocative baselines (ABs)[8] for clinker (0.9615t $CO_2$-e/t clinker) and cement (0.0234t/t) and production levels for the two products, multiplied by 90% (the allocation percentage given the high emissions intensity) and by the surrender obligation (Table 2).[9] Calculating the values this way provides a result that is less than 2% different from using actual allocations (for two calendar years) averaged across financial years. The analysis suggests the levels of allocation, based on historical emission intensity baselines, are over 100% of current surrender obligations (or their equivalents).[10]

Production levels and emissions are expected to increase in the future, although emissions will also be affected by the introduction of tyre-derived fuel expected in February 2021.[11] It is expected to substitute 20% or more of GBC's coal use.

## 2.3 Prices and Profits

To understand the impacts of emissions price, below we examine what can be identified from existing data on production costs and profits.

Table 4 shows the revenues from sales using data provided by GBC. The average price received was s 9(2) cement or s 9(2)(b) after deduction of transport costs

Table 4 Estimates of revenues received for sales of cement

| | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| External sales (tonnes) | s 9(2)(b)(ii) | | | |
| Revenue from Sales ($) | | | | |
| Transport costs ($) | | | | |
| Net Revenue ($) | | | | |
| Gross revenue ($/tonne) | | | | |
| Net revenue ($/tonne) | | | | |

FBL reports EBIT for the concrete division, but this includes Winstone Aggregates and Firth Industries. If we assume the ratio of EBIT and EBITDA to revenue is the same for GBC as for the rest of the concrete division of FBL (12% and 18% respectively - see Table 5), then EBIT and EBITDA for cement production would be expected to be in the order of s 9(2) million and s 9(2) million per year, or s 9(2) cement and s 9(2) respectively. This also suggests production costs of approximately s 9(2)(b)(ii) (net revenue minus EBIT) or s 9(2)(b)(ii) of cement.

To check on this EBIT figure, we examine survey data for the "Non-Metallic Mineral Product Manufacturing" sector in the Statistics NZ Annual Enterprise Survey (AES). For the three years 2017 to 2019, surplus before tax averaged 11% as a percentage of total income, which is very close to the 12% estimated.



[7] Available at https://gazette.govt.nz/notice/id/2019-au3767
[8] https://www.epa.govt.nz/industry-areas/emissions-trading-scheme/industrial-allocations/eligibility/
[9] For example, s 9(2)(b)(ii)
[10] The calculation of surrender obligations includes those for suppliers, eg of electricity
[11] Fletcher Building Limited (2020)

Table 5 Revenue, EBIT and EBITDA ($million) estimates for cement production

| | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|
| Gross Revenue (Concrete Division) | s 9(2)(b)(ii) [redacted] | | | |
| EBIT (Concrete Division) | | | | |
| EBITDA (Concrete Division) | | | | |
| EBIT as % of Revenue | | | | |
| EBITDA as % of Revenue | | | | |
| Estimated EBIT (Cement) | | | | |
| Estimated EBITDA (Cement) | | | | |
| Estimated production costs | | | | |
| Production costs ($/tonne) | | | | |
| EBIT ($/tonne) | | | | |
| EBITDA ($/tonne) | | | | |

EBITDA estimated as EBIT plus depreciation, depletion and amortisation expense
Source: Fletcher Building Ltd (2018, 2019, 2020)

We assume average annual EBIT and EBITDA values of s 9(2)(b)(ii) [redacted] and s 9(2)(b)(ii) [redacted] respectively based on 12% and 18% of gross revenue.

As a further check on these numbers, we compare the production costs we can estimate for New Zealand (revenues minus EBIT) with percentage estimates for production costs elsewhere. Historically energy costs for cement production have been in the order of 20-40% of direct costs of manufacture,[12] although they have been falling over time. This is a wide range, reflecting differences in energy costs (particularly for electricity) and energy intensities of production. Energy costs at GBC are estimated to be approximately s 9(2) [redacted] (Table 6), which is 23% of the estimated production costs (taken from Table 5). This is at the lower end of the international industry percentage range. If coal is assumed to be used for all thermal requirements, instead of wood waste, then energy costs would rise to s 9(2) [redacted] and to 25% of production costs, still at the low end of the estimated international range.

To assess the reasonableness of these estimates, we can compare energy intensities of production compared to stated international averages. The IEA suggests average energy intensities currently of:[13]

- Thermal fuel - approximately 3.4GJ/t of clinker; and
- Electricity – approximately 88kWh/t of cement.

Estimates of energy intensity at GBC are shown in Table 7. Both thermal fuel and electricity intensities appear to be higher than global averages, perhaps reflecting the age of the New Zealand plant, although any conclusions would require a more detailed analysis of the data used.

[12] Natural Resources Canada (2001); IEA (2010); US EPA (2013)
[13] The thermal fuel intensity of clinker production is stated for 2018. The electricity intensity of cement production is estimated from the data provided, ie a 0.3% reduction in intensity per annum leading to an intensity of 85kWh/t cement in 2030 under the Sustainable Development Scenario (SDS). See https://www.iea.org/reports/cement

Table 6 Energy Costs for GBC

| Component | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| Coal (tonnes) | s 9(2)(b)(ii) [redacted] | | | |
| Cost per tonne[1] | | | | |
| Total cost | | | | |
| Wood waste (GJ)[2] | | | | |
| Cost ($/GJ)[3] | | | | |
| Total cost | | | | |
| Electricity (MWh) | | | | |
| Price per MWh[4] | | | | |
| Electricity cost | | | | |
| Total Energy | | | | |
| Costs per tonne | | | | |
| % of total production costs | | | | |

[1] Import price for Australian bituminous coal (StatsNZ Infoshare Table Ref TIM00[illegible]C).

[2] The quantities of wood waste consumed are not included in the GBC spreadsheet, so we estimate it using values provided in the Environmental Product Declaration (EPD) (Golden Bay Cement, [illegible]010). The EPD includes energy use per tonne for two cement products (EverSure™ GP cement and EverFast™ HE cement); we use a simple average of the two to estimate non-renewable (wood waste) energy use (in GJ) at 27[illegible]% of the coal use. The coal energy value is assumed to be s 9(2)(b)(ii) [redacted] (GBC data).

[3] s 9(2)(b)(ii) [redacted]

[4] Electricity price for Mineral and Petroleum extraction from MBIE Energy Prices (https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/energy-prices/)

Table 7 GBC Energy Intensity

| | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| Coal use (TJ) | s 9(2)(b)(ii) [redacted] | | | |
| Coal use (GJ/t clinker) | | | | |
| Wood waste (GJ/t clinker) | | | | |
| Thermal energy (GJ/t clinker) | | | | |
| Electricity use (kWh/t cement) | | | | |

Note: coal energy value assumed to be s 9(2)(b)(ii) [redacted] (in GBC spreadsheet)

Before we examine the impact of emission prices on production costs and EBIT, we first consider cement import prices and the competition from Holcim and other potential importers.

## 2.4 International Trade in Cement

There is significant international movement and trade in clinker and cement (Table 8) representing close to 3% of global cement consumption.[14] Shipping clinker is simpler and lower cost as it does not require specialised ships or handling equipment, but it requires a grinding plant with a storage facility of suitable size on the receiving end.[15] Cement can be shipped in paper bags, big bags or in bulk.

Table 8 Movements of clinker and cement by water (million tonnes)

| Clinker/cement type | International seaborne trade | Domestic seaborne trade | Inland water domestic trade |
|---|---|---|---|
| Clinker | 43.9 | 9.4 | 4.7 |
| Cement-bulk | 49.1 | 72.1 | 0.3 |
| Cement-bagged | 17.0 | 11.5 | 3.7 |
| Total | 110.0 | 93.0 | 18.7 |

Source: Ligthart (2016)

Analysts suggest that global demand growth has slowed over the last decade, and that historical capacity expansion has led to regional overcapacity with a global average plant utilisation of about 70%.[16] This suggests imports to New Zealand may become more price-competitive in the short run before (or if) demand growth rises to levels closer to capacity. Prices may fall if plant owners in other countries are pricing to cover only their variable and fixed annual costs, rather than recovery of capital costs while there is over capacity.

Cement import prices are shown in Table 9, calculated as the cost including insurance and freight (cif) divided by the quantity imported. The largest imports are for white Portland cement containing more than 0.5% of iron oxide from Thailand (33% by import cost over the three financial years), Viet Nam (27%), Australia (16%) and Malaysia (12%). Weighted average costs over the three years examined are $1[illegible]6/t, which is somewhere in-between the estimated gross and net revenues (after subtraction of transport costs) received by GBC (Table 4). The importer would also need to transport cement to market, so it appears that the competitiveness of the import prices will depend on the distance from the import port relative to the distance from GBC. Holcim imports via ports of Auckland and Timaru.

Table 9 Cement imports and import prices ($/tonne)

| Product | | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|---|
| Cement; portland, white, whether or artificially coloured, containing not more than 0.5% of iron oxide | tonnes | 2,263 | 1,997 | 2,331 | 2,197 |
| | $/t | $305 | $328 | $309 | $313 |
| Cement; portland, white, whether or artificially coloured, containing more than 0.5% of iron oxide | tonnes | 27,077 | 18,299 | 27,676 | 24,351 |
| | $/t | $165 | $155 | $253 | $196 |

Source: data from StatsNZ Infoshare (Table Ref: TIM001C)

The numbers confirm that GBC is limited from raising prices because of competing import prices.

[14] Global consumption is estimated at approximately 4.08 billion tonnes in 2019. https://www.prnewswire.com/news-releases/world-cement-consumption-rises-by-2-8-in-2019--300996142.html
[15] https://cementdistribution.com/industry-information/the-cement-industry-in-a-nutshell/
[16] CW Research in Schlorke *et al* (2020)

## 2.5 Vulnerability to Emissions Prices

The emissions intensity of GBC cement production is approximately s 9(2) $CO_2$-e per tonne of clinker and s 9(2) cement (Table 3). Given a ratio of approximately s 9(2)(b)(ii), this means a total production emission rate of s 9(2)(b)(ii). We use this with different emissions prices to examine the impacts relative to current assumed EBIT and EBITDA. Given that current allocations appear to be close to 100% of surrender obligations for GBC, we do not need to take account of emissions prices in existing EBIT or EBITDA.

Figure 3 shows the impacts of emissions prices, given a 100% surrender obligation, no free allocation and an initial EBIT of s 9(2) of cement and EBITDA of s 9(2). EBIT drops to zero s 9(2) $CO_2$;[17] EBITDA drops to zero at s 9(2)(b)(ii).

Figure 3 Impacts of Emissions Price on EBIT and EBITDA for cement production

s 9(2)(b)(ii)

Given there is some uncertainty over the current EBIT and EBITDA for the cement business, Figure 4 shows the level of current EBIT or EBITDA (as a percentage of gross revenue) that would fall to zero with the emissions price at different levels. At an emissions price of s 9(2) $CO_2$, EBIT or EBITDA would fall to zero (or below) if current EBIT/EBITDA was s 9(2) of gross revenue (or less); at s 9(2) it would fall to zero if current EBIT/EBITDA was s 9(2) (or less). The results are calculated as the emissions cost (emissions price times the emissions factor of s 9(2)(b)(ii) cement), divided by gross revenue (s 9(2)(b)(ii) – see Table 4).

[17] s 9(2)(b)(ii)

Figure 4 Current EBIT or EBITDA for cement production (% of revenue) that would fall to zero at different NZU prices

s 9(2)(b)(ii) [redacted]

## 2.6 Summary

The cement production industry appears to be over-allocated with emission units. For the three financial years analysed, allocations appear to be equivalent to approximately s 9(2) [redacted] of emissions.

Analysis of the impacts of emission costs on estimated EBIT and EBITDA suggests that the cement industry is at risk of being wound down in New Zealand if it faced the full costs of emissions and emission prices were above s 9(2)(b)(ii) [redacted].[18] Closure might be more immediate if the NZU price rose to s 9(2)(b)(ii) [redacted] or higher.



[18] Because of the uncertainty, NZU prices are rounded to the nearest $5/t

# 3 Burnt Lime

## 3.1 Production Plants and Process

Burnt lime (sometimes known as quicklime) is used by several industries to neutralise acid waste, as a causticiser[19] in the pulp and paper industry and as flux (removing impurities) in steel making. It is produced by heating limestone to a high temperature, producing lime and releasing $CO_2$:[20]

$$CaCO_3 + heat \rightarrow CaO + CO_2$$

Two companies, Graymont New Zealand and Websters Hydrated Lime Company, produce burnt lime in New Zealand. Graymont purchased and incorporated McDonald's Lime and Taylor's Lime that previously operated in New Zealand.

- Graymont has limestone quarries in Oparure, near Te Kuiti and Dunback in North Otago. It has production plants close to both quarries.
- Websters operates a quarry and production plant near Havelock North.

## 3.2 Production Levels and Emissions

s 9(2)(b)(ii) [redacted]

Table 10 Burnt lime production and emissions (tonnes)

| | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| **Production** (tonnes) | | | | |
| Graymont | s 9(2)(b)(ii) [redacted] | | | |
| Websters | | | | |
| **Total** | | | | |
| **Emissions** (tonnes) | | | | |
| Graymont | | | | |
| Websters | | | | |
| **Total** | | | | |
| Surrender obligation | | | | |
| Estimated allocations | | | | |
| % of emissions | | | | |
| % of requirement | | | | |

Source: Production and emissions data from company returns.

As with the analysis of cement manufacture, allocation estimates are made using the allocative baseline for burnt lime (1.4115 t $CO_2$/t lime), which is multiplied by 90%, the surrender obligation (Table 2) and production levels. Total allocation, based on historical emission rates, is over s 9(2) [redacted] of emissions. The emission rate from the data in Table 10 is s 9(2)(b)(ii) [redacted] of lime, which

[19] Converting sodium carbonate into caustic soda
[20] NZ Institute of Chemistry (2017a)

is [redacted] s 9(2) lower than the allocative baseline (AB). The emissions rate has been falling over time, eg a 2009 estimate was 1.52t/t lime.[21]

## 3.3 Prices and Profits

Table 11 summarises the revenue and sales price estimates for burnt lime from the two companies. Gross revenue per tonne averages approximately [redacted] s 9(2)(b)(ii) per tonne and falls to an average of [redacted] s 9(2)(b)(ii) after subtracting transport costs.

Table 11 Estimates of revenues received for sales of burnt lime

| Component | Company | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|---|
| Revenue from Sales ($ million) | Graymont | s 9(2)(b)(ii) [redacted] | | | |
| | Websters | | | | |
| | Total | | | | |
| Transport costs ($ million) | Graymont | | | | |
| | Websters | | | | |
| | Total | | | | |
| Net Revenue ($ million) | Total | | | | |
| Gross revenue ($/tonne) | | | | | |
| Net revenue ($/tonne) | | | | | |

Source: company returns

Because the EBIT value is very close to that for the "Non-Metallic Mineral Product Manufacturing" from the AES results for 2017 to 2019 (and burnt lime is also part of this industry group), to estimate EBIT and EBITDA, we use the same assumption of 12% and 18% of total revenue respectively as for cement manufacture. EBIT is estimated as [redacted] s 9(2)(b)(ii) of burnt lime produced and EBITDA as [redacted] s 9(2)(b)(ii) (Table 12).

Table 12 Estimates of EBIT and EBITDA for burnt lime production

| | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| EBIT % of gross revenue | s 9(2)(b)(ii) [redacted] | | | |
| EBIT estimate ($ million) | | | | |
| EBIT ($/tonne) | | | | |
| EBITDA % of gross revenue | | | | |
| EBITDA estimate ($ million) | | | | |
| EBITDA ($/tonne) | | | | |

## 3.4 International Trade Prices

Small amounts of burnt lime are imported to New Zealand, with a weighted average price of $221/t and a range of $206/t to $364/t (Table 13). The average is slightly higher (<5%) than the average price of burnt lime produced in New Zealand but close enough to place competitive pressure on domestic prices.

Larger quantities are exported, although as noted above, there was a significant fall in quantities exported after 2017. Export prices average $169/t, slightly lower than the domestic price.

[21] Denne *et al* (2009)

Table 13 Burnt lime imports and exports

| | | 2017 | 2018 | 2019 | Average |
|---|---|---|---|---|---|
| Imports | Quantity (tonnes) | 835 | 842 | 167 | 615 |
| | Cost (cif) | $172,078 | $175,639 | $60,670 | $136,129 |
| | Price | $206 | $209 | $364 | $221 |
| Exports | Quantity (tonnes) | 91,367 | 2,290 | 2,455 | 32,038 |
| | Value (fob) | $15,192,829 | $486,568 | $584,751 | $5,421,383 |
| | Price | $166 | $212 | $238 | $169 |

cif = cost including insurance and freight; fob = free on board
Source: StatsNZ Infoshare. Imports of Quicklime; excluding calcium oxide and hydroxide of heading no. 2825. Table Ref: TIM001C.

## 3.5 Vulnerability to Emissions Prices

The vulnerability to emissions prices is estimated by comparing emissions prices with average estimated EBIT and EBITDA. We have not adjusted EBIT or EBITDA estimates for current emission prices because burnt lime producers appear to be receiving allocations currently that are close to s 9(2)(b)(ii) of their NZU surrender requirements (Table 10).

The emissions intensity of burnt lime production is approximately s 9(2)(b)(ii) $CO_2$-e per tonne of lime. Figure 5 shows the impacts of emissions prices, given a 100% surrender obligation, no free allocation and initial EBIT of s 9(2)(b)(ii) and EBITDA of s 9(2)(b)(ii) of burnt lime. EBIT drops to zero when NZUs are at s 9(2)(b)(ii) $CO_2$ and EBITDA drops to zero at s 9(2)(b)(ii) $CO_2$.

Figure 5 Impacts of Emissions Price on EBIT and EBITDA for burnt lime production

s 9(2)(b)(ii)

Figure 6 shows the level of current EBIT or EBITDA (as a percentage of gross revenue) which would fall to zero with the emissions price at different levels. So, at an emissions price of s 9(2)(b)(ii) $CO_2$, EBIT would fall to zero (or below) if current EBIT/EBITDA was s 9(2)(b)(ii) of gross revenue (or less); at s 9(2)(b)(ii) t it would fall to zero if current EBIT/EBITDA was s 9(2)(b)(ii) of revenue (or less). The results are calculated as the emissions cost (emissions price times the emissions factor of s 9(2)(b)(ii) $CO_2$/t lime), divided by gross revenue.

Figure 6 Current EBIT or EBITDA for burnt lime (as % of revenue) that would fall to zero at different NZU prices

s 9(2)(b)(ii) [redacted]

## 3.6 Summary

The burnt lime production industry appears to be over-allocated with emission units. For the three financial years analysed, allocations appear to be equivalent to approximately s 9(2) [redacted] of emissions.

Analysis of the impacts of emission costs on estimated EBIT and EBITDA suggests that the burnt lime industry is at risk of being wound down in New Zealand if it faced the full costs of emissions and emission prices were above s 9(2)(b)(ii) [redacted].[22] Closure might be more immediate if the NZU price rose to s 9(2)(b)(ii) [redacted] or higher.



[22] Because of the uncertainty, NZU prices are rounded to the nearest $5/t

# 4 Cartonboard

## 4.1 Production Plants and Process

The cartonboard mill at Whakatane is owned by the Swiss company SIG. It produces cartonboard for food packaging from a mix of timber and recycled materials. There are three main products:

- Product A: cartonboard;[23]
- Product B: pulp produced from wood;
- Product C: pulp produced from recovered paper.

There is one board machine and an integrated stoneground wood pulp mill. The mill has a capacity of approximately 140,000 tonnes per annum (tpa) and it produces liquid packaging board and folding boxboard.

## 4.2 Production Levels and Emissions

Production levels, emissions and emission rates for the three financial years to June 2019 are shown in Table 14.

Table 14 Cartonboard production and emissions (tonnes)

| | Product | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|---|
| Production | Product A | s 9(2)(b)(ii) [redacted] | | | |
| | Product B | | | | |
| | Product C | | | | |
| Emissions | Product A | | | | |
| | Product B | | | | |
| | Product C | | | | |
| | Total | | | | |
| Emissions rate ($t CO_2/t$) | Product A | | | | |
| | Product B | | | | |
| | Product C | | | | |
| Surrender obligation | | | | | |
| Estimated allocations | | | | | |
| % of emissions | | | | | |
| % of requirement | | | | | |

Source: Production and emissions data from company returns.

Production levels and emissions are reasonably constant over time.[24] The emissions are largely from electricity use, with smaller quantities from natural gas and coal. The estimated allocations of emission units average s 9(2) [redacted] of surrender obligations, considerably above the expected 90%. The difference between the AB and the calculated emission rate differs significantly by product (Table 15).

[23] Cartonboard with a grammage range of $150 g/m^2$ to $500 g/m^2$ and a moisture content range of 4 to 11 percent by weight and be generally used as a cartonboard product such as kraft liner, multiply and other paperboard

[24] Although, we note electricity intensity has fallen since that estimated in 2009 (Denne *et al*, 2009)

Table 15 Emission rates and allocative baselines for cartonboard

| Product | Allocative Baseline (AB) | Average emission rate (ER) | ER as % of AB |
|---|---|---|---|
| Product A | 1.1783 | s 9(2)(b)(ii) [redacted] | [redacted] |
| Product B | 0.4784 | [redacted] | [redacted] |
| Product C | 0.3377 | [redacted] | [redacted] |

## 4.3 Prices and Profits

Revenues from sales of cartonboard are shown in Table 16 in total and per tonne of product output (total production).

Table 16 Estimates of revenues received for sales of cartonboard

| | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| External sales (tonnes) | s 9(2)(b)(ii) [redacted] | [redacted] | [redacted] | [redacted] |
| Revenue from Sales ($m) | [redacted] | [redacted] | [redacted] | [redacted] |
| Transport costs ($m) | [redacted] | [redacted] | [redacted] | [redacted] |
| Net Revenue ($m) | [redacted] | [redacted] | [redacted] | [redacted] |
| Gross revenue ($/tonne) | [redacted] | [redacted] | [redacted] | [redacted] |
| Net revenue ($/tonne) | [redacted] | [redacted] | [redacted] | [redacted] |

Table 17 shows estimates of EBIT for the plant. It is based on a range of the percentage of gross revenue. The bottom end of the range (s [redacted]) is based on estimates provided by Whakatane mill staff.[25] The top end (s [redacted]) is the average f[redacted]r 2017 to 2019 financial years for the "Pulp, Paper and Converted Paper Product Manufacturing" in the AES. EBITDA is also estimated from the AES (as EBIT plus depreciation) at approximately [redacted] of reve[redacted]ue.

Table 17 Estimates of EBIT and EBITDA fo[redacted] artonb[redacted]ard production

| | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| EBIT % of gross revenue | 9( [redacted] (b)(ii) [redacted] | [redacted] | [redacted] | [redacted] |
| EBIT estimate ($ m[redacted]on) | [redacted] | [redacted] | [redacted] | [redacted] |
| EBIT ($/tonne) | [redacted] | [redacted] | [redacted] | [redacted] |
| EBITDA % of [redacted]oss revenue | [redacted] | [redacted] | [redacted] | [redacted] |
| EBITDA estima[redacted] ($ mi[redacted]ion) | [redacted] | [redacted] | [redacted] | [redacted] |
| EBITD[redacted] ($/t[redacted]ne) | [redacted] | [redacted] | [redacted] | [redacted] |

## 4.4 International Trade

The Whakatane mill produces cartonboard very largely for export markets. The mill owner, the Swiss company SIG, competes with TetraPak in producing food quality packaging, eg plastic or aluminium laminated card for liquid containers. In the global market for aseptic cartons, SIG holds an approximate 21% market share, compared to 67% for TetraPak.[26] The Whakatane mill produces significant quantities of SIG's demand for food quality packaging.



[25] Andrew Batchelar, Finance Manager, personal communication

[26] SIG (2019)

The Whakatane mill supplies the New Zealand domestic market, in competition with imports of cartonboard and filled packages of foodstuffs. Given the wide range of products it is difficult to identify these in import statistics. And in any case, the chief competitive pressures on the mill, and the greatest risk to emission leakage, is via the impact on costs of production for the export market. Prices for the mill's inputs are also subject to competitive pressure, including prices for energy, timber and recovered paper supplies.

Table 18 shows quantities and export prices for cartonboard. The quantities of the two main export categories (as included in Table 18) range from 54% of production in 2016/17 to 91% in 2017/18. Table 20 shows the destination of exports and the percentage of each destination country by value.

Table 18 Cartonboard exports

| Product | Unit | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|
| Paper and paperboard; cartonboard or boxboard, multi-ply, coated with inorganic substances only, n.e.c. in heading no. 4810, (not printed), in rolls or sheets | tonnes | 71,896 | 120,[illegible]08 | 111,844 |
| | $/t (fob) | $1,1[illegible]4 | $1[illegible]219 | $1,335 |
| Kraft paper and paperboard; cartonboard and boxboard, uncoated, weight between 150 and 225g/m2, in rolls or sheets, n.e.c. in item no. 4804.4, other than that of heading no. 4802 or 4803 | tonnes | 1,[illegible]69 | 3,712 | 7,185 |
| | $/t (fob) | $1[illegible]392 | $1,501 | $1,495 |

Fob = free on board

Table 19 shows the top 10 global exporters of cartonboard by value, the quantity exported and the average value. It also shows the quantities and values of exports from New Zealand.

Table 19 Exports of cartonboard (annual average for 2016-2019)

| | Export Value US$million | Export Quantity tonnes | Average Value ($/tonne) | % by value | % by weight |
|---|---|---|---|---|---|
| USA | $2,928 | 2,352[illegible]282 | $1,245 | 13.4% | 12.4% |
| Sweden | $2,801 | 2[illegible]961,689 | $946 | 12.8% | 15.6% |
| Germany | $2,6[illegible]8 | 2,029,917 | $1,290 | 12.0% | 10.7% |
| Finland | $2[illegible]426 | 2,495,112 | $972 | 11.1% | 13.1% |
| China | $2,30[illegible] | 2,340,194 | $986 | 10.6% | 12.3% |
| Italy | [illegible]572 | 487,303 | $1,174 | 2.6% | 2.6% |
| Japan | $537 | 203,959 | $2,632 | 2.5% | 1.1% |
| Poland | $525 | 312,994 | $1,678 | 2.4% | 1.6% |
| Singapore | $486 | 169,202 | $2,874 | 2.2% | 0.9% |
| Canada | $485 | 394,013 | $1,231 | 2.2% | 2.1% |
| Australia | $101 | 168,792 | $595 | 0.5% | 0.9% |
| New Zealand | $97 | 107,696 | $904 | 0.4% | 0.6% |
| World | $21,828 | 19,019,000 | $1,148 | 100% | 100% |

Source: FAO (http://www.fao.org/faostat/en/#data/FO)

Table 20 shows the destination of cartonboard exports from New Zealand. Close to 30% are to Australia, with the remainder going to Thailand, Saudi Arabia and other parts of Asia.

Table 20 Destination of cartonboard exports

| Country | Percentage by Value (fob) |
|---|---|
| Australia | 29% |
| Thailand | 25% |
| Saudi Arabia | 15% |
| China | 13% |
| Malaysia | 7% |
| Viet Nam | 5% |
| Taiwan | 3% |
| Philippines | 2% |
| Other | 1% |

fob = free on board
Source: StatsNZ Infoshare. Table Ref: TEX001F.

Given that there are numerous other exporting countries, many closer to destination markets, the Whakatane mill competes through a combination of:[27]

- relatively low-cost freight – because trade with China tends to be more significantly of imports to New Zealand, there is less competition for space so freight costs of cartonboard to China is not much more than for freight to Australia; and
- specialisation of production to niche markets in liquid food packaging.

The plant operators note that specialisation is the key to their ongoing survival. They are an old (originally built in the early 1970s) and relatively small (140,000 tpa) plant competing with very significantly larger plants (500,000 tpa and above) being built in China and elsewhere.

## 4.5 Vulnerability to Emissions Prices

We estimate the Whakatane mill's vulnerability to emissions prices by comparing the costs of NZUs with estimates of EBIT and EBITDA. Unlike for cement and burnt lime, we first adjust EBIT and EBITDA for existing emissions prices. The analysis above suggests that the Whakatane mill receives an allocation equal to approximately s 9(2)(b)(ii) of annual emissions on average, which means allocations could be a significant component of profit. Using the average price to 30 June 2019 of $2_.45/t $CO_2$ and an average emissions intensity of s 9(2)(b)(ii) cartonboard, the current additional profit per tonne (with a 100% surrender requirement) would be s 9(2)(b)(ii) cartonboard.[28] This means the starting estimate of EBIT (with no emissions price) would fall to s 9(2)(b)(ii) cartonboard (assuming EBIT = s 9(2 of revenue) and to s 9(2)(b)(ii) (assuming s 9(2); EBITDA would fall to s 9(2)(b)(ii)

Figure 7 shows the estimated impacts on adjusted EBIT and EBITDA of different levels of emissions price.

[27] Philip Jacobs, Whakatane Mill, personal communication

[28] s 9(2)(b)(ii)

Figure 7 Impacts of emissions price on cartonboard production EBIT and EBITDA

s 9(2)(b)(ii)

EBIT turns negative from an emissions price of between s 9(2) and s 9(2) $CO_2$, depending on whether the low (s 9(2) ) or high (s 9(2) ) starting EBIT assumption made. EBITDA turns negative when prices rise to s 9(2)(b)(ii) .

Figure 8 shows the current EBIT or EBITDA as a percentage of gross revenue which would fall to zero at different emissions prices. This is calculated as the emissions cost per tonne (emissions price x s 9(2) ) divided by gross revenue per tonne of cartonboard (s 9(2) from Table 16). At s 9(2) $CO_2$, EBIT/EBITDA falls to zero if the starting point is EBIT of s 9 2 of gross revenue; at s 9 2) /t it falls to zero at a starting point of s (2) of revenue.

Figure 8 Current EBIT or EBITDA for cement production (% of revenue) that would fall to zero at different NZU prices

s 9(2)(b)(ii)

## 4.6 Summary

The cartonboard production industry appears to be over-allocated with emission units. For the three financial years analysed, allocations appear to be equivalent to approximately s 9(2) b) i ) of emissions.

Analysis of the impacts of emission costs on estimated EBIT and EBITDA suggests that the cartonboard production industry is at risk of being wound down in New Zealand if it faced the full costs of emissions and emission prices were above between approximately s 9 2) and s 9(2) b)(i ) $CO_2$-e.[29] Closure might be more immediate if the NZU price rose to s 9(2)(b) $CO_2$-e or higher.



[29] Because of the uncertainty, NZU prices are rounded to the nearest $5/t

# 5 Fresh Cucumbers

## 5.1 Production Locations

Eligible fresh cucumber producers operate in south Auckland (and Pokeno in northern Waikato) and near Christchurch. Energy is used in heating and lighting of glasshouses.

## 5.2 Production Levels and Emissions

Table 21 summarises the data provided by the producers (in data forms) for production and emissions. Emission intensity (tonnes $CO_2$/t of cucumbers) varies significantly with the fuel source used, s 9(2)(b)(ii) [redacted]

Table 21 Fresh cucumber production and emissions (tonnes)

| | Production (tonnes) | | | Emissions (tonnes) | | | Average intensity (t $CO_2$/t) |
|---|---|---|---|---|---|---|---|
| | 2016/17 | 2017/18 | 2018/19 | 2016/17 | 2017/18 | 2018/19 | |
| Exception | s 9(2)(b)(ii) [redacted] | | | | | | |
| Island Horticulture | | | | | | | |
| JS Mahey | | | | | | | |
| Karaka Park Produce | | | | | | | |
| Nova Trust | | | | | | | |
| RK & MD Sharma | | | | | | | |
| Sharma Produce | | | | | | | |
| Underglass (Bombay) | | | | | | | |
| **Total** | | | | | | | |
| Surrender obligation | | | | | | | |
| Estimated allocations | | | | | | | |
| % of emissions | | | | | | | |
| % of requirement | | | | | | | |

Table 21 also includes estimates of the allocations of emission units. They appear to be very significantly more than required, with emission intensities for all but one producer, significantly less than the AB of 3.4461 t $CO_2$-e/t cucumbers. s 9(2)(b)(ii) [redacted]

## 5.3 Prices and Profits

Table 22 shows estimates of revenues from sales of cucumbers, in total and per tonne of product.

Table 22 Estimates of revenues received for sales of cucumbers

| | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| External sales tonnes | s 9(2)(b)(ii) [redacted] | | | |
| Revenue from sales ($m) | | | | |
| Transport costs ($m) | | | | |
| Net revenue | | | | |
| Gross revenue ($/t) | | | | |
| Net revenue ($/t) | | | | |

Table 23 shows estimated average prices received for cucumber sales for the individual producers, as estimated from company returns. Sale prices have varied from approximately s 9(2)(b)(ii) [redacted] per tonne, with an average of s 9(2)(b)(ii) [redacted]

Table 23 Fresh cucumber price estimates ($/t)

| Producer | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| Exception | s 9(2)(b)(ii) [redacted] | | | |
| Island Horticulture | | | | |
| JS Mahey | | | | |
| Karaka Park Produce | | | | |
| Nova Trust | | | | |
| RK & MD Sharma | | | | |
| Sharma Produce | | | | |
| Underglass (Bombay) | | | | |
| Total | | | | |

A review of the cucumber industry in Australia suggests that the costs of growing cucumbers vary significantly by grower and season, with much of the variation attributable to crop management decisions.[30] It is likely that this is so in New Zealand also, as reflected in the different prices obtained.

An economic analysis of cucumber production in Australia suggests profit ranging from 8% to 16% of sales revenue (Table 24). In comparison, the AES (Horticulture and Fruit Growing) suggests EBIT of approximately 18% (average for 2017 to 2019) and EBITDA of 23%. For analysis we use a range of 8% to 18% for EBIT and 13% to 23% for EBITDA (five percentage points above EBIT). We use these assumptions to estimate aggregate EBIT and EBITDA in Table 25.

Table 24 Economics of cucumber production in Australia (A$/kg)

| Component | High tech | Low tech |
|---|---|---|
| Costs of production | $2.17 | $2.33 |
| Average sales price | $2.53 | $2.53 |
| Profit | $0.36 | $0.20 |
| % of revenue | 16% | 8% |

Source: Parker *et al* (2019)

Table 25 Estimates of aggregate EBIT and EBITDA for cucumber production

| | 2016/17 | 2017/18 | 2018/19 | Average |
|---|---|---|---|---|
| EBIT % of gross revenue | s 9(2)(b)(ii) [redacted] | | | |
| EBIT estimate ($ million) | | | | |
| EBIT ($/tonne) | | | | |
| EBITDA % of gross revenue | | | | |
| EBITDA estimate ($ million) | | | | |
| EBITDA ($/tonne) | | | | |

[30] Parker *et al* (2019)

## 5.4 International Trade Prices

New Zealand imports small quantities of cucumbers (and gherkins)[31] from Australia and exports declining quantities to Australia, several Pacific Islands and the USA. For the 2017 to 2019 financial years, approximately 16% of total production was exported; imports were equivalent to approximately 1% of production (Table 26).

Table 26 Trade in Cucumbers (2017 to 2019 financial years)

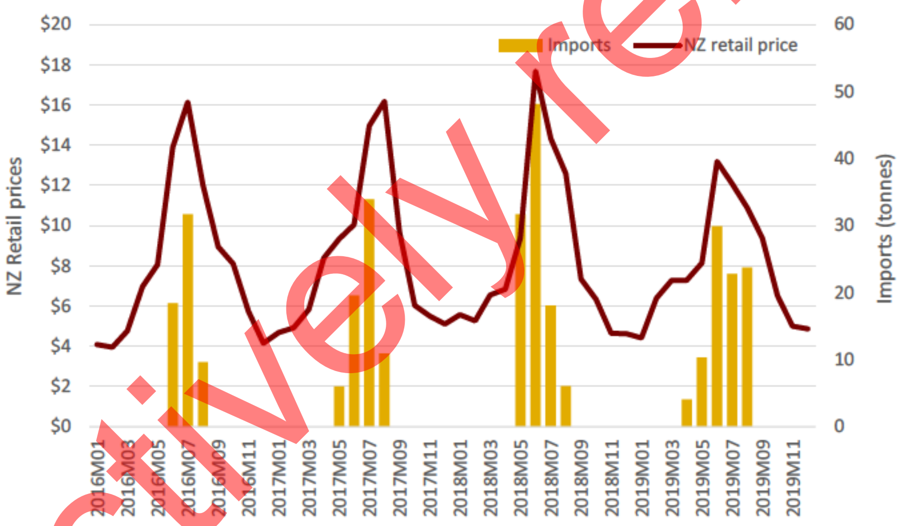
| | Quantity (tonnes) | Percentage of total |
|---|---|---|
| Production | 29,708 | 100% |
| Import | 260.2 | 1% |
| Export | 4,891 | 16% |

Source: Production: Table 21; Imports and Exports: StatisticsNZ Infoshare

### 5.4.1 Imports

The imports are highly seasonal and correspond to times of the year when NZ retail prices are high (Figure 9).

Figure 9 NZ retail prices and Imports of cucumbers and gherkins from Australia




Source: Statistics NZ Infoshare. Imports of Vegetables; cucumbers and gherkins, fresh or chilled (Table ref: TIM001C)

Costs of imports for July to June years are shown in Table 27. These costs are high compared to average costs received by NZ producers, but we do not have seasonal prices received by the NZ producers to compare, although we assume they will vary seasonally as with retail prices (Figure 9).

Table 27 Import costs for cucumbers and gherkins

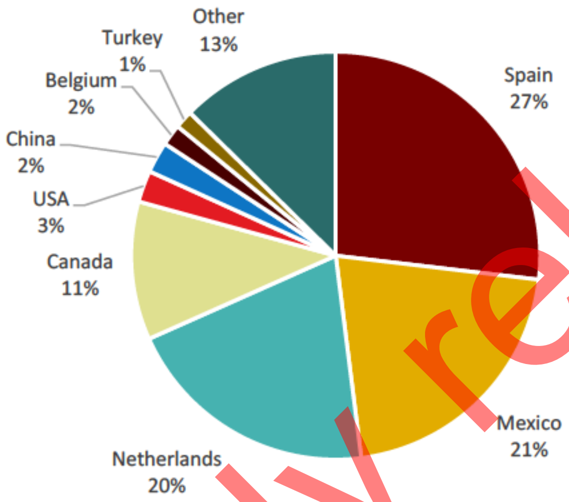
| Year | Quantity (tonnes) | Price ($/t) |
|---|---|---|
| 2016/17 | 67.0 | $3,988 |
| 2017/18 | 124.7 | $3,667 |
| 2018/19 | 68.5 | $3,877 |

Source: Statistics NZ Infoshare. Imports of Vegetables; cucumbers and gherkins, fresh or chilled (Table ref: TIM001C)

[31] The import data are for a category that includes both: "cucumbers and gherkins, fresh or chilled"

Australia produces over 90,000 tonnes of cucumbers per annum, compared to approximately 12,000 tonnes in New Zealand (Table 21). An analysis of the market in 2014/15 identified New Zealand as Australia's biggest export market at 54% of total exports by value; NZ imported 58 tonnes from Australia in 2014/15[32] so exports are not a significant part of its production (approximately 0.14%).[33] Worldwide, trade in cucumbers is more significant, totalling US$2.7 billion in value in 2019, mostly from Spain, Mexico, the Netherlands and Canada (Figure 10). There is comparatively little trade in Asia and the Pacific, and China, for example, is only 2% of world trade.

Figure 10 Cucumber exporting countries by value




Source: [http://www.worldstopexports.com/top-cucumbers-exporting-countries/](http://www.worldstopexports.com/top-cucumbers-exporting-countries/)

Wholesale prices of cucumbers in Australia are similar to in New Zealand. In 2019 the average wholesale cucumber price (excluding the snack type)[34] was A$2.82/kg (NZ$2.97/kg).[35] Seasonal wholesale prices for the different varieties are shown in Figure 11.[36]

Figure 11 Wholesale cucumber prices in Australia


Source: Parker *et al* (2019)

[32] AUSVEG (2016)

[33] This assumes production of 75,000 tonnes in 2014/15 (based on production of 60,000t in 2010 and 90,000t in 2019 - Parker *et al* 2019).

[34] Lebanese, continental and green slicing cucumbers are the main types grown in Australia.

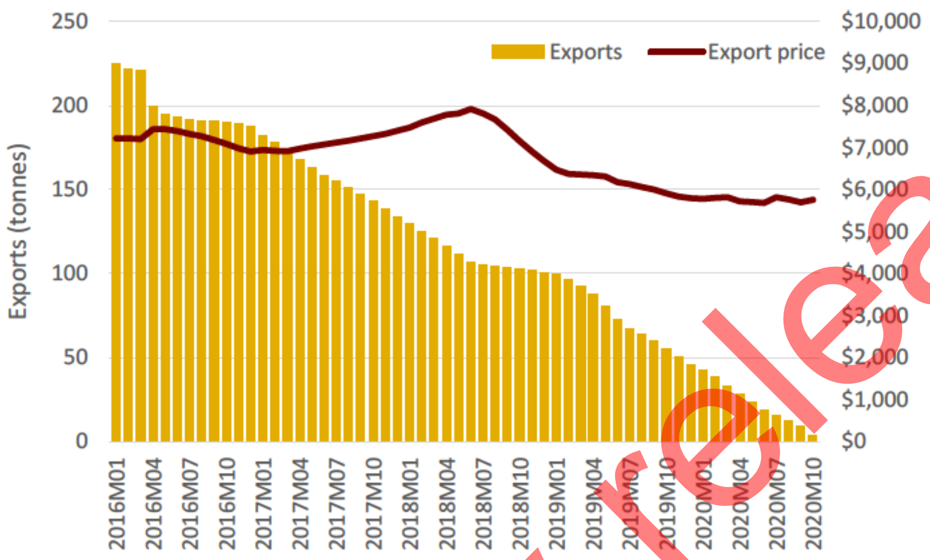
[35] Using average daily exchange rate for 2019 of A$0.948:NZ$1 (Reserve Bank of NZ Series: EXR.DS11.D01)

[36] Note the prices for the snack variety are on a secondary axis

### 5.4.2 Exports

Figure 12 shows exported quantities and prices received from 2016 to 2020. Quantities have dropped from 225 tonnes in January 2016 to 4 tonnes in October 2020; the trend is to zero exports. Prices have fallen slightly over time, from approximately $7,200/t (fob) to approximately $5,700/t.

Figure 12 Exports of cucumbers and export prices




Source: Statistics NZ Infoshare. Exports of Vegetables; cucumbers and gherkins, fresh or chilled Table Ref: TEX001F

## 5.5 Vulnerability to Emission Prices

Cucumbers are produced in New Zealand largely for a domestic market with a diminishing quantity exported. Imports are equivalent to approximately 1% of production and occur in winter months when domestic prices are high. In total there appears to be comparatively little competition from other countries.

Emission intensity of production varies significantly amongst NZ producers, so increases in the costs of emission units is more likely to shift activity between NZ producers than to lead to import or export substitution.

However, below we examine expected effects of emission prices relative to estimates of profit.

Figure 13 shows estimates of cost impacts on EBIT and EBITDA using the starting low and high values from Table 25. Unlike the analysis of the other products, the estimated impacts on EBIT and EBITDA for cucumber production do not result in negative numbers until emission prices are very high, ranging from s 9(2)(b)(ii) under the low EBIT assumptions to s 9(2) under the high EBITDA assumptions.

Figure 13 Impacts of emissions price on estimated cucumber production EBIT and EBITDA

s 9(2)(b)(ii)

At s 9(2)(b)(ii) of $CO_2$, EBIT (or EBITDA) would need to be less than s 9 2 of gross revenue to fall to zero.

The risk of leakage from cucumber producers facing a full emissions price appears to be very low.

## 5.6 Summary

The cucumber production industry appears to be highly over-allocated with emission units. For the three financial years analysed, allocations appear to be equivalent to approximately s 9(2)(b)(ii) of emissions.

Analysis of the impacts of emission costs on estimated EBIT and EBITDA suggests that, on average, the cucumber production industry is at risk of being wound down in New Zealand if it faced the full costs of emissions and emission prices were above between approximately s 9(2)(b)(ii) $CO_2$-e.[37] Closure might be more immediate if the NZU price rose to s 9(2)(b)(ii) $CO_2$-e or higher.

Unlike the other industries examined in this report, there is high variability in emission rates and vulnerability to emission costs. The industry as a whole does not appear to be at much risk of leakage and even if production stopped at the one producer that has high emissions, production might just shift within New Zealand rather than to international producers.

[37] Because of the uncertainty, NZU prices are rounded to the nearest $5/t

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