New Zealand Equity Research
5 December 2019

FORSYTH BARR

Dairy Sector

Counting Carbon Emissions

Chelsea Leadbetter, CFA
chelsea.leadbetter@forsythbarr.co.nz
+64 4 495 5262

The environmental impact of the dairy sector is gaining increasing government/regulatory focus as well as attention from consumers and the broader public. The dairy industry makes up ~23% of New Zealand's total greenhouse gas (GHG) emissions, primarily from methane on the farm. The NZ listed dairy companies have started the complex journey to lower emissions — with bold targets, various initiatives (including farmer incentives) and good disclosure. However — it will be no easy feat. Fonterra is the most exposed of the listed players, while the key challenge for the sector is lowering natural emissions from animals.

- **The sector has an increasing will to make change:** With changing attitudes and behaviours increasingly evident across farmers, processors and broader industry participants.
- **Collaborative approach:** Between the broader sector and Government including some policy flexibility, support for various R&D projects and processors providing incentives for behaviour change on farm.
- **Listed NZ dairy companies are being proactive** with good disclosure on emissions, various initiatives underway and bold targets.
- **More information, guidance, support and tools are still needed on-farm:** There is no 'one size fits all' silver bullet and individual on-farm plans being provided appears a logical start. Various trials and R&D projects are underway across a number of areas with early signs of success. More is still required to expand the available toolbox to help lower emissions.
- **Key considerations:**
  - Cost/benefit: We expect accountability for emissions to lift the cost of doing business for the New Zealand dairy sector. What is less clear is (1) how the burden will be shared, (2) quantifying mitigators (i.e. pricing power, efficiencies, carbon neutral as interim marketing tool).
  - New Zealand pasture-based farming systems compare favourably to global dairy on GHG intensity. Reducing dairy production would lower New Zealand's emissions, albeit there are unintended environmental consequences if this is simply replaced with production elsewhere.
  - Changing consumer preferences is a risk.
  - We expect the debate about best use of land to continue.
  - Industry forecasts for declining dairy herd numbers should help.

Investment View

Our preferred exposure in the New Zealand listed Dairy Sector is The a2 Milk Company (ATM), with an OUTPERFORM rating. We view current valuation metrics as attractive vs peers, history and the NZ market, particularly considering its growth outlook and strong free cashflow.

We rate Synlait Milk (SML) as NEUTRAL, while Fonterra Shareholders' Fund (FSF) is in our Research Insights series (unrated).

Overview

The dairy industry makes up ~23% of New Zealand's total GHG emissions, predominantly through methane on the farm. 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.

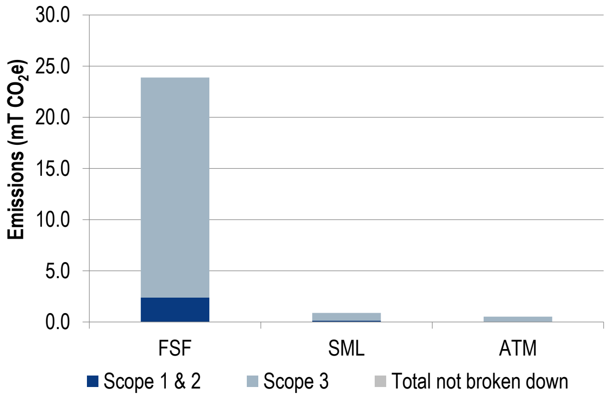
Over the last 25 years New Zealand farmers have become more efficient and reduced emissions intensity, however, significantly more progress is needed in our opinion. The sector appears cognisant of the need to change, but the roadmap and measures to achieving its own ambitious goals are still being worked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

Listed company exposure

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.

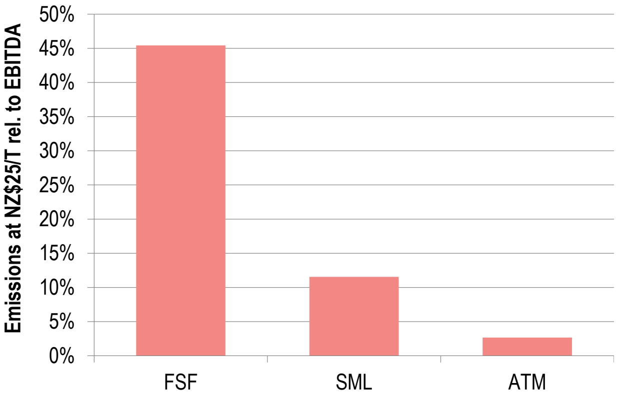
- **ATM:** Reliant on influencing third parties. The company is also offsetting its direct and indirect emissions via purchasing carbon credits.
- **SML:** A clear standout in terms of disclosure, willingness and initiatives underway. SML has bold targets (ahead of policy) and is taking some opex/capex risk front-footing the necessary change. This should also help support its premium positioning.
- **FSF:** Faces the largest challenge, primarily on-farm, but also in processing. The complex journey has started to reach targets, with hurdles already evident and more solutions still required. The Farmgate Milk Price Manual limits its direct exposure to additional opex/capex, albeit we expect the cost burden in reality to be shared.

Figure 1. Latest annual carbon emissions for dairy companies



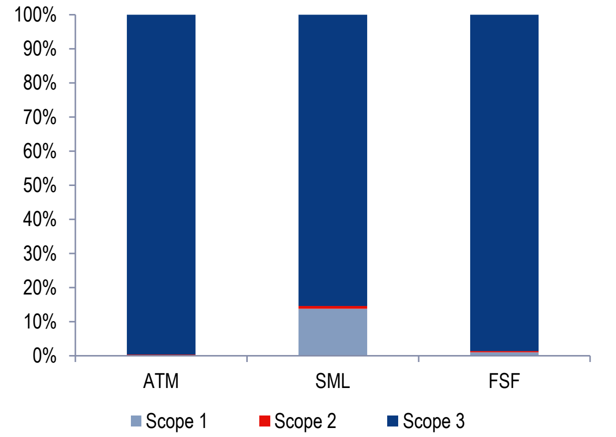
Source: Forsyth Barr analysis, Company reports

Figure 2. Profit exposure to carbon costs



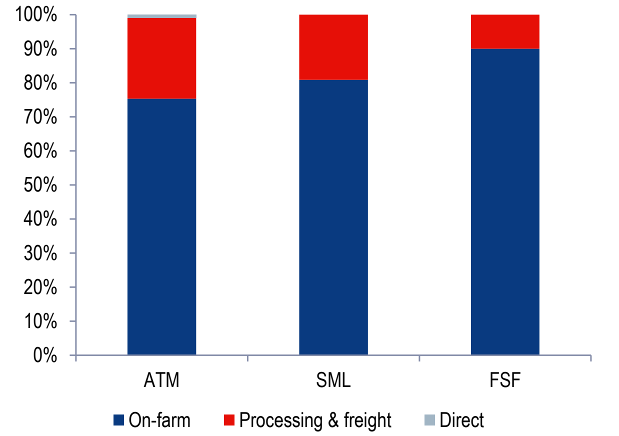
Source: Forsyth Barr analysis, Company reports

Figure 3. Listed dairy players heavily weighted to Scope 3….



Source: Forsyth Barr analysis, Company reports

Figure 4. …and reliant on behaviours on-farm



Source: Forsyth Barr analysis, Company reports

Dairy sector — emissions exposure

Where are we today?

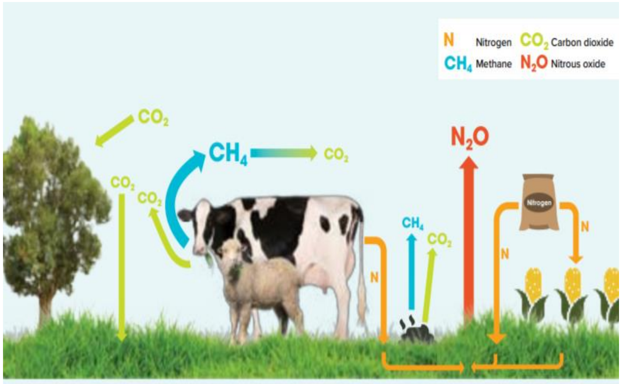
The dairy industry accounts for about half of New Zealand's agricultural emissions, or 23% of New Zealand's total GHG emissions (Dairy NZ). This is predominantly produced on-farm (~85%), with the remainder through processing (~10%) and transport (~5%).

Breaking down the various GHG

- **Methane:** Almost three quarters (71%) of reported agricultural emissions is methane from livestock digestive systems.
  - Ruminant animals (for example cows, sheep and deer) have a complex digestion process that uses microbes to break down and extract nutrients from fibrous plants like grass. As part of this process, other microbes produce methane that is burped and breathed out.
- **Nitrous oxide:** A further ~21% of agricultural emissions are nitrous oxide — predominantly from nitrogen in animal urine and fertilisers.
  - Some of the nitrogen from urine in soil is taken up by plants as they grow, some is lost through leaching and a small amount is emitted as nitrous oxide.
  - Nitrous oxide emissions also arise from the use of synthetic fertilisers on livestock, arable and horticultural farms.

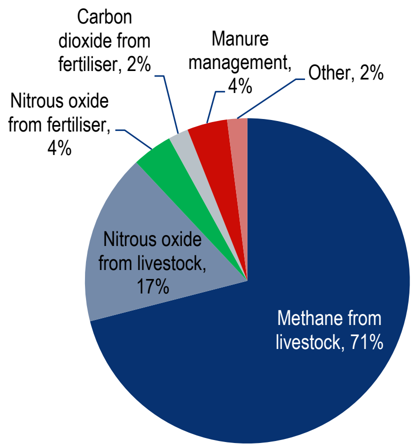
The remainder of agricultural emissions are mostly methane from manure management, and carbon dioxide from fertiliser, lime and dolomite.

Figure 5. Sources and sinks of GHG on a farm



Source: Forsyth Barr analysis, MPI

Figure 6. Breakdown of New Zealand's agricultural emissions



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

Understanding the gases

To compare agricultural emissions with other sectors, the methane and nitrous oxide gases are converted into carbon dioxide equivalent (CO_2e) as these two gases have a different life span and effect in the atmosphere. There is some debate on conversion factors, albeit using the standard (though somewhat arbitrary) 100yr timeframe shows both gases are more potent than CO_2 in warming the atmosphere — by a factor of 298 for nitrous oxide and 25 for methane.

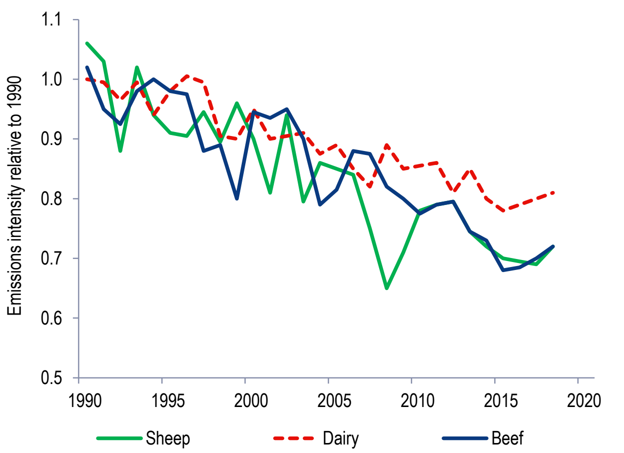
- **Methane is a powerful but relatively short-live GHG**: Methane is shorter lived than CO_2 (~12 years for methane and 100s of years for CO_2) albeit creates a strong burst of warming over a shorter period.
  - According to various industry commentators there are a range of arguments as to why New Zealand's ruminant-sourced methane, which decays rapidly, is much less of a long-term threat to climate than CO_2. The 'methane cloud' from New Zealand's pastoral agriculture is now close to stable whereas CO_2 levels in the atmosphere remains on an upwards journey.
- **Nitrous oxide is a powerful gas and relatively long-lived:** Nitrous oxide is a very powerful greenhouse gas with a lifetime of more than 100 years. Over a century or two, nitrous oxide is similar to carbon dioxide as it causes long-lived warming but it does not dominate headlines because much less is emitted.

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 in New Zealand, overall emissions from agriculture continue to climb because farmers are producing more.

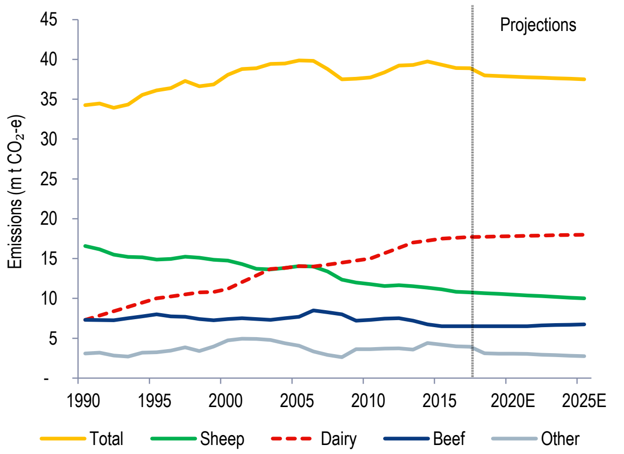
- **Reduced emissions intensity:** Over the last 25 years New Zealand farmers have become more efficient and have reduced emissions intensity by about -1% each year. Initiatives include:
  - Selective animal breeding,
  - Improved pasture & feed management,
  - Fencing off marginal land and planting
  - 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 7. Emissions intensity (i.e. emissions per unit of product)



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

Figure 8. New Zealand'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 would be unintended environmental consequences if this is simply replaced with production elsewhere.

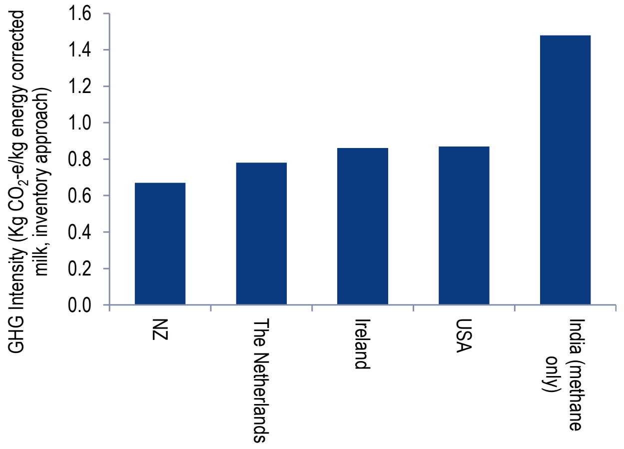
GHG intensity — New Zealand compares favourably

Comparing GHG emission intensity across countries is not a simple exercise, but various methodologies indicate New Zealand'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).

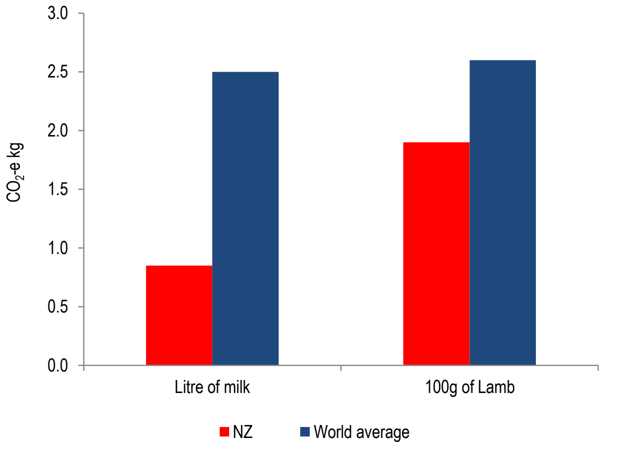
[1] https://www.interest.co.nz/rural-news/88406/fonterras-jeremy-hill-points-out-if-worlds-dairy-producers-were-emissions-efficient

Figure 9. 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 10. 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 dairy products relative to the size of the population. Circa 90% of dairy emissions are associated with consumption in other countries.

…hence simply reducing our dairy production could see unintended consequences

Even with relatively long distribution chains, the consumption of dairy products produced by New Zealand in some export markets can result in a much lower global carbon footprint than if they 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, in our view. 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 demonstrates 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 11. Scenario modelling of dairy on-farm system change (sample of farms)

	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

According to DairyNZ, the current breakeven price for the average dairy farmer is NZ$5.88/kgMS. Under a scenario where emissions are priced (at NZ$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.

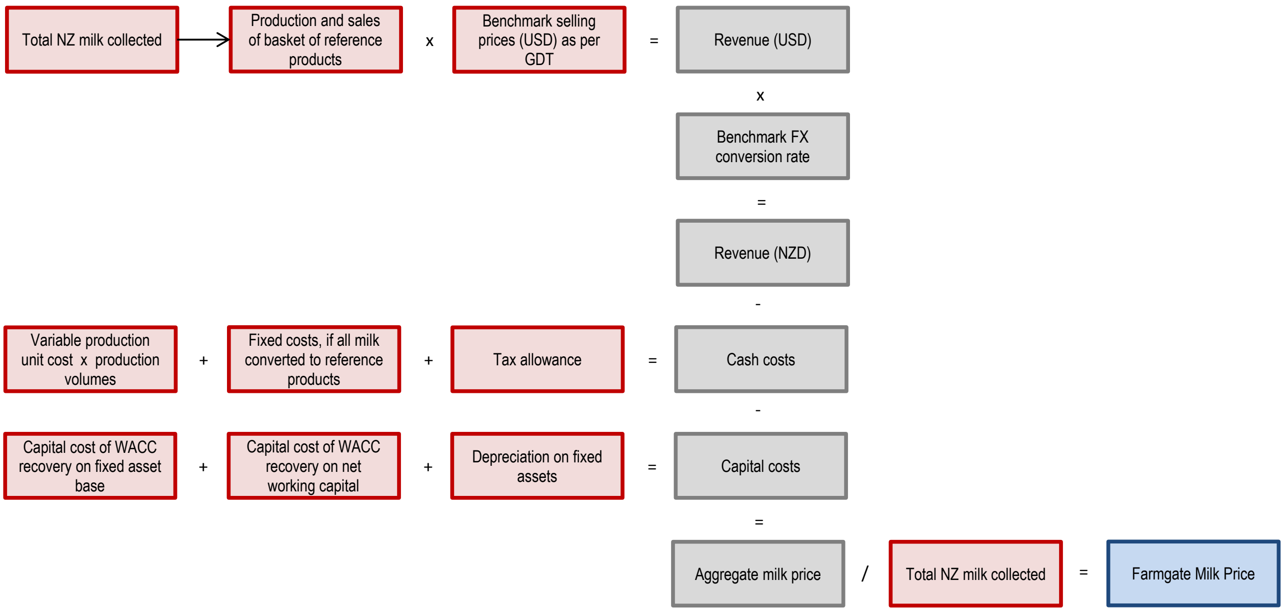
The Productivity Commission believes a carbon price rising to between NZ$75-150/tonne is required for New Zealand to transition to a low-emissions economy while to achieve net-zero emissions the carbon price needs to rise to between NZ$150-250/tonne. This would materially dent farm economics (all else 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) — which is 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 and 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 12. 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 and availability of substitute products.
  - The carbon footprint is only one aspect of a given food's sustainability; it's also important to consider the source of the product (such as whether the soy is sustainably farmed) and other resource use, such as water, needed to produce substitutes.

- **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 the 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

Company specific commentary

The a2 Milk Company — reliant on third parties

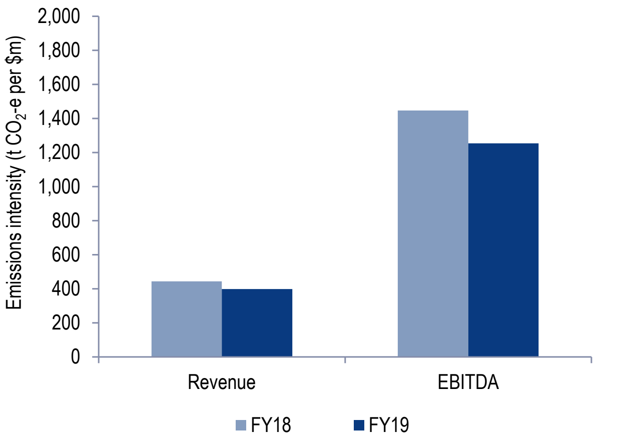
ATM's disclosure on carbon, and sustainability more broadly, increased materially in its FY19 Annual Report.

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

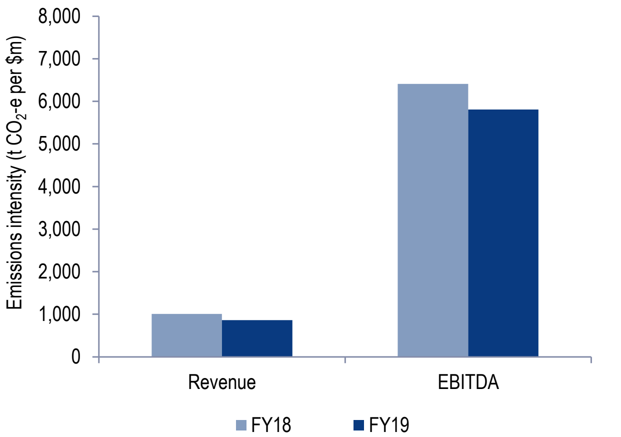
- **A commitment to remain carbon neutral across its supply chain:** With emissions to be offset via purchasing carbon credits. ATM first achieved carbon neutral in FY19.
  - Direct and indirect emissions to be offset through purchasing carbon credits sourced from projects in its key markets (ANZ, US 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 current 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 13. Emissions intensity - ATM



Source: Forsyth Barr analysis, Company reports

Figure 14. Emissions intensity - SML



Source: Forsyth Barr analysis, Company reports

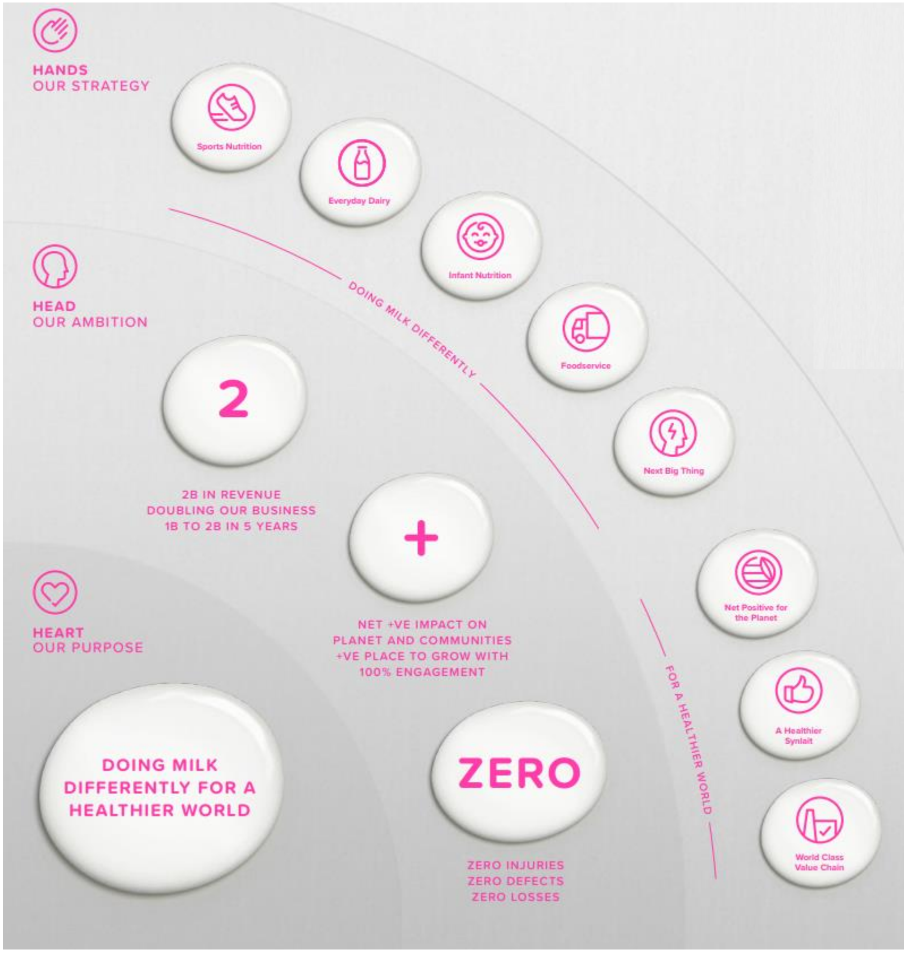
Synlait Milk — "*doing milk differently for a healthier world*"

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 15. 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.
    - The company has added a financial incentive for farmers who understand measure and mitigate on-farm emissions.
    - As at FY19, 49% of its suppliers are certified Lead with Pride (vs. 28% in FY18).
- **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?

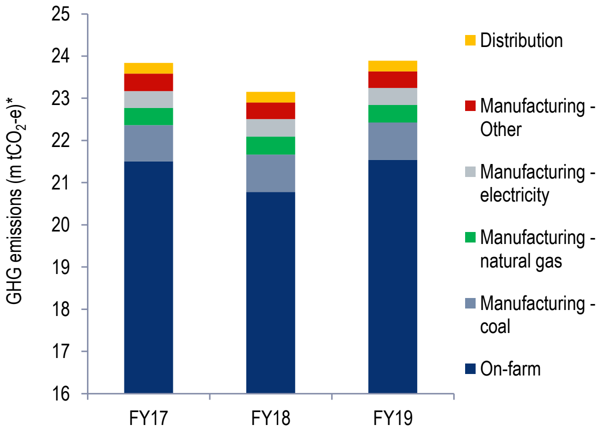
SML is already implementing and making decisions on more than just economics / profitability (with the recent electrode boiler the most obvious example). Our analysis of its strategy points to SML choosing to take at least some of the capital/cost risk (i.e. capex and/or through incentive payments to 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.

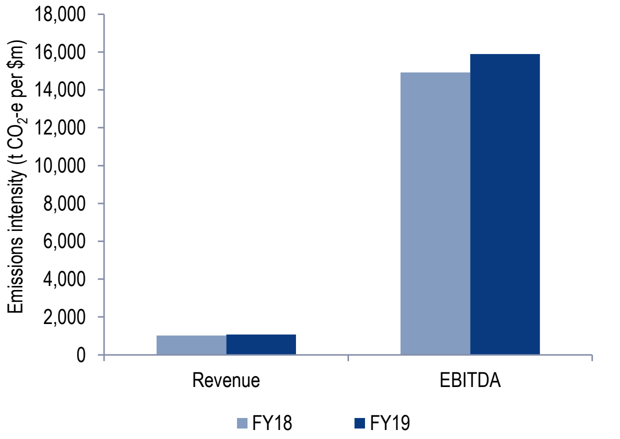
While the co-op has started on the journey, there is considerable work to do to reach its targets. A comprehensive array of mitigating activities will be required, including some which don't currently appear technically and/or commercially viable.

Figure 16. Emissions breakdown



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

Figure 17. 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, particularly 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.