Submission on Process Heat in New Zealand: Opportunities and barriers to lowering emissions

22 February 2019

FONTERRA CO-OPERATIVE GROUP LIMITED

1) Introduction

The transition to a low emissions economy: improving energy productivity and increasing the use of renewable energy in Industry

Fonterra is pleased to participate in this discussion around Process Heat in New Zealand.

Fonterra's, and New Zealand's continued success on the world stage is reliant on a clean, sustainable environment and continuous improvement in the production and transportation of our products.
As the country's largest exporter and a key player in the agriculture sector there is opportunity for us to help the country meet its obligations to the Paris Agreement. With the scale of our operations, transitioning to a low emission future is going to require a staged approach.

We have already started on our journey. In 2017, Fonterra committed to achieving net zero emissions by 2050, on the way to using 100% renewable energy for our operation emissions (this includes our factories and distribution). We have set an interim target of achieving a 30% reduction in emissions by 2030 (from 2015 base year).

We welcome the opportunity to provide feedback on the identified opportunities and barriers industry faces in transitioning to low emission process heat.

2) Context

The use of process heat in New Zealand

Fonterra operate around 30 manufacturing sites nationally. We have factories located right across New Zealand, from Whangarei to Southland. Each of our factories is unique in terms of the daily volume of milk processed, types of products produced, age of assets and available energy sources.
Today, roughly one third of our sites rely on coal as a primary source of energy, most of these are in the South Island where there was no gas or feasible alternatives when we built these plants.
Another factor that Fonterra must work with, is our regulatory obligation to take any additional milk volume coming into the market, the majority of this growth is in the South Island.

This means that the transition to low emission generation of process heat will not be a one size fits all approach for Fonterra. We will need to consider a range of technology and fuel sources to ensure we can continue to efficiently process our Farmers' milk while meeting our sustainability targets. We also have a range of existing assets many of which still have considerable life left.

Fonterra is committed to our sustainability goals, and as part of this, we have already begun our transition away from coal. In 2018, our Brightwater site near Nelson switched to co-firing biomass, helping reduce CO_2 emissions by 25 percent, or about the same as taking 530 cars off the road.
We are also progressing our 'electric milk' program, with electrification of our Stirling site in Otago. By moving to electricity, coal use will be reduced by about 10,000 tonnes per year.
These trials are a step towards roll out of similar technology to other sites across Fonterra.
Underlining our commitments to having net zero emissions by 2050, we surrendered our mining permit at Mangatangi in the Waikato and divested nearly 50 percent of the land acquired there for coal mining (296 hectares).

An important step towards the transition to low emissions, will be increasing the energy efficiency of our plants. We have been on an energy efficiency journey since 2003, and we are on target to reach a 20% reduction in energy intensity by 2020, based on 2003 baseline year.

When considering new plant expansion we consider whether it can be achieved without increasing on-site energy demand. The installation of new water treatment capacity, a new milk protein concentrate

plant, and an anhydrous milk fat plant at Edendale in 2015 was achieved without expanding the site's existing energy generation capacity.

As outlined in this paper, there are many different opportunities to produce process heat with lower emissions, however there are also many barriers that we will need to address.

Fonterra is committed to lowering our carbon emissions. Getting there will involve combinations of renewable fuels and incremental changes to processing energy efficiency as new capacity is added or old plant replaced. The choices available will vary regionally and will need to evolve over time as the costs and technology changes.

3) Opportunities and barriers to lowering emissions from process heat.

Barrier A: The cost of emissions is not fully priced

Q1: To what extent has the NZ ETS influenced process heat investments in your business?

Fonterra considers sustainability in our investment decisions, but to date, the NZ ETS has had a limited direct influence on process heat investment decisions due to the historic low cost of carbon units in the ETS. We consider carbon pricing as part of the wider financial decision making, but uncertainty around longer term pricing makes this a difficult undertaking.
We support a well-functioning Emissions Trading Scheme, and recognise the Government is currently considering a number of further improvements to the NZ ETS.

Q2: To what extent do you agree that businesses are accounting for the price (and future price) of emissions, but face other barriers to reducing process heat related emissions?

We have a number criteria that are considered when making investment decisions, one of which is sustainability. We are anticipating the outcomes of the ETS review currently underway.
We look forward to having clarity and visibility on the Government's plan to achieve emissions budgets in order to assist our business planning.
We believe that allocation decisions should be informed by the level of mitigation technologies available and the impact on international competitiveness of the industry. Decisions should be based on recommendations from the Climate Change Commission

Fonterra's responsiveness to changes in emissions price is complicated by several factors, particularly in the short to medium term:

- Our existing capital intensive assets are spread over multiple locations and have a long life span. These will need to be replaced or upgraded to lower emission options at significant capital expense over a period of time.
- There is a regulatory requirement to process all milk supplied, and the majority of milk growth is in the South Island, where most of our process heat is currently supplied with coal, as there is no natural gas available and limited volumes of forest residual for biomass boilers.
- We do not always have the appropriate technology available to switch our processing sites to lower emission options, as outlined in the sections below.
- We cannot quickly convert to electricity, the reasons are outlined in more detail in barriers I-K

Having clarity about the Government's long term plan for emissions pricing will be important as we plan our transition to low emission process heat.

Q3: To what extent do you agree that businesses are accounting for emissions prices but are unresponsive to changes in the emissions price?

Fonterra is responsive to emissions prices and responds when the prices make sustainability initiatives financially attractive. However, our ability to respond is constrained by the barriers discussed above

Q4: Does the NZ ETS provide an incentive to significantly reduce emissions beyond current levels for business who receive industrial allocation?

Fonterra does not receive a significant volume of EITE industrial allocations at approximately 2% of total production, so on its own merit is not enough to justify any significant changes, but would be considered as part of wider project analysis.

Barriers to improving energy efficiency and the uptake of renewables in process heat systems

Barrier B: Energy Projects have to compete with other capital investment projects

Addressed in question responses below

Barrier C: Access to Capital

Addressed in question responses below

Barrier D: Aversion to production disruption

Fonterra is able to plan and implement capital projects during our winter maintenance period that aligns with milk production stopping for several weeks over winter each year. Implementation or retrofitting of new technology would not usually result in interruption to our production schedule.

As outlined in paragraph 57-59, the risk we consider when reviewing new technology is any potential disruption to production during the dairy season (roughly August-May). Due to the perishable nature of milk, and our need to collect milk daily from our farmer shareholders any disruption can very quickly have a significant cost and environmental impact. This means we need a high degree of certainty in the reliability of new technology or energy sources. This may favour proven technology in the decision making process. We are currently trialling co-firing biomass, at our Brightwater site, and an important outcome of this trial will be to prove the technology and understand risks before considering this option for other sites at larger scale of utilisation.

Barrier E: Hidden costs and benefits of Energy Improvements

Addressed in question responses below

Q5: To what extent does your business ring-fence capital for energy related projects?

We have a ring fenced capital fund which has been allocated to a program specifically for the purposes of achieving energy and other sustainability improvement targets as publicly stated.
Within this program an energy portfolio manager has been assigned to lead the selection and prioritisation of initiatives based on maximising carbon dioxide emission reductions while minimising capital cost.

Q6: To what extent are objectives such as sustainability incorporated into your organisations investments, i.e. is sustainability included in your KPIs?

Fonterra has publicly stated our sustainability goals out to 2050 and has an internal group sustainability policy that provides sustainability guidance to all capital projects. Sustainability objectives are built into KPIs at all level of our business. Senior managers, site and plant managers, through to site process engineers have sustainability targets relating to energy and water efficiency built into their KPIs. Our capital project teams must work with these stakeholders when considering new capital investments. Our capex approval system requires every application for capital to state the impact on site energy usage.

Q7: Are these objectives considered secondary to risk and return?

Our sustainability targets are included in risk and return, and this is one of the criteria considered when making investment decisions.
We use our ring-fenced sustainability fund as a way to progress projects that may not meet financial payback criteria in other areas.

Q8: Do you agree that energy efficiency or renewable projects are often not implemented as they are not core business investments?

To be able to meet our own targets for sustainability, sustainability projects are core business investments. Energy Efficiency projects that may not meet financial payback criteria, can be implemented using the ring fenced sustainability capital fund.

Q9: Is your business limited by access to capital for energy related investments? Is this due to lender appetite or are these limits self-imposed?

Like most businesses, we manage a limited capital pool in all areas of our business. Limits are set by the businesses capacity to fund capital and the competing priorities. All of our capital investment decisions are based on several criteria including financial return, risk management and sustainability criteria.
Ability to invest is limited by how much we can borrow. Fonterra's co-operative structure means we have different capital structure and ability to raise funds.
We also have a regulatory requirement to process additional milk growth, so capital requirement for capacity can override other investment criteria.

Q10: To what extent do hidden costs or co-benefits (as described above) hinder or progress process heat investments?

We often see a combination of benefits from sustainability projects across water reduction and energy efficiency. Co-benefits are recognised as a way of leveraging synergies and delivering greater benefit from the capital that is available.
We agree with Paragraph 60-I and II. Additional costs outside the actual capital installation, including feasibility studies, and resourcing to identify and design improvement projects can be a barrier.
This is an area where having resource available in the form of industry shared learnings/best practise, technical experts or feasibility funding can assist to progress new capital projects. A good example of this approach is the support from the Government's Energy Efficiency and Conservation Authority to complete the biomass trial at our Brightwater site.

Q11: Does your organisation actively monitor its energy use and/or its emissions?

Yes, we measure energy use at all of our manufacturing sites, and use this information in our KPIs across the business to track performance. We also measure emissions across our supply chain at an aggregate level.

Q12: Do you think that there would be benefits from publishing individual emissions data reported by NZ ETS participants and/or large process heat users?

Fonterra already publically discloses its emissions across our supply chain at an aggregate level. While we don't have an issue with disclosing our emissions at this level, we're not sure it's appropriate for all participants. We do not see a benefit in sharing it at a more detailed level.

Q13: Do any of the informational barriers described above have an impact on your organisation's decision to invest in process heat technologies, and if so, to what extent?

Barrier F: Inadequate information on the emissions profiles of products or firms

We agree that providing adequate emissions profiles of our products is becoming increasingly important to our customers. Fonterra export most of our production, so it is important that emissions data is compared on a like for like basis. This requires consistent methodology between different countries, as shown by the errors and consumer confusion generated in the past when products where differentiated by food miles. But it is not a barrier to invest in process heat technologies.

Barrier G: Some firms have poor information on their own energy use

We have good information on our energy use, which allows us to efficiently justify the benefit from energy efficiency improvements. Without this level of information it would be a barrier to prove the value of the capital spend. We have metering and measurement systems at all of our manufacturing sites and

a dedicated team of process engineers focused on energy to support the business understand and optimise energy use.

Barrier H: Lack of information or aversion to new technologies

We also agree that we do not have perfect information about new technology and alternative sources of process heat, that there is some bias towards proven technology and trials can help decrease the perceived risk to production or benefit delivery.
The bias towards proven technology is not just related to the technology itself, but also the confidence we have that we can deliver the capital project at the projected price, in the projected timeframe, and our operations staff will be able to manage the new technology efficiently.

Q14: Could you please rank the three informational barriers as listed directly above this box in order of impact on your organisation?
H, F, G

Barriers to the electrification of production

Electrification will play an important role in Fonterra's transition to a low emission future. However, as outlined in this technical paper, there are some significant barriers to electrification that will need to be considered and worked through.

Q15: Has your organisation considered electrifying part or all of a given site's heating process?

As outlined in the Fonterra partnership with the Ministry for the Environment "Roadmap to Transition to a Low Emission Future", a project team from a range of academic and industry experts, has undertaken a study to establish how we can convert our manufacturing sites from fossil fuels to electricity. An important part of this study is to understand the capacity of the electricity supply infrastructure to each site.
The process heat requirements at our sites mean we would not be able to immediately switch to electricity without requiring a distribution or transmission grid upgrade at most locations. This means that reducing our thermal load through efficiency projects is an important step before transitioning to electricity and we have started on this process. We also note that an issue arises when customers contribute towards a transmission asset capacity upgrade but do not receive any future capacity rights for the investment it has made.

In August 2018, we announced that we will be installing an electrode boiler at our Stirling site, in Southland. Stirling was selected for this trial because the local OtagoNet grid could absorb this change without a major upgrade. The change will displace about 9,700 tonnes of coal annually.

Q16: If so, to what extent do you agree with the barriers I to K listed here?

Barrier I: High cost of electrical energy relative to other high carbon fuels

We agree that in the current market, without including externalities, electricity is significantly more expensive than coal and natural gas fuels. As an example, previous investigation into electrification our Edendale plant, in Southland, estimated that we would have increased the site's operating costs by about 50 percent and this would also have required an investment from Fonterra of about $160 million in upgrading the electrical supply to the site.

Barrier J: Electricity supply is fundamentally more complex than other fuels

We agree with the statements outlining the benefits of coal over electricity in terms of storage and transport flexibility.
We also agree that the relatively simple supply arrangements and longer term pricing of coal contracts allow us to plan and manage our energy costs with more predictability.

With electricity we face more exposure to market price fluctuations and more complex contractual choices. For example, the spring 2018 Pohukura gas field shut resulted in a significant increase in electricity prices which have continued into 2019. The electricity market regulator is currently investigating the high electricity sport market prices and hopefully includes investigating how the supply changes in the gas market and associated information disclosures impacted the efficient operation and trust of the electricity market
Fonterra supports a move to real time pricing for the wholesale electricity market.

Barrier J1: Connection costs and the transmission pricing methodology

Fonterra has noted that an issue arises when customers contribute towards a capacity upgrade of a transmission asset but do not receive any future capacity rights for the investment it has made. In the TPM review we would like to see expansion of the investment contract arrangements focus area to include the treatment of capacity rights for transmission assets which customers have contributed towards.

Barrier J2: Time and costs associated with developing electricity connections and new generation plants

We agree with paragraphs 84-86 that there are both timing and cost barriers to developing electricity connections.

Barrier J3: Perceived risk of electricity supply disruptions

Average outage rates across the network may achieve desired industry targets however, we do see repeat issues at some of our manufacturing sites that do not impact the current SADI and FADI metrics Voltage drops or spikes can cause significant downtime approaching 8 hours in some of our plants if they trip while in full production, yet no existing quality metrics track this impact.
We would like to see the value of lost load included in the metrics when measuring the impact of disruption and expansion of the term disruption to include voltage fluctuations.

Barrier J4: Variable and uncertain emissions intensity of electricity use

We agree that the emission intensity of electricity is variable depending on the makeup of generating sources. We also agree that there are established approaches to reporting emissions intensity. We would expect that an efficient ETS would guide the market towards low emission sources of electricity.

Barrier K: Electricity has historically been a 'last choice fuel' for industrial processes

Fonterra has historically favoured gas and coal due to many of the barriers outlined in response to question 3(2). Electricity has not been able to provide the required heat load to run our plants efficiently and cost effectively.
Electricity is not a 'last choice fuel' for Fonterra today, we are actively working towards electrification of some of our manufacturing sites as a way to meet our sustainability goals.

Q17: What does your organisation consider are the largest barriers to the electrification of its production?

- Ability to supply required load to sites.
- Cost of electricity connection
- On-going cost of electricity supply,
- Available technology to provide required heat load.

Q18: Are there any costs or co-benefits of electrification that we have not included that your organisation has identified?
Fonterra production and process heat requirements peak in the summer, which is counter cyclical to the historic electricity demand winter peak and therefore should be the lowest electricity prices.

Barriers to the use of woody biomass

Q19: Has your organisation considered biomass as a fuel source? If so, what did you conclude and why?

Yes, Fonterra is currently trialling biomass as fuel source at our Brightwater site. We have converted the existing boiler to be able to co-fire wood biomass as well as coal. This will cut emissions at Brightwater by 25 per cent.
We have been supported to complete this trial using funding from the Energy Efficiency and Conservation Authority Low Carbon Dairy and Meat partnership. This type of support is beneficial to Fonterra to be able to trial and prove technology before committing to large scale implementation.

The proximity of a biomass fuel source near the site has also been a factor in the success of undertaking this trial. Having access to sufficient and reliable biomass fuel will be important to the further roll out of this technology to our other coal using sites.

Q20: To what extent do you agree with the barriers L to M listed?

Barrier L: The economics of biomass fuels is situationally dependant and complicated

The Brightwater trial has confirmed that biomass is a feasible fuel option for a dairy manufacturing site, but there are several factors that could prevent further rollout of this option. We agree with each of the points raised (94-99).
We would need to be confident in a reliable and guaranteed supply of biomass at a uniform quality.
We would like to see accreditation of biomass suppliers and the ability to fix long term supply agreements, with uniform quality of product and consistent and transparent pricing, as we currently have with coal and gas suppliers. This will allow us to make capital investment decisions, and be confident to transition away from coal.

Barrier M: Biomass supply chains are undeveloped and face development difficulties

We agree with the statements made (100-101)
To transition more of our sites to biomass, we will need to be confident of a quality supply of fuel, and suppliers will also require certainty of a market for their production. Supply and demand for biomass fuel need to grow together.
We see the Government, potentially through a third party Industry Organisation assisting in balancing this supply and demand growth.
We support the Government's plan to plant one billion trees and would like to see this planting spread throughout NZ. This will allow biofuel transportation networks to be more efficient in delivering fuel where it will be used.
As mentioned above, we would like to see accreditation of biomass suppliers and the ability to fix long term supply agreements, with uniform quality of product and consistent and transparent pricing, as we currently have with coal and gas suppliers.

Barrier N: Air emissions regulations.

We did not have any issue with consents at Brightwater, as our modelling and testing showed the particulate profile was within the PM 10 limit. We would expect this to be similar at other sites, however if particulate regulations were changed, we would need to manage that transition.
The example in the paper about high moisture content has not been an issue for us at Brightwater, but could be an issue if the moisture content of biomass is not consistent. This highlights the points raised earlier about the requirement of a consistent and reliable source of biomass fuel.
Switching from coal to biomass would mean a significant reduction in SO_2 emissions.

Q21: What does your organisation consider to be the largest barrier(s) to the use of biomass for supplying heat?

As we have proven at Brightwater, when we have a reliable and local supply of biomass, this is a cost effective source of process heat for a small dairy site.
The lower energy density of biomass compared to coal means we may have to look at co-firing for our larger factories and invest in significant storage capacity at those sites.

One of the challenges for Fonterra will be matching a reliable supply of biomass at our required quality and volume at our larger manufacturing sites.
Dairy farms and dairy factories don't tend to be where there are a lot of trees and emission reductions can be quickly eroded – or turn negative - the further biomass has to be trucked.

Q22: Has your organisation identified any costs or co-benefits of using biomass that we have not included above?

The trial at our Brightwater site has been achieved partially using our existing assets. Being able to utilise existing assets can reduce capital cost, but will not be feasible at all of our sites.

Self-generation from renewable sources – wind or solar

Q23: Has your organisation considered building onsite generation? If so, why did the project go ahead or not go ahead?

We have previously completed high level investigation into renewable, onsite generation.
As outlined in the technical paper (paragraph 104-106) there are several reasons we have not investigated further, these include:

- High upfront cost, including feasibility studies.
- We would potentially still need to be connected to the national grid, as supply may be intermittent so would not replace this cost.
- Available technology may not suit our locations.
- Generating electricity is not our core business. We would require additional internal resources and expertise to manage this, and this may not be cost effective compared to purchasing electricity externally.
- There may be regulatory hurdles such as potential building code or resource consent issues.
- The potential requirement to become a market participant, particularly if we were to feed excess supply back to the national grid. The current legislation is prohibitive to small generators

This does not mean we would not investigate this option in the future, especially as technology options improve costs, or as a partnership with government or other parties.

Q24: Are there any barriers to, or co-benefits from, the use of onsite generation that we have not included that your organisation has encountered?

A benefit is that our energy demand peaks demand in late spring and summer, and has lowest demand in winter. This is counter cyclical to the electricity and gas peak demands in winter.

The use of direct heat from geothermal

Q25: Does your organisation have the potential to use direct heat from geothermal?

We have some manufacturing sites located near geothermal sources, and have previously investigated this option as a source of process heat as well as investigating stimulated geothermal. It has not been a suitable option for our requirements in the past, due to scale, complexity and access to resource, however, geothermal energy is an option that we will continue to investigate in our transition to low emissions

Q26: If so, what are the key barriers that hinder your organisation from using direct heat from geothermal?

The scale of technology available, reliability and quality of supply volume meant that we could not justify against more proven and cost effective sources of process heat. There is also an issue around the difference in maximum temperature available from geothermal versus the temperature required to spray dry milk.

Q27: Has your organisation identified any other barriers to, or co-benefits from, the direct use of geothermal heat that we have not included above?

Geothermal energy does have carbon emissions associated with it as a source of energy, depending on the field can be similar to gas fired boilers.

Switching from coal to natural gas

Roughly one third of our New Zealand manufacturing sites rely on coal as a primary source of energy. Historically there has been no reticulated natural gas or feasible cost effective alternatives available in the South Island and therefore we have relied on the use of coal in our plants to process our farmers' milk.
We also use coal at several of our North Island sites. As part of our commitment to having net zero emissions by 2050, we had started planning to transition these sites from coal to using natural gas or other low carbon alternatives to coal.

The paper does not mention the April 2018 decision by Government to cease new oil and gas exploration permits. Opposition parties have suggested that they would repeal this decision if elected to government. A lack of cross party agreement creates a level of future uncertainty that will impact decision making for capital investment.

If we were to hypothesise that natural gas was a feasible option to replace coal, then we agree with the barriers outlined in the paper when considering switching from coal to natural gas.

There are limited options to substitute coal for gas in the North Island.

We currently use coal at some of our North Island sites, and have included gas in our plan to reduce emissions from coal by 2030. The halt on oil and gas exploration means we may have to review this plan. We are still committed to transitioning from coal, so gas will help this transition.

There are no natural gas networks in the South Island

We agree with paragraph 113. There are currently no natural gas fields in the South Island, but if gas were to become available, and we are still using coal, we would investigate using gas to help transition away from coal.

Security of supply may be a concern for potential gas users.

Recent events, such as the Spring 2018 Pohukura gas field outage highlights the lack of visibility and security of natural gas supply, as well as the volatility of current and longer term pricing.
To make decisions about natural gas use, either moving to or from its use requires stability of supply and long term pricing that is managed in a transparent and well regulated market.
Fonterra supports the transition to low carbon fuels but we would like to see this transition be well planned and communicated to allow time to phase out and make the transition.

Co-generation opportunities exist but may not reduce system wide emissions in the medium term.

Fonterra has co-generation plants based on three of our manufacturing sites. These are owned and operated with third party suppliers.
Because of the requirement to balance electricity and heat generation, we do not always see an overall efficiency gain when undertaking process improvement projects to reduce energy usage.
We have supply agreements for purchasing annual steam volumes, so often will not see a financial return for reducing steam requirements below these thresholds. This can limit capital investment in process efficiency projects at our co-generation sites.

Another point to note at our co-generation sites is that when the ETS industrial allocations were established, the use of co-gen heat and electricity contributed to some of our products being too efficient to meet the criteria to receive an industrial allocation.

Hydrogen as a low emission fuel for process heat

We do not see a benefit to Fonterra in pursuing hydrogen for process heat at this time.
However, as technology improves, if a source of low cost green hydrogen, produced from renewable energy becomes available we would investigate this option. A benefit for us would be that we would be able to use our existing natural gas boilers and air heaters. Hydrogen will have to compete with direct electrification and must be available at scale with security of supply similar to the existing natural gas network.

We will be interested to review the outcomes of the EECA and MBIE joint research project to investigate potential for hydrogen usage and manufacture in New Zealand.

-End-