September 2025

Fonterra Waitoa case study

New bubbling fluidised bed biomass boiler for dairy product manufacturing

TE TARI TIAKI PŪNGAO
ENERGY EFFICIENCY & CONSERVATION AUTHORITY

aurecon

Executive summary

Fonterra's Waitoa site is a major producer of ultra heat treated (UHT) dairy products for global markets, and its operations require high-temperature, high-pressure process heat. Traditionally, this demand has been met by coal, resulting in significant emissions. To address this, Fonterra chose to install a new large-scale 30 MWth Bubbling Fluidised Bed (BFB) biomass boiler, which started in 2021 and became fully operational in 2024. This is the company's first BFB installation, chosen for its ability to fire a wide range of fuels with higher moisture and ash content, as well as larger particle sizes than conventional grate boilers can manage.

The BFB boiler allows the Waitoa site to use a wide range of including wood pellets, green hog fuel, and potentially sludge alongside or instead of coal, providing both flexibility and resilience. The system is expected to reduce carbon emissions by around 48,000 tonnes of CO_2e per year, delivering a significant reduction in carbon costs. As a highly automated plant, the boiler has also reduced operational requirements compared with coal systems and improved overall maintenance performance.

While the project has delivered clear benefits, it also highlighted challenges, particularly around biomass handling. The Toploader fuel system initially experienced operational issues, which were resolved through modifications to the overhead conveyor filling system. More broadly, the project reinforced that biomass handling is one of the most significant engineering elements of such conversions and requires careful planning and robust design.

The Waitoa project demonstrates that BFB biomass boiler technology can enable substantial emissions reductions, while offering energy resilience through the ability to fire multiple fuels. For industrial sites with high temperature and steam pressure demands, it provides a strong example of how biomass boiler systems can meet production needs, reduce coal dependency, and support long-term operational efficiency.

Contents

Figures

Tables

1 Project Overview

1.1 Fonterra

Fonterra is a New Zealand-based multinational dairy co-operative that is one of the world's largest exporters of dairy products. Fonterra operate around 30 manufacturing sites across New Zealand producing products such as milk powder, cheese, butter and yogurt.

1.2 Fonterra Waitoa

Fonterra's site in Waitoa, New Zealand, recently installed a large-scale biomass boiler. The project, named as 'Project Kahikatea' by Fonterra, installed a 30 MWth biomass boiler which was started in 2021 and was fully operation in 2024.

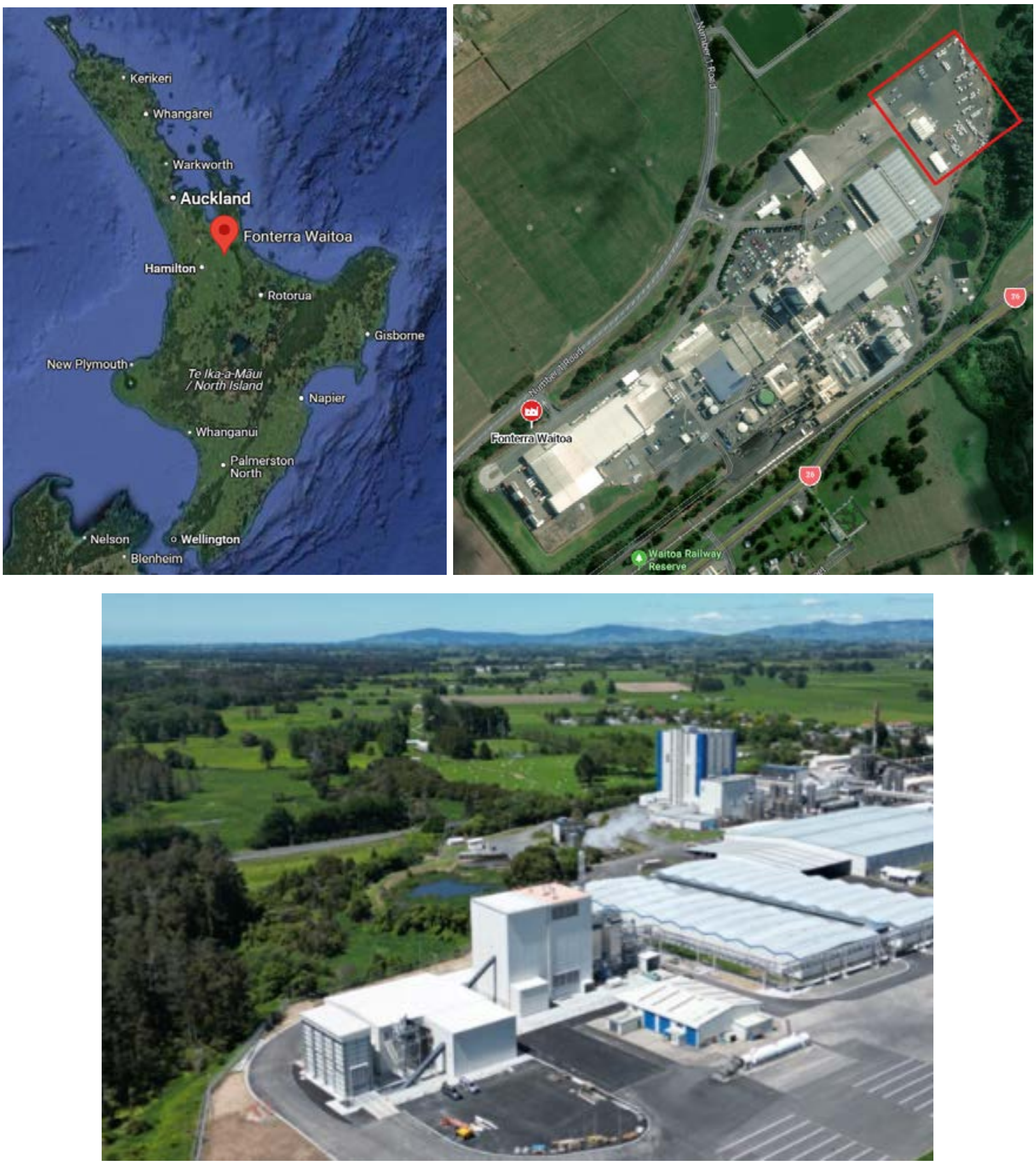

Figure 1: Location of Biomass Boiler at Fonterra Waitoa

1.3 Resources & Stakeholders

All information in this report has been obtained from the resources listed in this section.

Table 1: Resources and Stakeholders

Who	Location	Role & Expertise	Useful Links & Contacts
Fonterra	Auckland, New Zealand	Dairy producer	https://www.fonterra.com/nz/en/contact-us.html
Windsor	Napier, New Zealand	Boiler supplier and installer	https://www.windsorenergy.co.nz/fonterra-waitoa-green-steam/ https://www.windsorenergy.co.nz/building-our-own-bubbling-fluidised-beds-in-porirua/ https://www.windsorenergy.co.nz/fonterra-waitoa-110t-boiler-lift/ https://www.windsorenergy.co.nz/take-over-of-fonterra-waitoas-30mw-biomass-boiler/ https://www.windsorenergy.co.nz/contact/
Living Energy	Auckland, New Zealand	Living Energy supplied the biomass storage system (Toploader)	https://www.bioenergy.org.nz/living-energy
Trasmec	Headquarters in Italy	Trasmec supplied the handling and screening equipment	https://www.trasmec.com/
Aurecon	Wellington, New Zealand	Engineering and project management services	https://www.aurecongroup.com/projects/manufacturing/fonterra-waitoa-biomass-boiler https://www.aurecongroup.com/locations
Schick	Hamilton, New Zealand	Civil works and ground improvements	https://www.schick.co.nz/contact/
Northpower	Whangarei, Northland	Power supply	https://northpower.nz/contact/
Hendl & Murray Engineering (HME)	Hamilton, New Zealand	Equipment fabricator	https://hmengineering.co.nz/contact/

2 Concept & Feasibility Design

2.1 Biomass Supply Chain

Fonterra researched the biomass supply market and developed market intelligence. Fonterra then completed a competitive tender for the biomass supply to Waitoa, from which they contracted Pedersen Group and Rotorua Forest Haulage.

2.2 Boiler Pathway

Fonterra had a plan to transition away from coal with Waitoa being one of the target manufacturing sites. They considered new biomass boiler options included grate boilers and fluidised bed boilers. An options analysis on the boiler options was completed and Fonterra decided to install a Bubbling Fluidised Bed (BFB) boiler due to the fuel versatility and security it offers. Generally, BFB boilers can fire more difficult fuels than grate boilers, fuel that have higher moisture content, higher ash contents and with large particle sizes. This was the first BFB boiler that Fonterra have installed. As part of the study, Fonterra visited other fluidised bed boilers in New Zealand, which included the BFB boiler at PanPac in Napier.

3 Detailed Design & Procurement

The project can be split into two distinct sections, the biomass handling & feed system and the Bubbling Fluidised Bed (BFB) boiler, as shown visually in the 3D model below:

Figure 2: Bubbling Fluidised Bed Boiler (left) **& Biomass Handling & Feed System** (right)

3.1 Biomass Specification

Fonterra secured a biomass supply chain. The wood is chipped in the forest in the Rotorua/Tokoroa region and transported to Waitoa at a rate of 8-9 truckloads per day. The clean wood chip, or clean hog fuel, supplied to site has the approximate following specification:

- Moisture Content: 40%-55%
- Ash Content: <3%
- Size Distribution: P63

3.2 Biomass Handling & Feed System

The Block Flow Diagram (BFD) below shows the main components of the biomass handling and feed system, which is made up of the following features:

- The biomass resource is a green hog fuel made in a forestry site in Rotorua/Tokoroa region, which is stored in the forest for two days
- Trucks drive into a semi-enclosed biomass reception area and tip biomass into a deep reception pit, which is covered by a grate which acts as a screen to take out very large objects
  - The trucks do not reverse, which meets the site policy of no large reversing vehicles
- An in-ground plate conveyor and overhead conveying system then moves biomass from the pit to the three storage bays
  - Together the bays make up 1000 m^3 of biomass, which is 24 hours of boiler operation on average
- The biomass is passed through fuel screening system to which removed fuel exceeding 200mm in length and includes a magnet to remove any ferrous objects. The screen is self-cleaning
- A large rake, which is attached to a trolley system, rakes biomass from the storage area onto a transfer conveyor feeding an en masse conveyor which feeds the boiler hopper:
  - No front loader is needed, which removes the risk of operating heavy machinery and the staff overheads to operate such machinery
  - Living Energy supplied the storage bay rakes, trolleys and transfer conveyor which make up the Toploader system feeding the Extract Conveyor System
- The boiler hopper feed biomass to the boiler through a screw conveyor into wind swept spouts which blow the biomass onto the fluidised bed

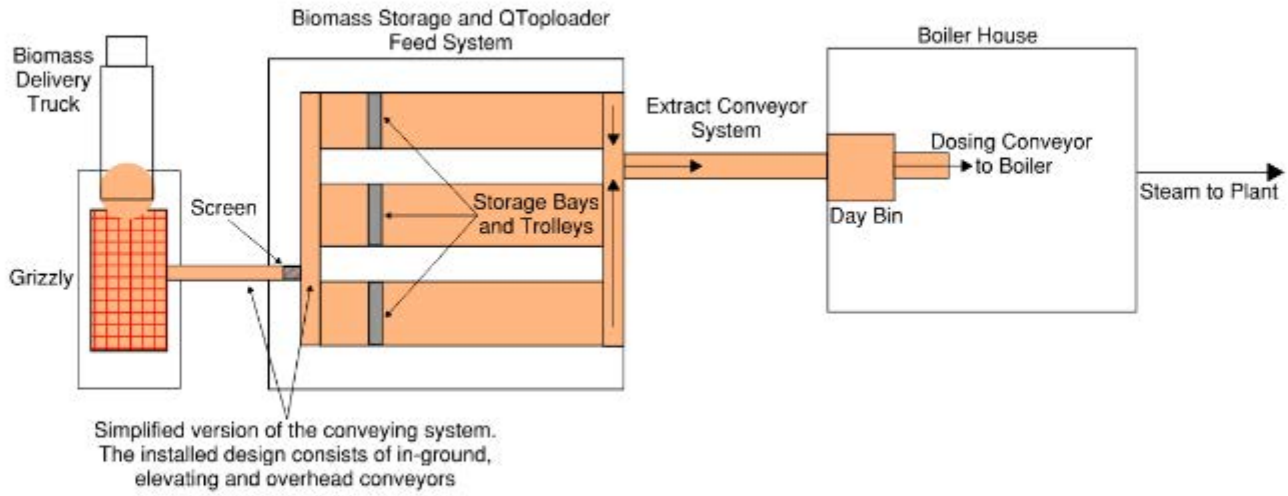

Figure 3: Layout of Biomass Handling & Feed System

The system operates in a cycle of three modes:

- Filling – the storage area is filled using an overhead conveying system equipped with pneumatic gates
- Stacking – the biomass is raked to the dosing conveyor
- Dosing – the product is discharged onto a conveying system which feeds biomass to the boiler

The Toploader system was chosen over other system, because it requires less foundation work, no front loader, smaller electrical drives, less heavy mechanical components and easier maintenance because all mechanical equipment is above the fuel. Fonterra learned this from a previous biomass project in Fonterra Stirling.

Figure 4: Example of Toploader showing Trolley System (not Waitoa)

3.3 Bubbling Fluidised Bed (BFB) Boiler

The BFB boiler design was completed by the Windsor Energy team in Napier under licence of Babcock & Wilcox (B & W Towerpak® Boiler). The boiler was made at BIB Thailand with ancillary parts fabricated at the Windsor Engineering workshop based in Porirua.

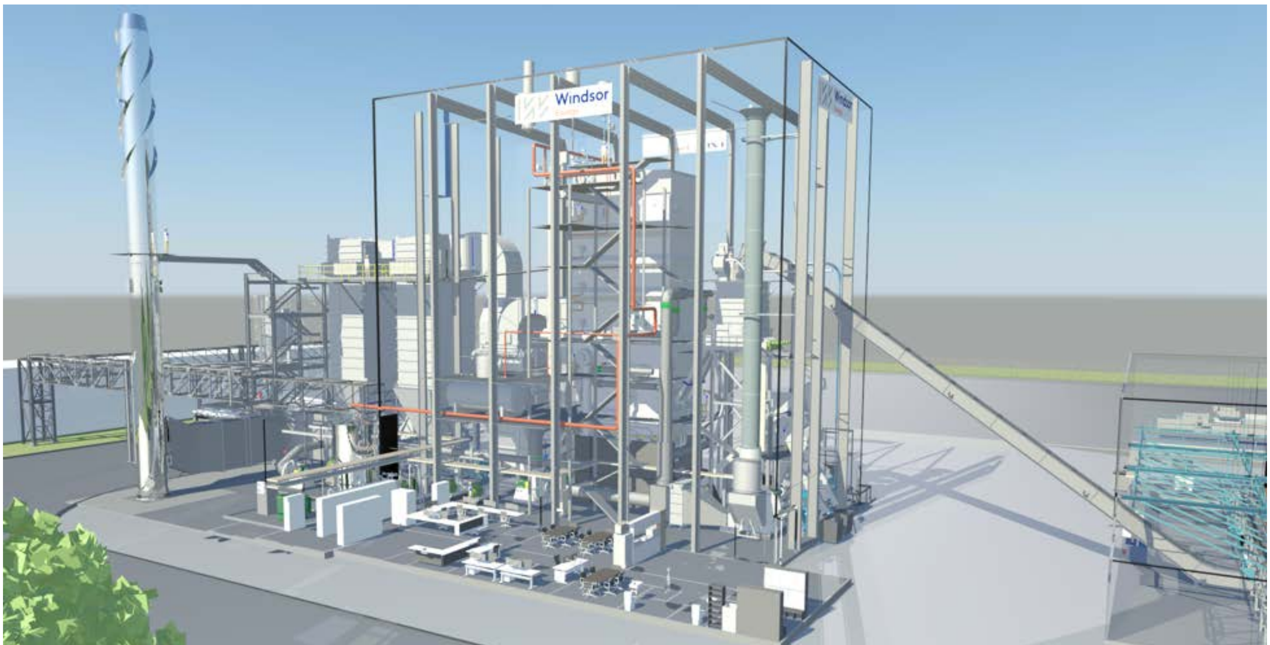

Figure 5: 3D Model of Waitoa Biomass Boiler

3.3.1 Configuration

The BFB boiler can fire a wide range of fuel with an average moisture content of up to 60%, with short-term spike up to 64%. High moisture content fuels, such as hog fuels or sludge-type wastes are handled due to the large thermal mass of sand held in the boiler bed. For comparison, grate boilers can generally fire fuels with an average moisture content of up to 57 or 58%.

A typical BFB boiler system is shown in the figure below and is made up of the following features:

- Bed Material: This is the material in the combustion chamber, which is largely sand, biomass and ash
- Fluidised zone is above the bubble caps
- Non-fluidised zone is below the bubble caps
- Secondary and tertiary over-fire combustion air inlets are above the fluidised bed
- Heat Exchanger:
  - The furnace is made up of water-cooled tubes connected by membranes to form walls
  - A water tube heat exchanger (generating bank) is installed in the top of the furnace for steam generation
  - Boiler water is preheated in a flue gas economiser

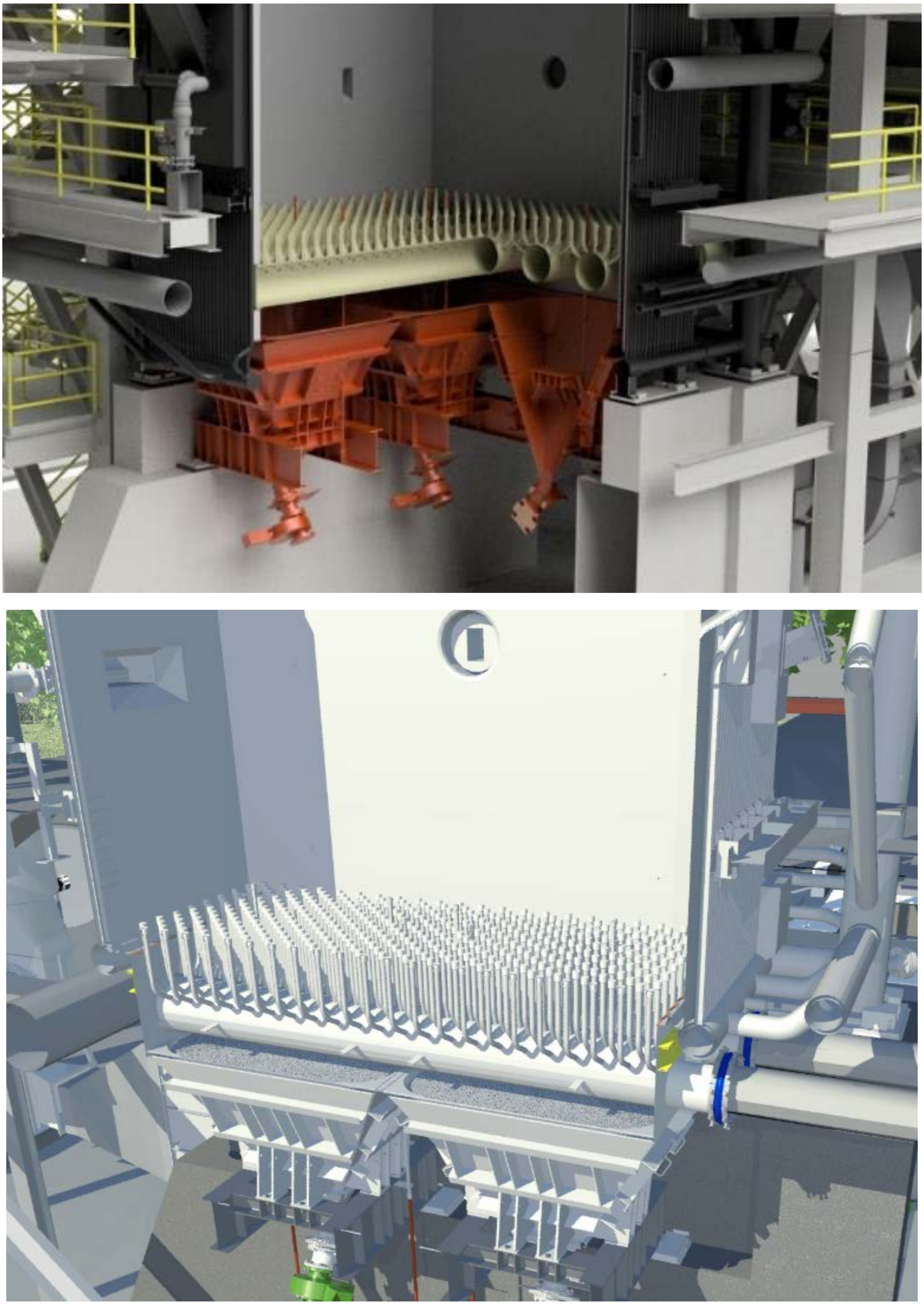

Figure 6: Cross-section of Bubbling Fluidised Bed (BFB)

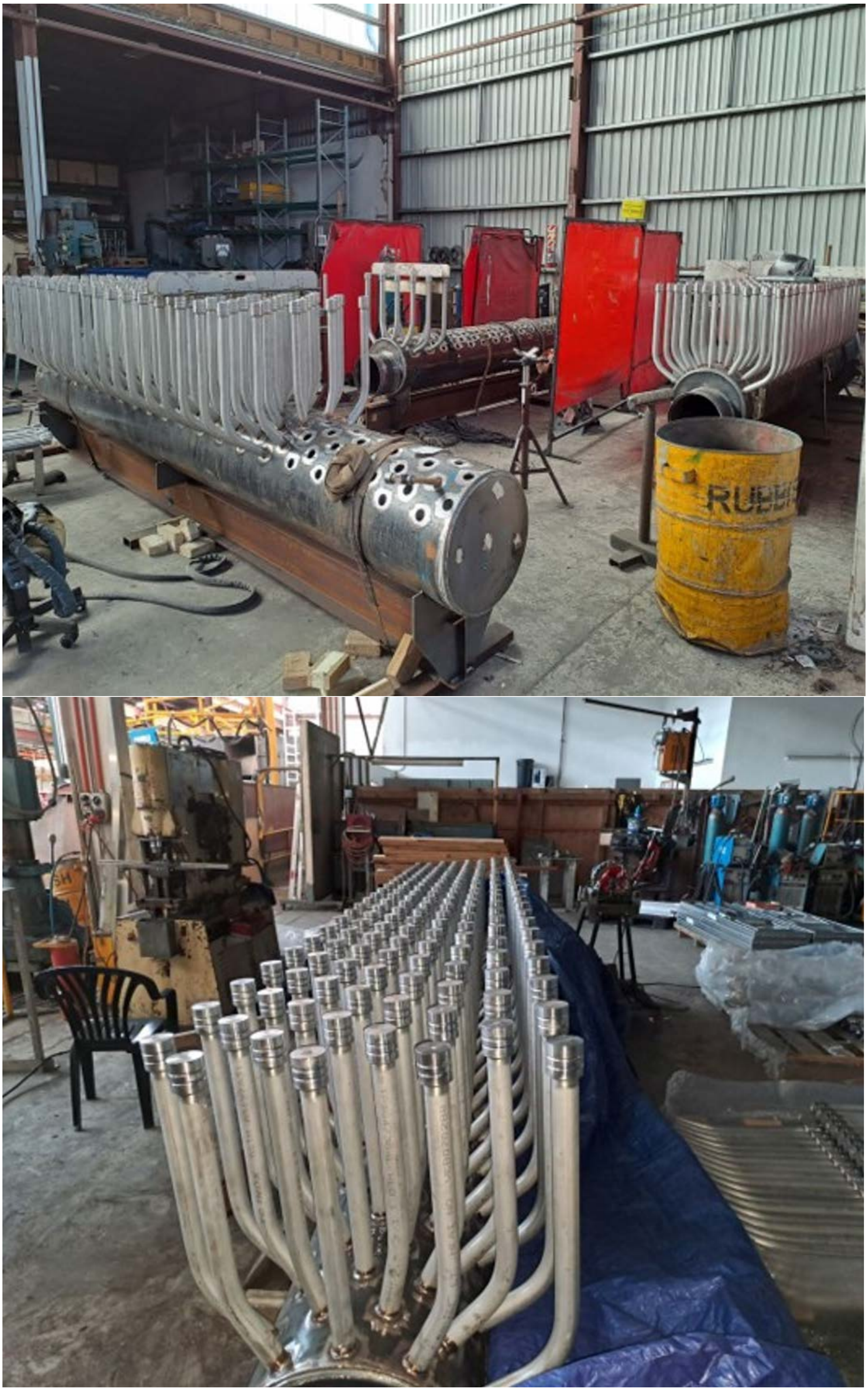

Figure 7: Air Header showing Antlers and Bubble Caps

3.3.2 Combustion Process

Each particle size follows the same combustion process in a BFB boiler as other combustion systems such as grate boilers. However, the mechanism, rate and control of the combustion is entirely different.

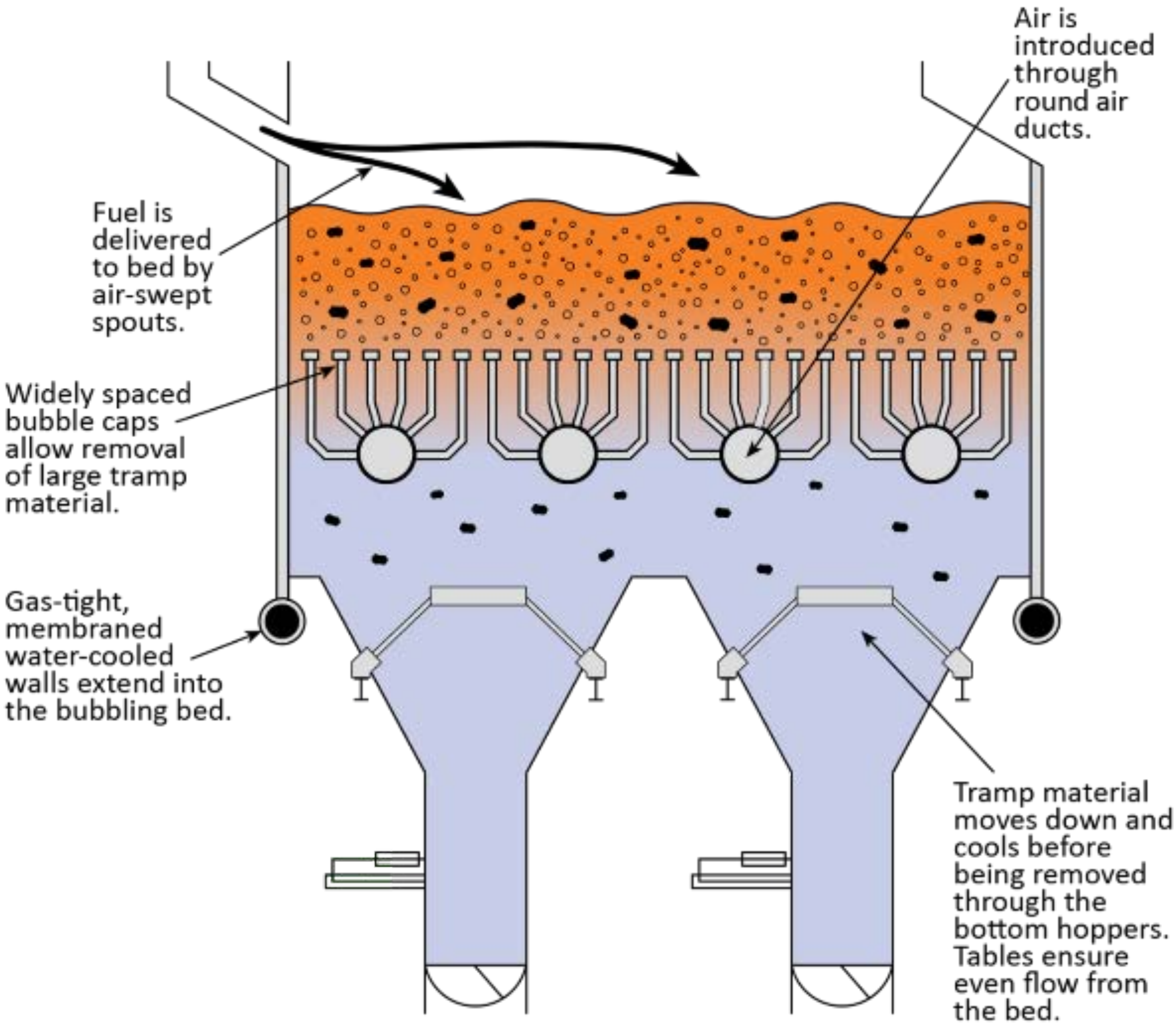

Figure 8: Schematic of the Bubbling Fluidised Bed (BFB) Boiler

The BFB combustion process is detailed below along with a schematic:

- Fuel distribution:
  - Particles of fuel are spread widely on to hot bed of sand fluidised with combustion air
- Drying:
  - Some fine fuel particles complete the combustion process from wet to ash while in suspension, (stoker grates also exhibit this trait, while mass fed systems all fuel is pushed onto the grate)
  - Fuel particles absorb heat from the hot sand to dry (other systems dry fuel with heat from the flames in the furnace above and radiant heat from dedicated refractory arches)
  - Fuel particles dry quickly according to their size as they are individually enveloped in sand, (other systems dry fuel relatively slowly)
- Pyrolysis/ Volatile Gases:
  - Volatile gases can ignite in the sand bed and above. Complete volatile combustion is staged using air injection at various levels in the upper furnace (for grate boilers volatiles burn in the furnace above the grate)

- Combustion of the char:
  - Complete combustion of solid fuel occurs in the bed with no residual unburnt carbon (in other systems char burns out on the grate, but typically residual unburnt fuel remains as it moves towards the discharge point)
- Ash:
  - Ash from fuel burnt in the bed becomes part of the bed media until it exits the bed with the sand recycling system

3.3.3 Fluidisation

The air introduced into the bed is made up of primary combustion air and flue gases. Combustion air doubles as fluidising air and oxygen supply for combustion. The air is fed into large header pipes and then through antlers to bubble caps in the boiler bed, which are uniformly spaced apart to allow the fluidised bed to flow. Only sand above the bubble caps is fluidised. The air double up as fluidising air and introduces oxygen for combustion.

The air flow rate must be above a minimum fluidisation velocity, of 1-3 m/s, to lift and suspend solid particles for them to behave like a fluid. It is essential that the bed material be of uniform particle size to maintain even fluidisation.

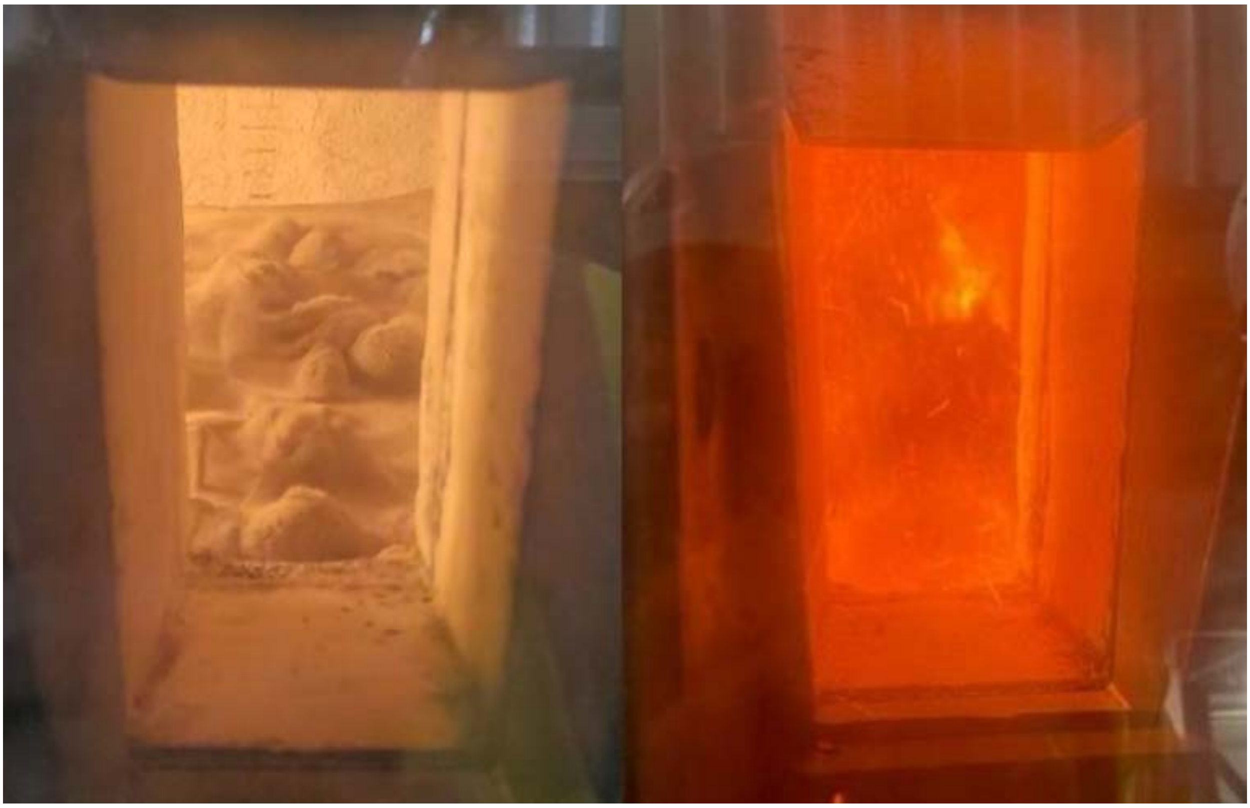

Figure 9: Fluidised Bed during Start-up(left) **& during Combustion** (right)

3.3.4 Sand Recirculation

Fuel is fed from a hopper through wind swept spouts into the bed. Large combustible materials will ‘float’ in the bed while burning. Any large non-combustible materials, such as stones and agglomeration, pass down through the fluidised bed into the non-fluidised zone and eventually exit through the bed-material outlet on the boiler.

The boiler includes a fully enclosed sand handling system that screens for oversized particulates (overs) and fine particulates (unders/fines) and then recirculates the sand in the BFB system. A sand recirculation system reduces the sand consumption of the boiler.

The system also includes a sand storage bin to allow for complete drainage of the BFB for maintenance. The overs and unders/fines as disposed of with the ash. Any new sand can be purchased in 1 m^3 bags and moved with a forklift. The sand meets a certain specification for use in fluidised beds, for example it does not have large pieces of sand or stones in.

3.3.5 Bed Temperature & Sintering

Crucial to proper operation of the fluid bed is tight control of the bed temperature, which operates around 760-800°C, to ensure complete combustion but below the ash fusion, or sintering, temperature. If the temperature gets too high, then glass crystals form which:

- Foul surfaces
- Agglomerate and become too big to pass out of the bottom of the bed
- Damage the antlers and bubble caps
- Could eventually solidify the bed

Bed temperature is control by adjusting the following flow rates: fuel flow; combustion air flow; and Flue Gas Recirculation (FGR) flow. Flue gases are used to control bed temperature because they dilute combustion air and reduce oxygen, which in turn reduces heat.

3.3.6 Air-to-fuel Ratio

Most boilers typically operate with excess air, which is a Lambda just over 1. This is the optimum combustion environment which achieves very high combustion efficiency and minimises emissions of hydrocarbons, carbon monoxide and particulates. This is illustrated in the figure below.

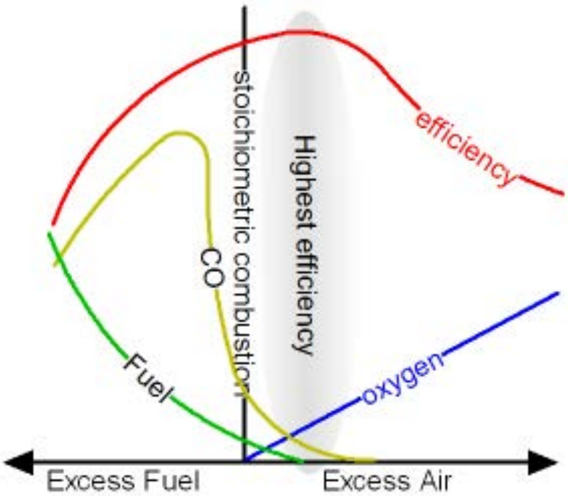

Figure 10: Ideal Air to Fuel Ratio

Compared with other systems, BFB boilers are superior at reducing NOx (oxides of nitrogen), CO (carbon monoxide), Volatile Organic Carbons (VOC's) and SOx (sulphur oxides) as products of combustion. A key feature of BFB boilers is the ability to heavily reduce undesirable emissions through staged combustion from the bed and throughout the furnace.

3.3.7 Flue Gas Temperature

Thermal efficiency of boilers is largely related to the flue gas exhaust temperature. Generally, the lower the flue gas temperature the high the efficiency and vice versa. The Windsor boiler at Fonterra lowers flue gas temperatures with a helical finned tube (as opposed to bare tube) economiser and a condensing economiser, which preheats demineralised feedwater. The temperature of the flue gas is ranges from 85 to 125°C.

3.3.8 Particulate Emission Control & Flue Stack

Fly ash is automatically blown off the boiler generating bank, with a combination of steam soot blowers and a sonic soot blower, to maintain high heat transfer and thermal efficiency.

Flue gas passes through grit arrestors and baghouses to capture fly ash. The flue gas passes through the cyclone first as this can capture large particulates which may still be burning, it can also capture any sand which is entrained in the flue gas, and it reduces the temperature of the flue gas.

The baghouse is made up of fabric filters which are air pulsed periodically with compressed air to dislodge particulate build up which drops out into the ash collection system.

The flue stack and its inlet duct are fabricated with 316 stainless steel to protect them from corrosion when the boiler operates with flue gas temperatures below the dewpoint, where certain compounds may condense into acidic liquid form. The flue stack is equipped with an opacity meter, annual checks are completed by the Verum Group.

4 Construction & Operation

4.1 Construction Contracts

Fonterra held three main contracts for the delivery of the boiler:

- Windsor Engineering were engaged as the Engineering Procurement and Construction (EPC) contractor for boiler. The main sub-contracts are listed below, this list is not exhaustive:
  - Living Energy provided the Toploader biomass handling and feed system
  - Trasmec supplied the handling and screening equipment
  - Livingstones provided the building
  - Bangkok Industry Boilers (BIB) in Thailand built the steam drum
  - Stewart & Cavalier built the baghouse casing and assembled the baghouses – Windsor built the baghouse plenums
- Schick were engaged by Fonterra to complete the ground works
- Hendl & Murray Engineering (HME) were engaged by Fonterra to build the pipe bridge and the connect the services, and assisted Windsor for smaller works
- Northpower completed the 11kV supply and the earthing for the new assets
- Aurecon provided engineering and project management services around the boiler service integration
- Masons completed an upgrade on the demineralised water supply
- There were numerous other contracts for specialist engagements, such as hydrology, consenting, surveying, minor building/fencing work, relocation of storage container buildings

The main challenge was constructing a new boiler on a brownfield site in an operating dairy factory. Windsor had to thoroughly plan and communicate the construction methodology, which including mobilising materials and resources to site and work onsite whilst minimising disruption.

The location was chosen because it could be isolated from main manufacturing site, and there was sufficient land available. A construction ring fence could be maintained during construction which is under Windsors control.

4.2 Earthworks

Once the land quality was brought to a suitable standard, new roading infrastructure was installed to allowed for biomass delivery trucks to complete a full drive through loop into the reception area described previously.

Figure 11: Earthworks

Figure 12: Construction Site

Figure 13: Pipebridge

Figure 14: Aerial Photos - New Biomass Boiler

4.3 Biomass Handling & Feed System

The Toploader had has commissioning snag where the conveying system from the reception pit piled up biomass unevenly across the 8m width of the Toploader bay. This uneven fuel loading across the Toploader bay put excessive stress on one side of the drive chains, which skewed the trolley and caused problems. This snag was also caused with wider bays than the standard design. The bays were made 8m wide as opposed to the standard 6m wide design, without increasing the strength of the associated components.

The solution was to convey the biomass into the Toploader evenly in to allow the trolley to work. Once all parties understood the issue, the biomass was loaded in evenly with the conveyor running down the length of the fuel bay with a splitter to spread it across the bay width.

Figure 15: Biomass Reception Pit

Figure 16: Biomass Conveyors

Figure 17: Filling the Toploaders

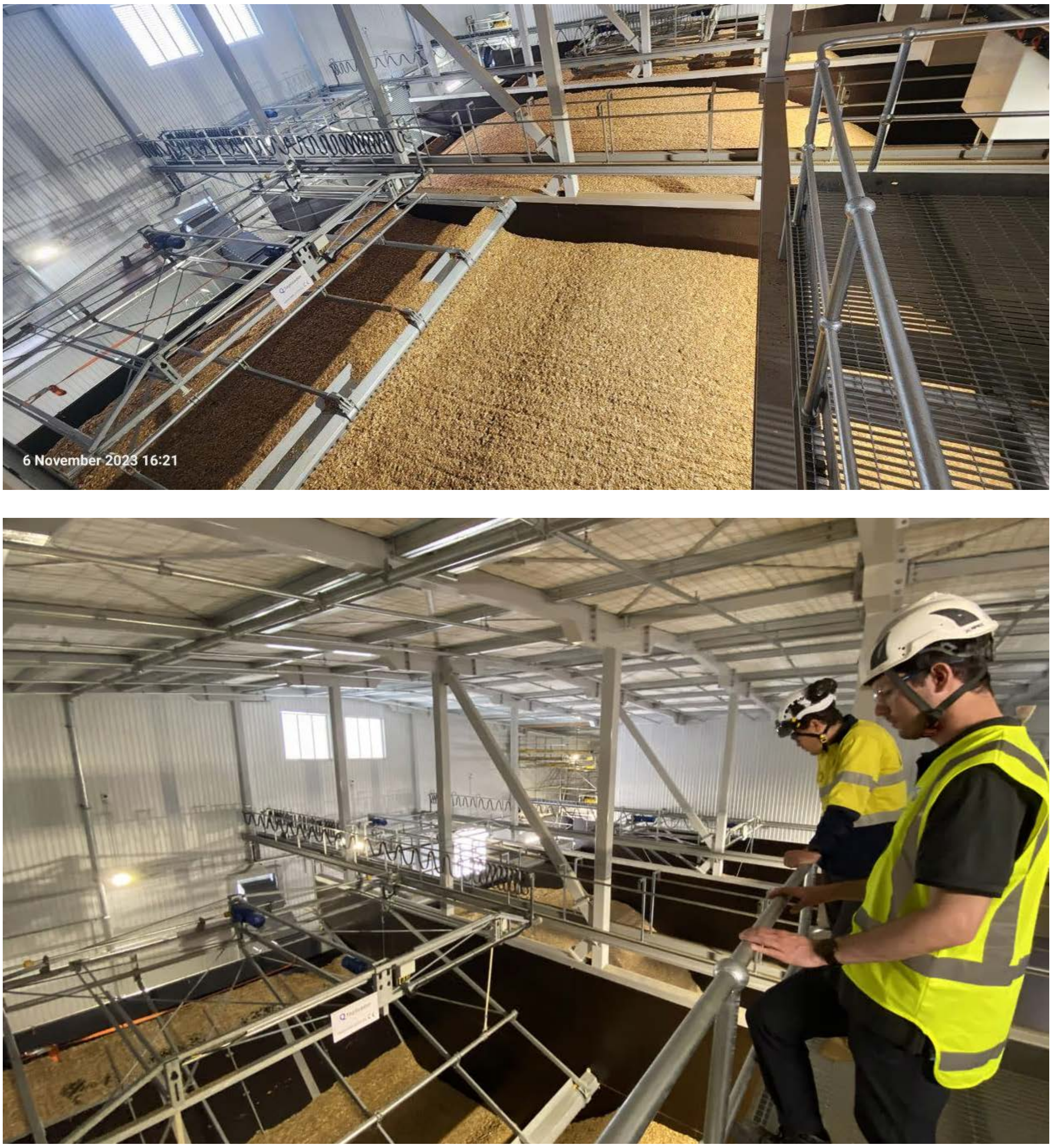

Figure 18: Toploaders in Operation

4.4 Bubbling Fluidised Bed (BFB) Boiler

Some of the key operational aspects for the boiler are summarised below:

- The boiler can run itself autonomously
- Fonterra Shift Engineers inspect the boiler daily
- The boiler has an automated start-up system that preheats the sand bed with auxiliary burners
- The boiler requires ash to be removed by truck every 1 to 2 days

Figure 19: BFB Boiler in Thailand

4.5 Boiler Lift

The fully assembled boiler weighed in at 110 tonnes. A crawler crane in a super lift configuration, and a secondary tailing crane to rotate the boiler mid-air, were required to life the boiler into place. Once the boiler was held in place by the cranes then the ground team welded and secured the boiler to the foundation. The boiler house is approximately 20 m tall due to the height of the fluidised bed boiler.

Figure 20: Boiler and Crane

Figure 21: 110 Tonne Boiler Lift

Figure 22: Boiler Installation

Figure 23: External View of Baghouse, Flue, Boiler and Pipebridge

4.6 Boiler Performance

The boiler performance details are listed in the table below:

Table 2: Boiler Performance Details

Parameter	Unit
Maximum Continuous Rating (MCR)	33 MWth (gross output) 30 MWth (net output)
Stream production rate	47,000 kg/h (gross output)
Operational pressure and temperature	32 bar(g) and 239°C
Design pressure	40 bar(g)
Net thermal efficiency *Steam and hot water	96.3%
Ramp rate	15%, or 4.5 MWth, per minute
Turndown ratio	3:1 which achieves 10 MW minimum load
Specified range of moisture content	40% - 55%
Particulate removal	Bag house removes 98%+ of particulates Meets national particulate emission limit for PM10 and PM2.5

Note that thermal efficiency of steam boilers can be stated based upon the gross calorific value (GCV) or the net calorific value (NCV). The difference between the GCV and NCV depends on the fuel moisture content and water vapour arising from combustion. The gross efficiency of a boiler improves when combusting dryer fuel with lower moisture content whereas the net efficiency remains relatively constant as moisture content of the fuel reduces. Therefore, when comparing efficiencies of boilers combusting fuels with different moisture contents it is better to compare net efficiencies.

5 Approvals and Consents

5.1 Approvals

Fonterra have an internal project gating system that follow a similar structure to the cost estimate classification system set out by the Association for the Advancement of Cost Engineers international (AACEi). The classification system follows the project development framework. Additional project definition provides a more accurate cost estimate, as shown in the table below.

aurecon

Table 3: AACEi Cost Estimation Classification

AACEi Classification	AACEi Accuracy Range
Class 5	Low: -20% to -50% High: +30% to +100%
Class 4	Low: -15% to -30% High: +20% to +50%
Class 3	Low: -10% to -20% High: +10% to +30%
Class 2	Low: -5% to -15% High: +5% to +20%
Class 1	Low: -3% to -10% High: +3% to +15%

Fonterra have phase gate reviews after each cost estimate to determine to proceed, or not, and what are the tasks required to de-risk the project. For this project the Final Investment Decision by the Fonterra Board was made with the following information:

- Class 1 cost estimate, based on quotes from suppliers and contractors
- Confirmed biomass fuel supply
- Confirmed ash disposal plan
- Resource and building consents could be obtained
- National suppliers of major equipment items and key consumables

5.2 Resource Consent

The obtain a resource consent, Fonterra has to meet the following:

- Air discharge limits
- Noise Limits: Due to the site situation near a township, noise limits were set by the Waikato District Council at 85 db. The noise limits were met by constructing a building, with sound insulation, around the biomass fuel handling and feed system and the BFB boiler
- Land use change consent for greenfield earthworks and dewatering

6 Summary & Shared Learnings

Fonterra Waitoa have successfully installed a Bubbling Fluidised Bed (BFB) boiler. The fuel switch from coal to biomass has resulted in the following outcomes, costs and co-benefits:

- The reduction in carbon emissions is estimated at 48,000 tonnes of CO_2-e per annum, which significantly reduced carbon costs
- Removed exposure risk to the carbon price
- Improved energy resilience. The BFB boiler is capable of firing a range of fuels, including coal, wood pellets, green hog fuel and potentially sludge.
- The total project cost was just over $90M
  - This was under the capital cost estimate of $100M
- Maintenance has generally improved
- High automated plant has reduced operational needs compared with coal boiler

Table 4: Summary of Shared Learnings

Category	Shared Learnings
Knowledge of best practice	■ Engage suitably qualified resources to assist in the design development of the project ■ Fonterra have an in-house project delivery team, engineer teams and engaged national consultants and boiler suppliers to obtain advice
Design development	■ Client involvement during the design development and construction phases is critical to ensure that the asset has minimal issues over its lifetime ■ Fonterra project managed the project and were heavily involved in the design through an integrated project management team
Boiler ramp rates	■ The steam supply and demand has to be mapped and managed accordingly ■ Fonterra have had to match steam demand and supply according to change in process plant and utility plant over time
Biomass Supply Chain	■ Fonterra secured a biomass supply contract ■ Fonterra have investigated fuel contingency plans because fuel security Is critical ■ The BFB boiler can handle a diverse range of fuels, up to 60% moisture content on average, with short term spikes, as well as large particle sizes, high ash contents and contamination ■ Ensure biomass storage bays onsite are kept high at all times. The current storage of 1000 m^3 of biomass onsite allows for 1 day of operation, constrained by other site requirements, and there is 2 days of storage off-site
Biomass handling and feed system	■ Handling biomass is a large part of a biomass boiler project and requires significant engineering work ■ The Toploader initially had operational issues which were resolved with modifications to the overhead conveyor filling system
Availability and quality of construction contractors	■ Fonterra have a long-standing professional working relationship with the main Contractors, including Windsor who have installed many boilers throughout Fonterra's dairy sites
Risks management with installation in a working manufacturing site	■ Installation away from site operations ■ Construction ring fence managed by main contractor ■ Off-site manufacturing where practical

7 Additional Information

7.1 Types of Biomass

Common types of solid biomass fuel are listed in the table below:

Table 5: Common Types of Solid Biomass Fuel

Biomass Type	Description	Image
Wood Pellets	Wood that has been pulverised and densified (pelletised) under heat and high pressure to produce a cylindrical wood derived fuel of consistent size.	
Wood Chips	Chipped woody biomass in the form of pieces, with a defined particle size produced by mechanical treatment with sharp tools such as knives.	
Hog fuel	Fuel wood in pieces of varying size and shape produced by crushing with blunt tools such as rollers, hammers or flails. These fuels are typically of a lower quality compared to wood chip.	
Urban Wood Fuel	Wood residues derived from the urban activities including packaging materials, off-cuts from manufacturing, construction and demolition used wood residues, yard trimmings, arborist trimmings, urban tree residues and from land clearing	

Wood pellets can meet the following standards, DIN Plus and/or EnPlus and have low moisture <10% by weight and high energy density of 16-17 MJ/kg. Wood chips, hog fuel and urban wood fuel can have a range of fuel properties, which can be classified according to technical standard *'ISO 17225-1:2021(en): Solid biofuels — Fuel specifications and classes'*. A guide for biomass fuel specification is provided by the Bioenergy Association which is based on ISO 17225. Biomass fuel is typically described by the following properties: particle size (P), fine fraction, moisture content (M), ash (A), bulk density (kg/m3) and energy density (MJ/kg). Classified biomass fuels must be free from non-wood contamination, such as soil and stones. Common biomass fuel properties are shown in the tables below.

Table 6: Moisture Content

Moisture *weight percentage as received	
M20	≤ 20%
M30	≤ 30%
M35	≤ 35%
M40	≤ 40%
M55	≤ 55%
M55+	≤ 55+%

Table 7: Particle Size

Main Fraction *>60% weight	
P16	3.15 ≤ P ≤ 16mm
P45	3.15 ≤ P ≤ 45mm
P63	3.15 ≤ P ≤ 63mm

Table 8: Fine Fraction

Fine Fraction *weight percentage with P<3.15 mm	
F02	≤ 2%
F05	≤ 5%
F10	≤ 10%
F20	≤ 20%
F30	≤ 30%
F40	≤ 40%

Table 9: Ash Content

Ash Content *weight percentage of dry basis	
A.0.5	≤ 0.5%
A1	≤ 1%
A3	≤ 3%
A5	≤ 5%
A6+	≤ 6% - Actual value to be stated

Contact

For more info visit eeca.govt.nz/biomass-boiler-case-studies or email eecaenquiries@eeca.govt.nz