September 2025

JS Ewers case study

Coal boiler replacements and conversions to biomass for indoor cropping

EECA
TE TARI TIAKI PŪNGAO
ENERGY EFFICIENCY & CONSERVATION AUTHORITY

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Executive summary

JS Ewers grows tomatoes, capsicum, and eggplant from twelve hectares of glasshouses in Nelson, which heavily depend on reliable process heat as hot water for maintaining critical temperature inside the glasshouses. Until recently this came from coal-fired boilers, requiring constant attention and significant labour. Between 2021 and 2023, the company installed two new 4.5 MWth step grate biomass boilers in the main boiler house and converted 5 smaller units (3.3 MWth total), to run on wood pellets. Note that the word 'boiler' is used, however technically they are hot water generators.

A defining feature of the project was the installation of two stratified hot water tanks with a combined capacity of 4 million litres. This reduced the required boiler capacity by 3–6 MWth, lowering capital costs while allowing the boilers to run at a constant baseload. This improved efficiency, extended equipment life, and reduced maintenance. The biomass boilers consistently achieve net thermal efficiencies of 92–94%, well above the 88% guarantee. Unlike the coal boilers, which demanded up to a full-time operator for cleaning and monitoring, the new system runs largely autonomously with minimal manual input- a step change in efficiency.

Fuel procurement has also improved. Paying for biomass on an energy basis ensures consistent quality and avoids costs for fuel with high moisture content and low energy yield. Maintenance demands are lower, and the streamlined system has freed staff for other priorities.

Delivering this project was not without challenges. The boiler supplier entered receivership mid-project, while COVID-19 created cost pressures and delays. Despite these setbacks, JS Ewers remained committed, working with stakeholders and consulting with other businesses facing similar risks. Early engagement with the board and the local authority was also critical to securing approvals without delay.

Alongside efficiency gains, the project has eliminated scope 1 emissions from process heat, cutting an estimated 18,500 tonnes of CO_2e each year. This outcome shows the role biomass can play in boosting performance and sustainability for heat-intensive glasshouse operations.

The JS Ewers case demonstrates that investing strategically in biomass boilers, with thermal storage, can transform efficiency and strengthen resilience in horticulture. This case study was commissioned by EECA to capture lessons from the project and offers valuable insights for other horticultural businesses moving away from coal.

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1 Project Overview

All information was obtained from the resources listed in this section. Note that the word ‘boiler’ is used, however technically they are hot water generators.

1.1 JS Ewers

JS Ewers supplies tomatoes, capsicum and eggplant from twelve hectares of glasshouses to the New Zealand market. Located in Nelson, New Zealand, they have a main boiler house with new biomass boilers near Blackbyre road, which supplies nine glasshouses, and there are three other boiler houses, which have coal boilers converted to fire biomass pellets.

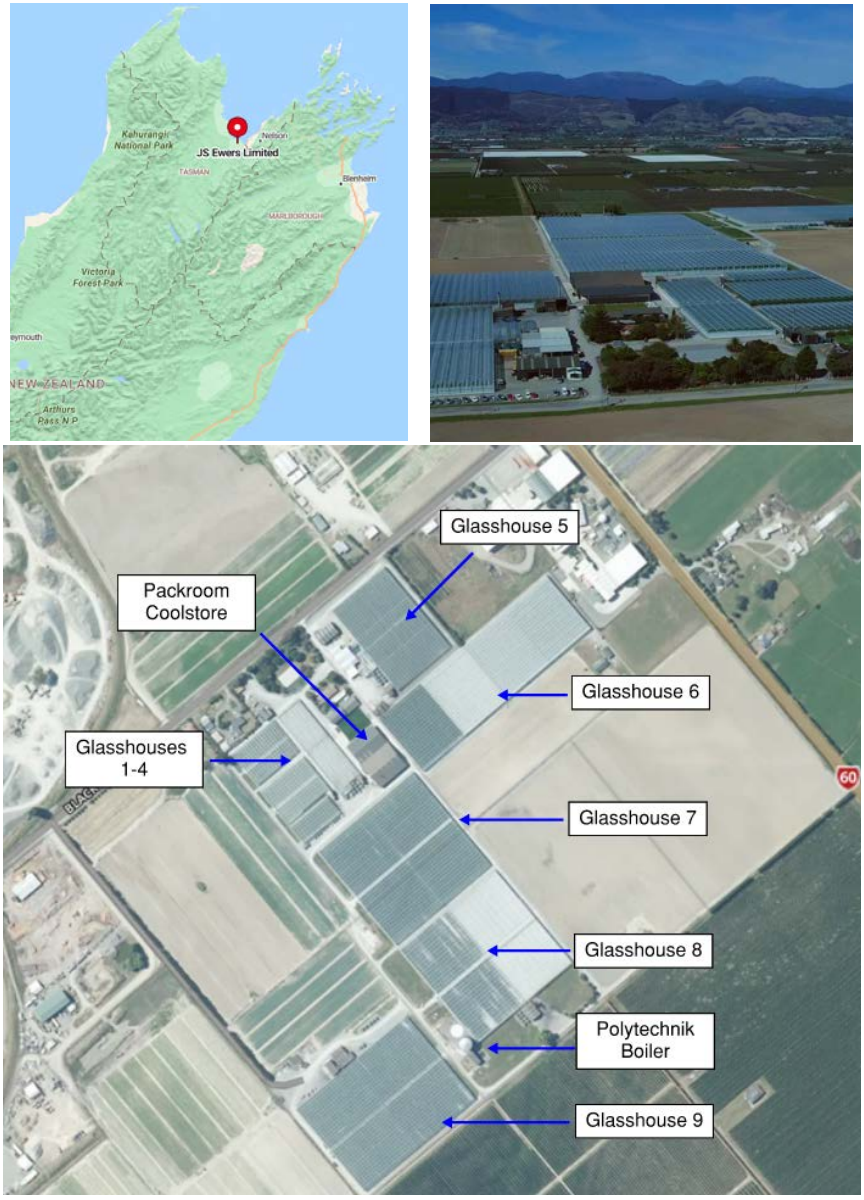

Figure 1: JS Ewers Blackbyre Road

1.2 Project Background

From 2021 to 2023, JS Ewers installed two new 4.5 MWth biomass boilers in the main boiler house and converted five smaller boilers which total 3.3 MWth, from coal to wood pellets. The figure below shows the project roadmap. The two new 4.5 MWth biomass boilers are specifically designed to use low-cost lower-grade high-moisture biomass which is combusted at a high thermal efficiency. There are large load fluctuations between summer and winter, which are met by the boilers couple with thermal storage.

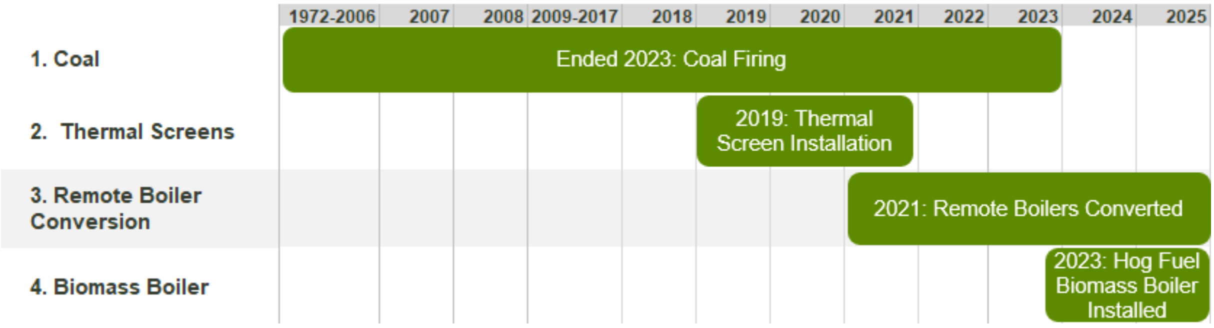

Figure 2: Project Roadmap

1.3 Project Stakeholders

Table 1: Stakeholders

Stakeholder	Location	Role
Azwood	Nelson, New Zealand	Wood pellet supplier for JS Ewers. Note they do not supply wood chip to JS Ewers.
Canterbury Woodchips	Christchurch, New Zealand	Hogfuel / wood chip processor
Deta Consulting	Christchurch, New Zealand	Completed ETA Report
Energy Efficiency & Conservation Authority (EECA)	Wellington, New Zealand	Project support
Enerstena	Lithuania	Boiler OEM - participated in boiler bid
Enriva Pty Ltd	Australia	Owners engineer
IMB Construction	Nelson, New Zealand	Civil works / Builder
JS Ewers	Nelson, New Zealand	Client
Justsen Pacific	Denmark / Australia	Boiler OEM - participated in boiler bid
One Forty-One	Nelson, New Zealand	Forest grower
Polytechnik	Austria	Boiler OEM
	Hawke's Bay, NZ	NZ based agent
Sollys	Nelson, New Zealand	Biomass supplier
Tasman District Council	Nelson, New Zealand	Consent managers
Verum Group	Christchurch, New Zealand	Environmental Testing
VYNCKE	Belgium	Boiler OEM - participated in boiler bid
Walker Engineering	Nelson, New Zealand	Engineering works

2 Concept & Feasibility Design

2.1 2000s JS Ewers

J S Ewers started investigating biomass as a fuel back in the 2000s when they co-fired woodchip in existing coal boilers. Little information on this project exists but in summary, the biomass did not flow well under-grate stoker and did not burn well in the small furnace and fire tube boiler. These issues were compounded because the biomass was contaminated with soil and stones. Converting the existing boilers to woodchip was abandoned. JS Ewers also found that modifying the existing coal boilers to fire 100% pellets was financially unfavourable for the majority of boilers due to the large heat demand.

Figure 3: Example of Old Fire-tube Coal Boiler

2.2 2010s Enriva

Enriva had completed a feasibility study on converting the site from coal to biomass.

2.3 2020s Energy Transition Accelerator (ETA)

Enriva had completed a feasibility study on converting the site from coal to biomass. In 2020, DETA Consulting completed an Energy Transition Accelerator (ETA), administered by the Energy Efficiency and Conservation Authority (EECA), which is a study that maps a pathway to decarbonise industrial sites, which concluded the following on biomass, heat pumps and flue gases to the glasshouses.

2.3.1 Biomass for the Blackbyre Road Boiler House

Modern biomass step grate hot water boilers can use high moisture content biomass, up to approx. 55% on average, efficiently with minimal issues and effectively run autonomously. For JS Ewers, the biomass boiler size could be reduced and operate on a consistent baseload with the use of hot water storage tanks.

2.3.2 Thermal Storage

JS Ewers installed two 2000 m^3 stratified hot water tanks to act as thermal storage (4 million litres of hot water) to reduce the boiler capacity by around 3-6 MWth, which reduced capital costs.

Additionally, the thermal storage allows constant baseload operations so their efficiency and longevity can be maximised, which lowers operating and maintenance costs.

2.3.3 Biomass for the Smaller Sites

The small coal boilers at the smaller sites could be converted to wood pellets at a low conversion cost. A trial was completed in the early 2010's and was successful. Wood pellets are made locally by Azwood with characteristics meeting internationally accredited standards. The cost of wood pellets is higher than other biomass but due to the small-scale use of pellets are approx. 2,000 tonnes per annum and low conversion cost, this practical conversion allowed the coal supply contract to be removed from JS Ewers operations.

2.3.4 Heat Pumps

Large-scale air source heat pumps were not pursued because the electrical upgrade cost was too high, the payback period was too long and generating hot water at 90°C was not well proven at that scale at the time.

2.3.5 Energy Efficiency

From 2017 to 2025, they installed thermal screens, to reduce process heat demand, on 10 hectares of glasshouses.

2.3.6 Flue Gas to Glasshouses

The option to send flue gas into the glasshouses as a mean of artificially increasing carbon dioxide (CO_2) concentrations was explored. It is thought that a crop yield increases of up to 15% could be achieved by doubling the CO_2 concentration. To scrub the contaminants out of the flue gas to make growing safe had prohibitively high costs and the option was not progressed.

2.4 Owner's Engineer

JS Ewers also engaged Enriva Pty Ltd, an Australian based engineering consultant who specialise in glasshouses, as the Owner's Engineer. Enriva developed project scope, which included schematics and layout drawings, cost estimates, prepared bid documents, evaluated bids and provided quality assurance for the project. From the feasibility studies and advice from Enriva, JS Ewers decided that two new biomass boilers coupled with thermal storage tanks was the most favourable option.

2.5 Block Flow Diagram (BFD)

The Block Flow Diagram (BFD) below shows the main components of the new heating system. To increase site energy resilience, the three remaining coal boilers were left connected in series with hot water running through them to keep them dry and minimise corrosion, which means they should be able to fire coal should there be an issue with the biomass boilers.

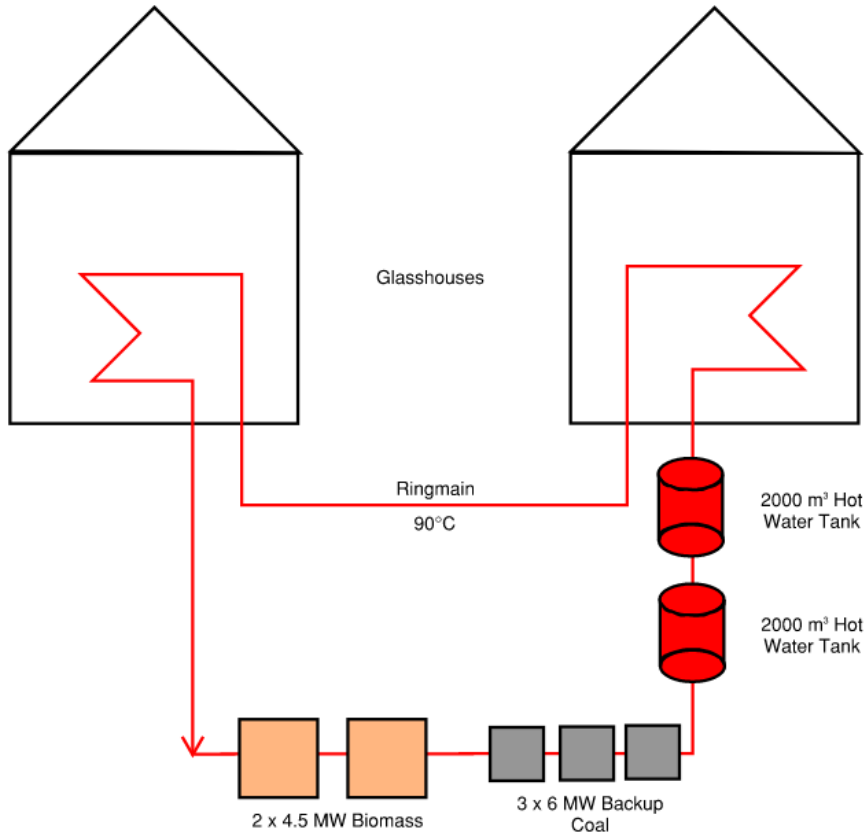

Figure 4: Block Flow Diagram (BFD) of Heating System

3 Detailed Design & Procurement

3.1 Biomass Supply Chain & Specifications

The biomass supply, which is currently at 28,000 tonnes/yr, is made up of the following stakeholders:

- **OneFortyOne:** Located 100 km from the main site, OneFortyOne own 2000 hectares of forests. Roughly a third of the biomass resource is classed as bin wood, which does not meet high enough quality standards for the export market and ends up as wood chips for JS Ewers.
- **Canterbury Woodchips:** Own and operate the machinery to process pine trees into wood chips. They have developed a method which turns bin wood into wood chips.
- **Sollys:** Sollys transport the chip from the forest to the fuel storage yard at JS Ewers. Sollys also transport waste sawdust from the local timber processing plants, which include a medium-density fibreboard (MDF) and laminated veneer lumber (LVL) plant. The supplied fuel is approximately 60% hog fuel and 40% sawdust. There is no physical involvement of JS Ewers in the biomass supply chain off-site. The fuel specifications of the fuel delivered is below:
  - Fuel Type: Wood chips P100M50A3
    - Percentage of total biomass fuel supply: 60%
    - Specification: The proposed Fuel Specification shall be as BANZ Technical Guide 01
    - Bulk Density: 250-400 kg/m3
    - Average Density: 300kg/m3
    - Moisture Content: 35-50% Moisture Content
    - Ash: <3%
    - Untreated timber and free from non-wood contaminants
  - Fuel Type: Sawdust
    - Percentage of total biomass fuel supply: 40%
    - Untreated timber and free from non-wood contaminants
- **JS Ewers:** End user of biomass at a rate of 28,000 tonnes per annum. Hog fuel in New Zealand is approximately $4 to $7 / GJ.

All these companies have back-to-back agreements as shown in the figure below.

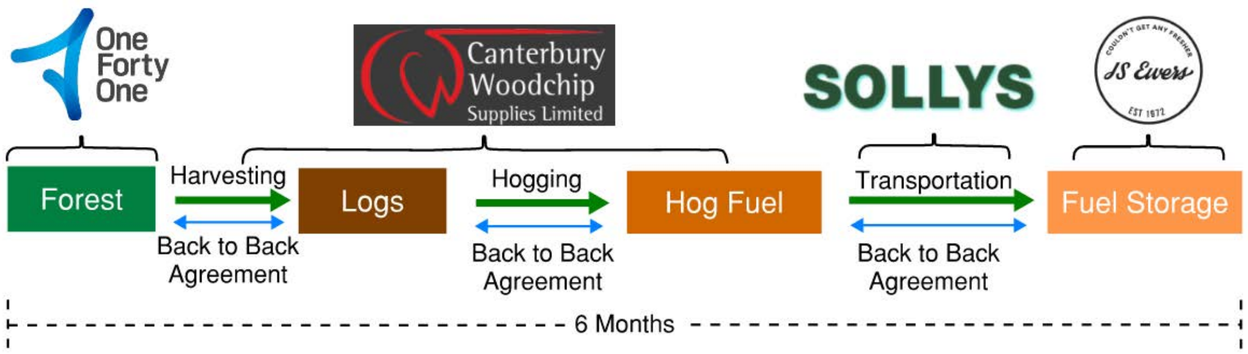

Figure 5: Biomass Supply Chain

3.2 Thermal Storage

The tank is steel with a rock wool insulation. The water level in the tanks is constant and the stratified temperature range is shown in the figure below. JS Ewers obtained two quotes to supply and install thermal storage tanks; the lowest cost bid was accepted by JS Ewers:

- A company based in the Netherlands bided $750k
- A New Zealand based company estimated $1.5M

The hydronic loop water is treated with Gendex-20, which is made up of <10% Sodium Hydroxide and -30% Tannins.

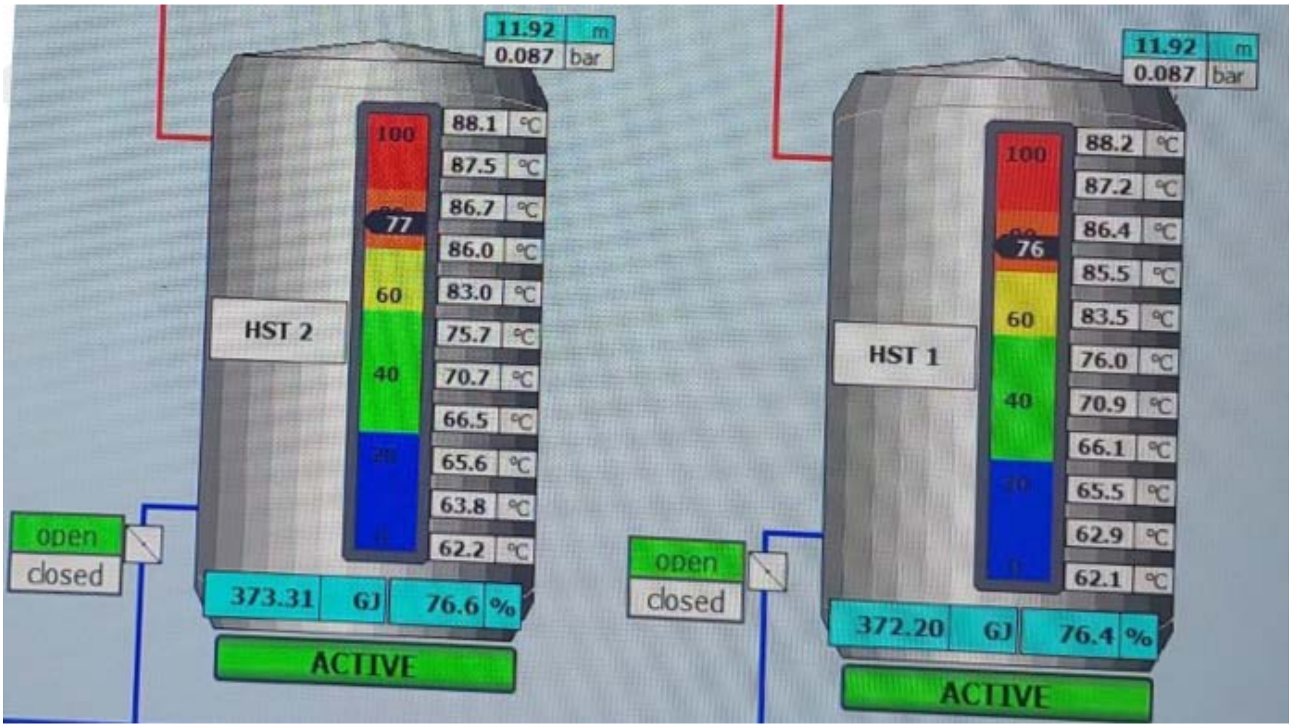

Figure 6: Human-Machine Interface (HMI) of Thermal Storage Tanks

3.3 Boiler Technology Supplier

J S Ewers approached four different suppliers for biomass boilers: VYNCKE, Justsen, Polytechnik and Enerstena. JS Ewers specified the fuel specifications of approx. 60% hog fuel and 40% sawdust. The boiler proposals were analysed based on the following criteria and Polytechnik was awarded the contract:

- Capital cost
- Contract type
- Freight and lead time
- Details of proposed plant
- Similar installations locally
- Robustness of design, sizing of components and fuel range
- Confidence in performance delivery
- Confidence in commitment to NZ market
- Knowledge of NZ conditions
- Freight and lead time

- Offices and service support in New Zealand

A key lesson for others here is that the boiler was purchased prior to signing the biomass supply contract; however, JS Ewers had completed due diligence on the supply side to be confident in there being a secure supply chain.

3.4 Boiler Design

This Section leads in with a Process Flow Diagram (PFD), that includes the components and features listed below, which are then explained in detail in the following sub-sections:

- Biomass Handling & Feed System
- Step Grate Furnace
- Hot Water Heat Exchange System
- Combustion Air Preheater System & Flue Gas Reticulation (FGR)
- Cyclone
- Automated Deashing System & Stack
- Boiler Management System (BMS)
- Motor Control Centre (MCC)

3.5 Process Flow Diagram (PFD)

A Process Flow Diagram (PFD) of a 4.5 MWth boiler is shown below. All components are designed and supplied by Polytechnik – this reduces potential issues with interfaces between multiple suppliers and installers.

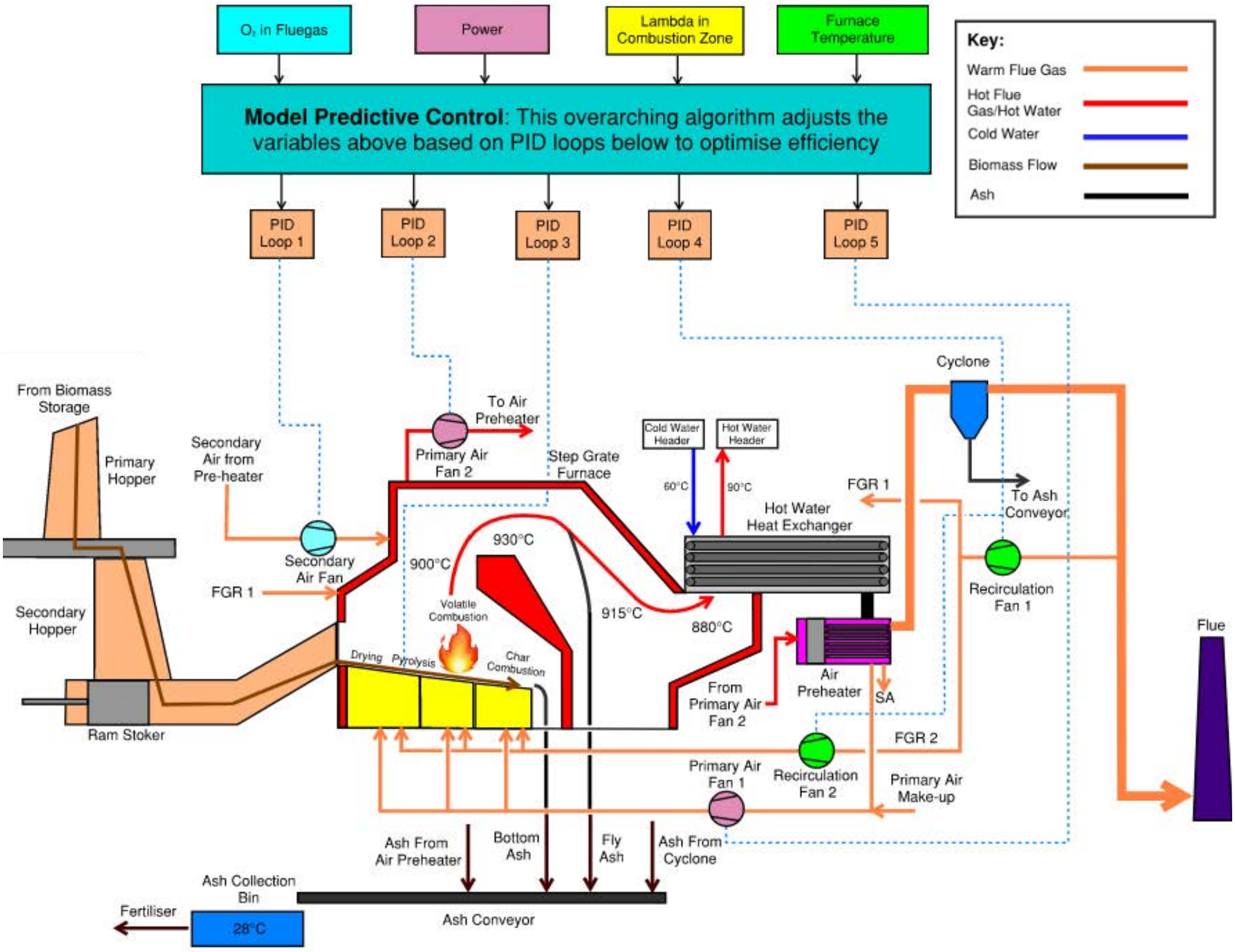

Figure 7: Draft Boiler Process Flow Diagram (PFD)

3.5.1 Biomass Handling & Feed System

JS Ewers tested the entire supply chain. They arranged for the biomass transport trucks to do a test drive from the biomass storage areas to the boiler fuel storage, to find any potential issues. The fuel storage was designed to accommodate the truck movements. Trucks reverse into the fuel store and tip the fuel in. A dedicated front loader pushes the fuel over the moving floor.

The number of trucks has increased threefold, however the trucks now only travel to one fuel storage area on the main site, as opposed to eight different sites when the site was using the coal boilers.

The moving floor has push rods that feed the biomass to the primary conveyor at a controlled rate. A primary chain conveyor transports the biomass from the storage bunker to the primary hopper for the two boilers. A secondary auger splits the fuel supply between boiler 1 and boiler 2. This is shown in the layout below.

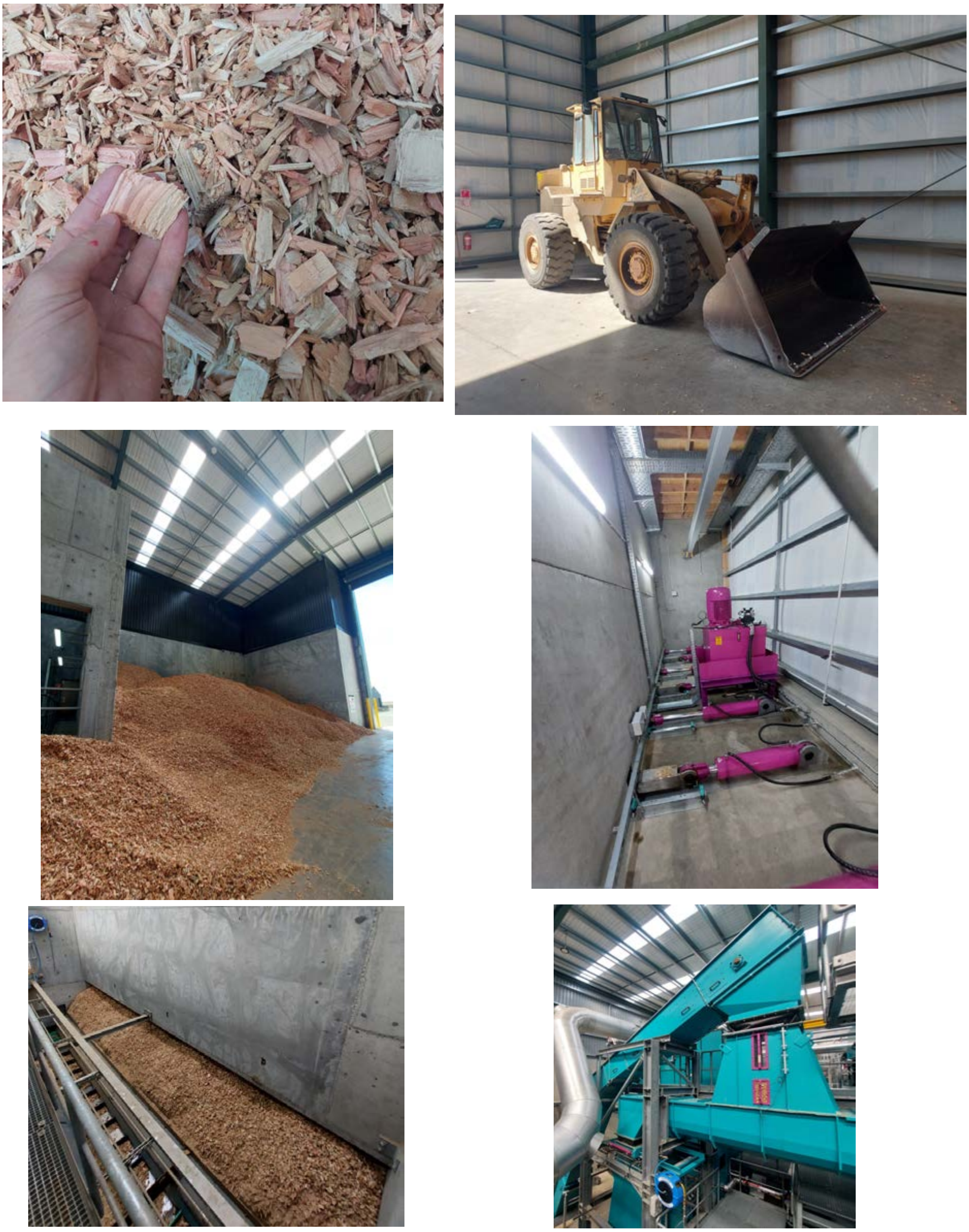

Figure 8: Biomass Handling & Feed System

3.5.2 Step Grate Furnace

The step grate allows for optimal distribution of biomass throughout the combustion system to ensure complete burnout, minimal emissions and maximum efficiency. As the fuel move down the grate it goes through the following stages of combustion, which are also visualised in the image below:

- Pre-drying to remove all moisture prior to pyrolysis and combustion
- Pyrolysis, where the gaseous volatiles are released from the fuel
- Volatile combustion, where the volatiles are burned in the gaseous phase
- Char burnout where the larger organic polymer structure break down and oxidise, such as hemi-cellulose, cellulose and lignin
- De-ashing:
  - Bottom ash falls into a conveyor which is fed into a dedicated skip bin.
  - Fly ash, which is ash entrained in the air is knocked out of the air by the geometric design of the furnace which causes inertial separation; similar to a cyclone to capture dust.
- The grate is air and water-cooled, using a small portion of the cold return water from the glasshouses, to maximise lifetime and maximise heat recovery.

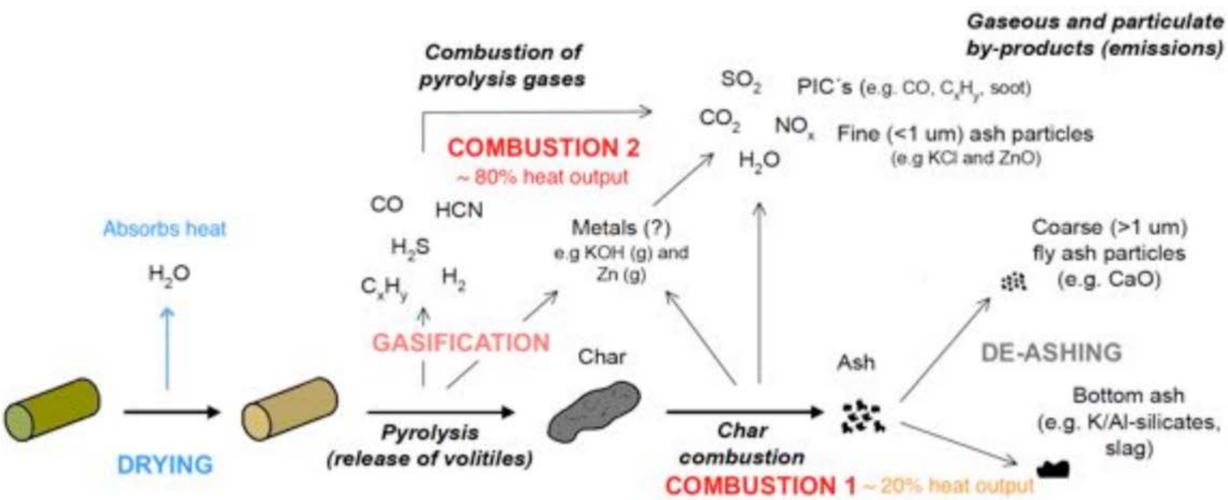

Figure 9: Stages of Combustion (Polytechnik)

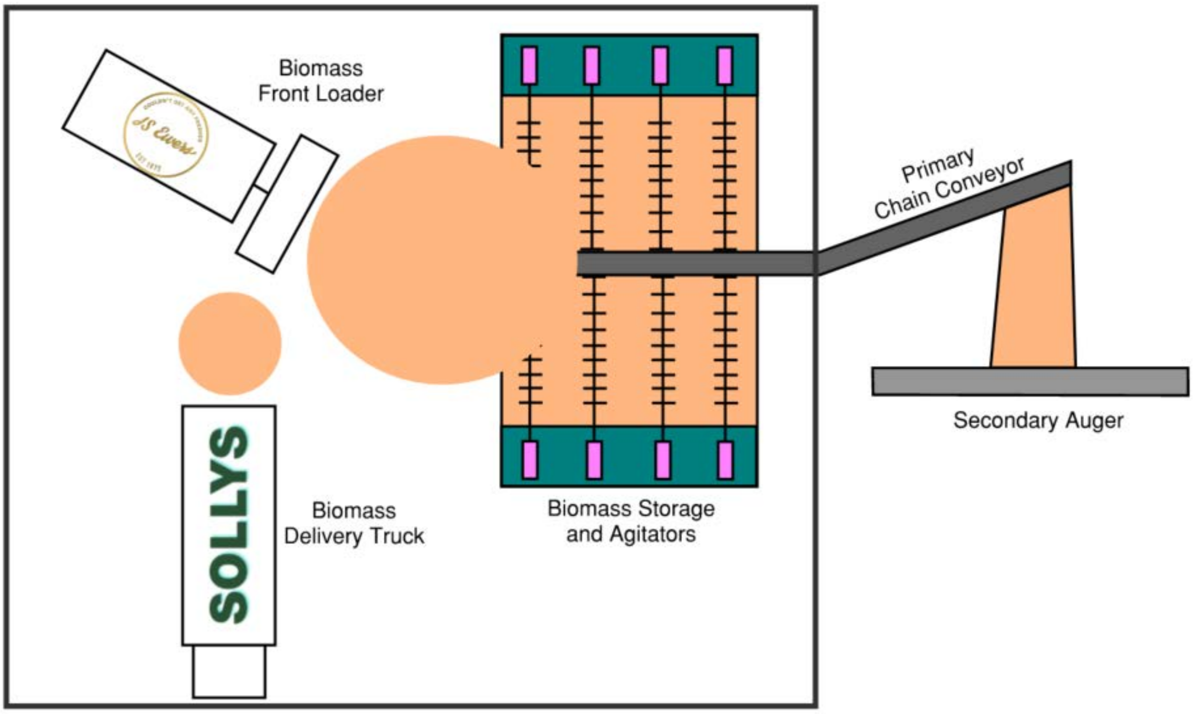

Figure 10: Biomass Handling & Feed System Layout

Figure 11: Boiler Grate Internal View

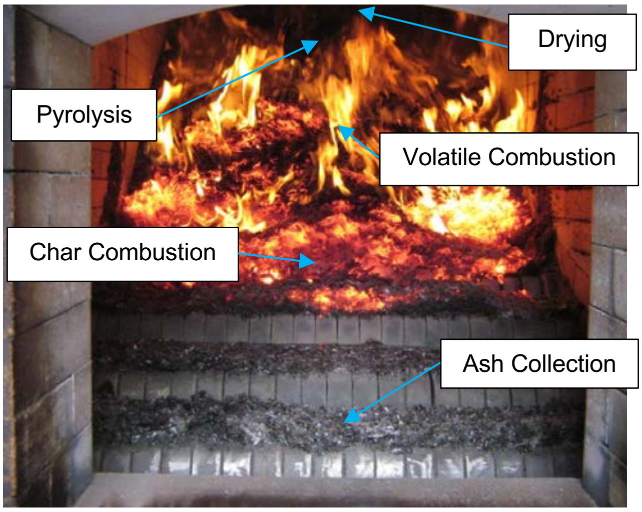

Figure 12: Photo Step Grate Boiler in Operation

Figure 13: Primary Air and FGR Pipework

Figure 14: Top View of Boiler Furnaces

3.5.3 Air-to-fuel Ratio

The boiler is operated with excess air overall, which is a Lambda just over 1. The air-to-fuel ratio varies across the combustion zones, it is lambda <1 in the pyrolysis and >1 in the volatile and char combustion. An overall Lambda just over 1 provides the optimum combustion environment which achieves the highest combustion efficiency and minimises emissions of hydrocarbons, carbon monoxide and particulates, as is illustrated in the figure below.

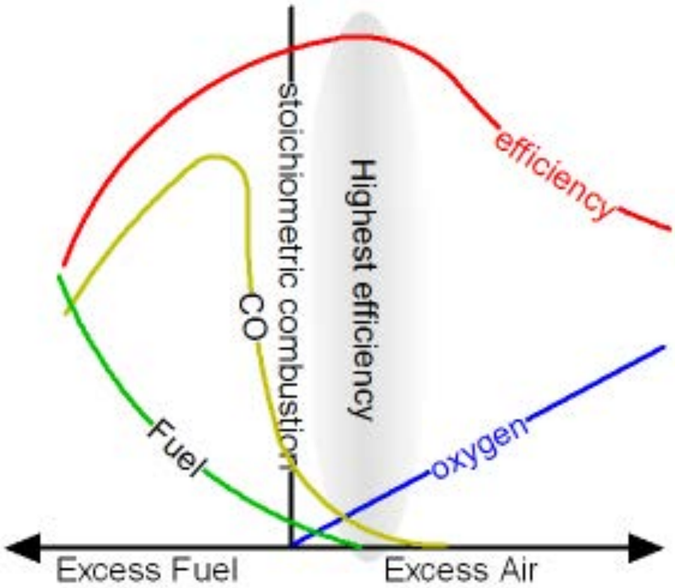

Figure 15: Optimum Air-to-Fuel Ratio

3.5.4 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 Polytechnik boiler at JS Ewers lowers flue gas temperatures, with the combustion air preheater system and the temperature of the flue gas is approx. 140°C. The flue gas temperature varies slightly through the year, based on ambient temperatures and boiler loading, and it is automated. Recovering more heat from the flue would require flue gas condensers, to condense out water vapour and recover the latent heat. Flue gas condensers were not used because the distribution system needs to reach 90°C, and a flue gas condenser would generate hot water at <<90°C, likely around 65°C, which is too cold to be of use in the existing hydronic system.

3.5.5 Hot Water Heat Exchange System

Hot gases from the furnace pass through a fire-tube heat exchanger, which transfers heat from combustion gases to the hydronic loop. Hot gas enters at approximately 880°C and heats water from the return header from approximately 60°C to 90°C which flows to the flow header.

Compressed air lines are permanently installed in the tubes to remove ash, which accumulates over time, with pulsed air jets. This cleaning maintains high heat transfer coefficient which maximises efficiency.

Figure 16: Fire-tube Heat Exchanger

Figure 17: Hot and Cold-Water Headers

3.5.6 Combustion Air Preheater System & Flue Gas Reticulation (FGR)

After the hot water heat exchanger, the flue gases pass through a fire-tube heat exchanger to pre-heat primary and secondary air from approximately 70°C to 160°C. Compressed air lines are permanently installed, and periodically run, in the tubes to remove ash which accumulates over time; this maintains high heat transfer coefficient which maximises efficiency.

A Flue Gas Recirculation (FGR) system is used to send oxygen deficient gas into the furnace to control flame temperature. The table below shows where the combustion air and FGR flows within the boiler to control and optimise the combustion zones.

Table 2: Boiler Air Flows

	Drying	Pyrolysis	Combustion
Temperature	< 800°C	< 800°C	> 850°C
Primary Air (PA)	Yes	Yes	Yes
Secondary Air (SA)	No	Yes	Yes
Tertiary Air (TA)	No	No	Yes
Flue Gas Recirculation (FGR)	No	No	Yes

Figure 18: Air Preheater Front View

Figure 19: Air Preheater Side View

3.5.7 Multi-Cyclone

The cool flue gases then pass through a multi-cyclone to collect most of the residual fly ash. A multi-cyclone has minimal moving parts and close to no maintenance. Multi-cyclones that typically reduce particulate emissions to 20 to 150 µg/m3 from biomass boilers depending on fuel and load. No further particulate removal is required to meet particulate limits in the air discharge consent.

3.5.8 Automated Deashing System & Stack

All ash conveyors lead to a common an ash collection bin, which stores the ash removed from the boiler at approx. 28°C. The ash is then used as a fertiliser across JS Ewers outdoor cropping land – the ash contains potassium, calcium, silica, alumina and other minerals and elements. There are two ash bins, one for collecting ash and one to distribute ash throughout the JS Ewers sites. Flue gasses exit through their own stack. Ash content is variable but around 90-150 tonnes per annum is produced.

Figure 20: Ash Collections Bin

Figure 21: Flue Stack

3.5.9 Boiler Management System (BMS)

Boilers are controlled by a Boiler Management System (BMS). Typical BMS consist of independent control loops, also known as Proportional-Integral-Derivative (PID) loops. PID loops are a feedback control mechanism that uses a mathematical model to regulate a process, adjusting a control output based on the difference between a desired setpoint and the actual process variable. The control system controls following variables with PID loops:

- Oxygen (O_2) in flue gas: The oxygen content in the flue gas is controlled by the secondary air fan which is optimised based on several process variables
- Power consumption: The power consumption is optimised by the adjustment of variable speed drives (VSDs) attached to the primary air fans. The set point is adjusted based on several variables
- Stoichiometry in the combustion zone, which is the fuel-to-air ratio measured in lambda. The lambda is controlled by the fuel feed rate, combustion air and FGR flow rates and varies across the combustion zones to optimise combustion efficiency
- Furnace temperature: The furnace temperature is controlled using the FGR system. Each of the fans are equipped with VSDs and are controlled based on other process variables

Polytechnik have developed an advanced control system that uses information from all PID loops to optimise independent PID loops, Model Predictive Control (MPC), to optimise boiler efficiency. MPS allows the boiler to operate efficiently.

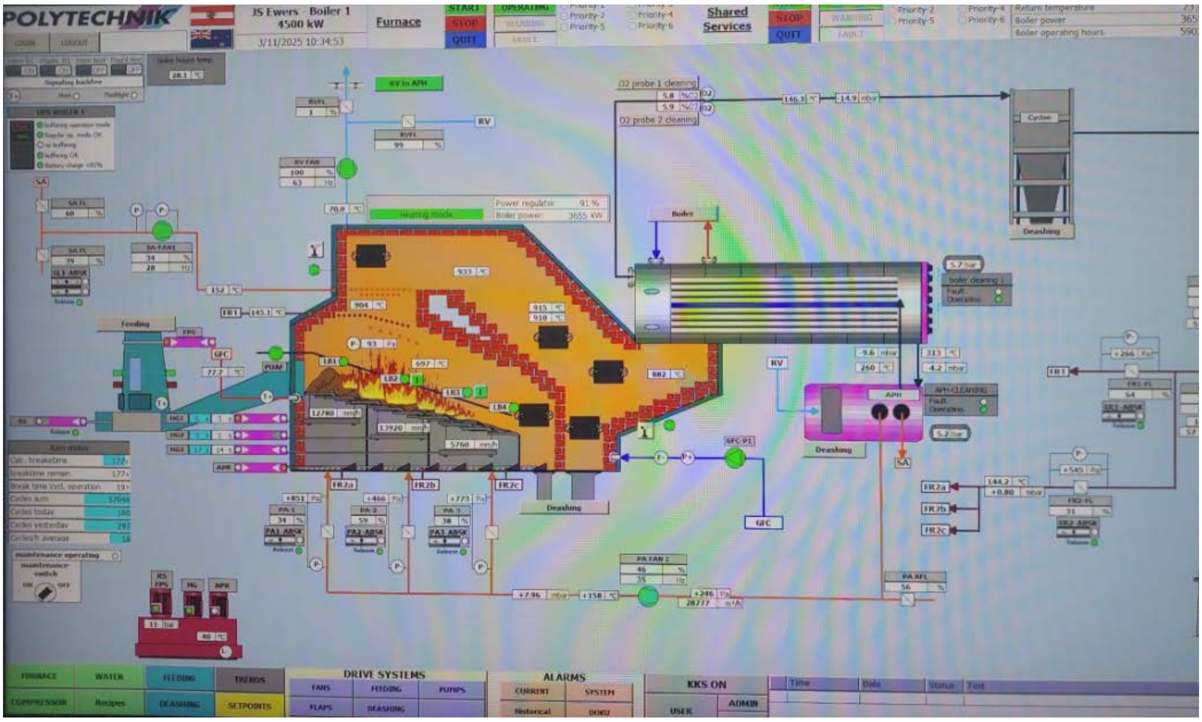

Figure 22: Boiler Human Machine Interface (HMI)

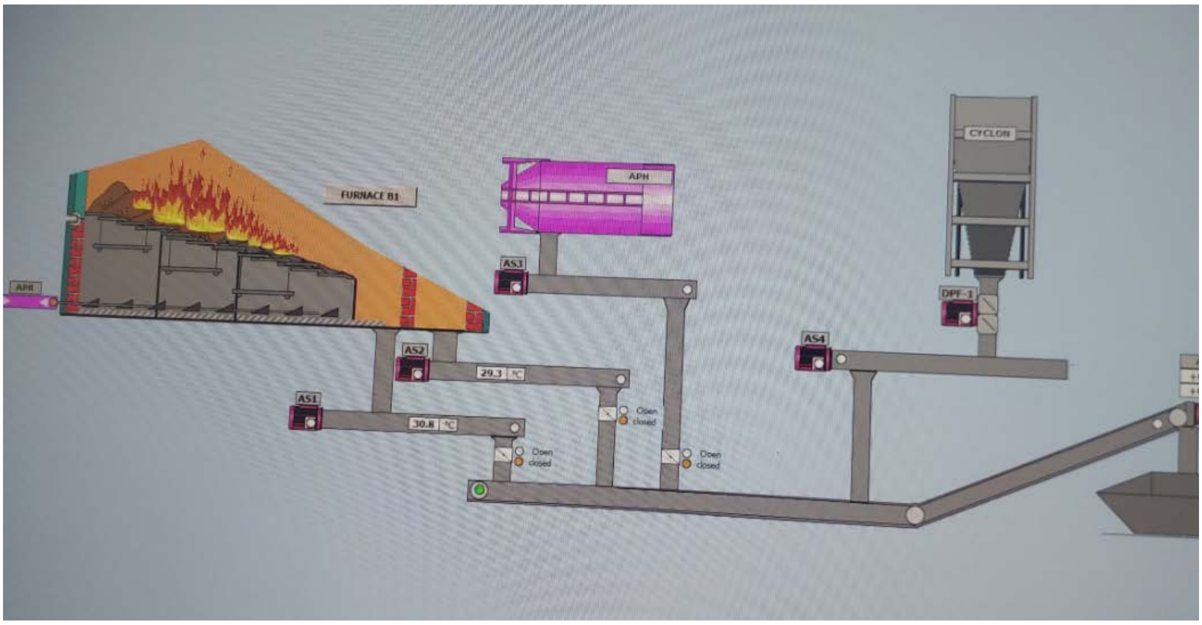

Figure 23: Ash Collection Human Machine Interface (HMI)

Both boilers share a Motor Control Centre (MCC), which is in the boiler house, adjacent to the Human Machine Interface (HMI) on the second level.

3.5.10 Boiler Performance

There are two boilers, and each one has Maximum Continuous Rating (MCR) of 4.5 MWth and a turndown ratio of 6:1 which achieves 0.8 MWth minimum load. It takes three days to go from cold to MCR – this can be faster but risks fatigue damage boiler components such as the refractory and grate. During the winter season the boiler is operated at 8 MWth baseload. Two boilers were selected, as opposed to one 9 MWth boiler, for the following reasons:

- The minimum load of this specific boiler type is 0.8 MWth, instead of 1.6 MWth
- Higher reliability – there is redundancy should one fail
- Higher availability – this is achieved by off-setting the scheduled maintenance

Each boiler operates with a net thermal efficiency of 92-94%, exceeding the guarantee of 88%. Note that net thermal efficiency does not include heat used to evaporate water into steam, which is largely latent heat with a phase change and some sensible heat. Gross thermal efficiency includes heat used in the evaporation of water, the majority of which is not recovered and would therefore show a lower percentage efficiency.

4 Installation, Commissioning & Handover

4.1 Boiler House

IMB Construction, a local Nelson civil, structural and building contractor built the foundations and boiler house. Each boiler weighs 186 tonnes which required 900 mm deep concrete foundation. A storage bunker to hold and shelter the biomass. A roof was added to prevent fuel from blowing around the yard and prevent fuel contamination, such as stones getting into the fuel.

4.2 Boiler Installation

The boiler components were all manufactured overseas and shipped to New Zealand in thirty-two 40 ft containers and flat racks. The furnace of the boiler was delivered in three sections. The total lead time was initially 12 months, however this increase to 24 months due to COVID and the Supplier going into receivership.

The boiler was installed by Walker Engineering, a local Nelson contractor, under the supervision of a Polytechnik representative. A refractory contractor flew to New Zealand, from Romania, to install the refectory. The contractor was made up of a team of six specialists refractory brick layers, who based themselves in New Zealand for 3 months to complete the works.

4.3 Thermal Storage

Two hot water buffer tanks were installed. The first tank was installed by a construction team from the Netherlands of four who flew to Nelson. Mild steel and Rockwall insulation was shipped in five open top containers and was all manufactured in the Netherlands. The tank was built from the ground up and used a 300-tonne crane which minimised hazards around working from heights.

The second tank was again purchased from the Dutch company but installed by a New Zealand based Walkers Engineering, with construction oversight, due to COVID restrictions. Walkers Engineering did a good job in installing the tank in line with instruction and were faster than expected taking only 10 days.

Figure 24: Installation of Boiler House & Thermal Storage Tanks

4.4 Boiler Conversions

The five boilers on the smaller sites are listed below:

1) Ranzau Road – One 0.4 MW, one Glasshouses (0.2 ha)

2-3) Pugh Road – Two 0.4 MW, one 0.6 MW, six glasshouses (1 ha)

4-5) Main Road - One 1.0 MW, one glasshouse (0.8 ha)

Each converted boilers provide heat to the glasshouses as outlined by the following BFD:

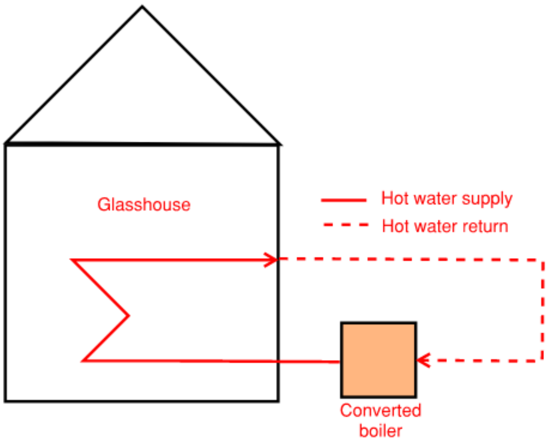

Figure 25: Conversion Block Flow Diagram

The conversion of the boilers involved three key changes, which included:

- The fuel bunker was altered to protect the wood pellets from water ingress
- The fuel delivery system was modified to protect from burn back, which included a heat sensor and a deluge system, as shown in the figure below
- Variable Speed Drives (VSDs) were added to all augers and Induced Draft (ID) fans to adjust the air to fuel ratio to fire 100% pellets.

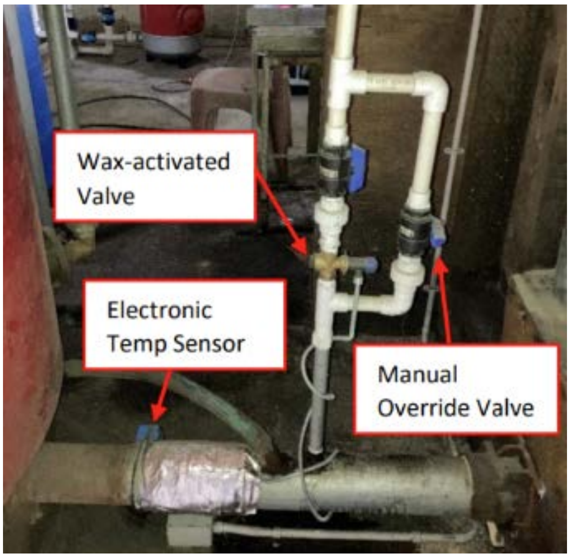

Figure 26: Burn Back Prevention

The upgraded fuel delivery system installed at Main and Ranzau Road are pictured below.

Figure 27: Main Road Fuel Bunker

Figure 28: Main Road Fuel Delivery

Figure 29: Pugh Road Fuel Hopper

5 Operations & Maintenance

5.1 Biomass Contracts

JS Ewers pay Sollys for the biomass on an energy basis, not a mass basis, which is measured with heat meters on the boiler, which are calibrated and certified by the supplier, and calculated in the Boiler Management System (BMS). Payment on an energy basis ensures the client is getting good value for the fuel, as they are not paying for fuel that does not meet the required specifications/standards, such as fuel with a high moisture content and lower energy content than required.

5.2 Boiler Operation

Any boiler operational or safety alarms are setup to contact a member of the JS Ewers staff by phone. There are five staff to share the operational duties – they have found that they spend virtually no time operating the boiler, because the system is autonomous. This is a step change from the coal boilers, all eight of them, which required 0.5-1 full-time employee to clean them all. JS Ewers have found that they must manually adjust the grate speed though, between seasons, to keep the combustion zones in the correct positions.

5.3 Boiler Maintenance

Each boiler undergoes a scheduled two-week maintenance period annually with the boiler shut down, cold and purged of combustion gases. Annual maintenance has been outsourced to Walker Engineering, who JS Ewers have built a close relationship with. JS Ewers also complete three days of maintenance each year.

5.4 Boiler Conversions

Unexpected learnings noted by the operational team was that fuel consumption was less than estimated and maintenance decreased. The only issue faced during operation was a gradual build-up of creosote, a carbonaceous chemical, which was dealt with by fine tuning the air-to-fuel ratio using the installed VSDs.

In 2025, one of the boiler houses which contained two of the boiler conversions burned down due to a fault VSD. Incredibly the pellets in the fuel store did not burn and both boilers are in the process of being repaired by Walker Engineering.

6 Approvals & Consents

6.1 Approval Process

JS Ewers is a subsidiary of the MG New Zealand Fresh Produce Group (MG). MG is a New Zealand-based cooperative that focuses on the production and marketing of fresh produce, particularly vegetables and fruits. The group is involved in the growing, packing, and distribution of a wide range of products. The MG group and its subsidiaries are shown in the figure below.

JS Ewers must have approval for all large projects from the MG board. JS Ewers communicate all aspects of the project in a business case, which includes the following key elements:

- A fixed capital cost
- A running cost estimate which is made up of the following:
  - Operational costs
  - Maintenance costs
  - Energy costs
  - Carbon costs
- Business risks and mitigations which includes:
  - Significantly recuing risk associated with carbon price increase. JS Ewers modelled what potential future carbon prices could affect the business. A carbon price of $100/t would have a significant financial impact on JS Ewers profit margins
  - Fuel supply cost
  - Security of fuel supply

The fuel switch project is a large project that happened over many years. JS Ewers approached the approval process by socialising the fuel switch project to the MG board over a four-year timeframe. The early engagement allowed the MG Board to understand the project key details sufficiently. When the GIDI capital co-funding programme came along, the business case became acceptable, and the fuel switch project was approved by the MG Group.

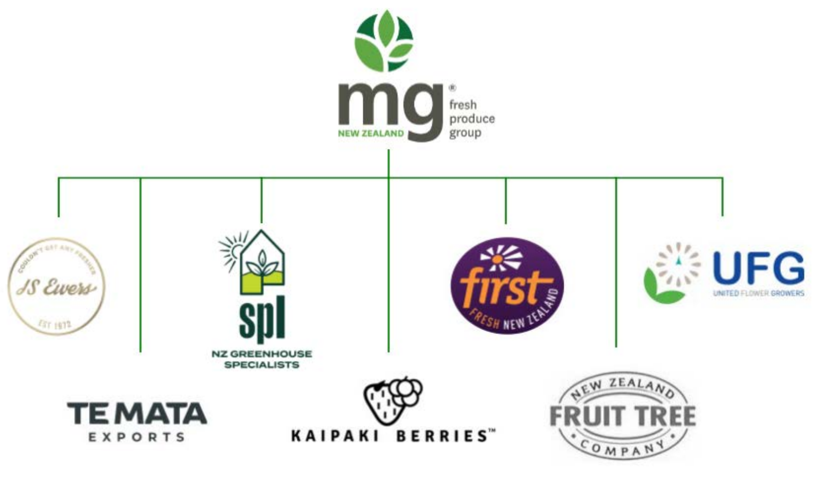

Figure 30: MG New Zealand Fresh Produce Group Businesses

6.2 Resource & Building Consent

JS Ewers had an existing air discharge limits for the coal boilers with their local authority, Tasman District Council, as part of their resource consent. JS Ewers had developed a good working relationship with Tasman District Council, and they understood the regulatory requirements well. JS

Ewers had engaged with the council early on the potential fuel switch project and had explained the scope and benefits to the community.

JS Ewers provided key construction documentation to the Council to obtain building consent. To fuel switch from coal to biomass, JS Ewers had to prove that new boilers could operate within the limits of the air discharge consent, which are listed below:

- Monitor particulate matter greater than 10 microns (PM10) once a year, where PM10 concentrations cannot exceed 50 µg/m^3 expressed as a 24 hour mean.
- Monitor total suspended particulate (TSP) once a year to a limit of 2.2 kg/hr
- Test completed when boiler is operated in winter

The boiler stack is not equipped with emission monitoring instrumentation. An external party, the Verum Group, are engaged measure than stack emission annually. The boiler emissions are currently around half of the emission limits in the air discharge resource consent.

7 Summary & Shared Learnings

JS Ewers have successfully switched fuel for process heat from coal to biomass. The concept of firing biomass was first investigated in the late 2000's. JS Ewers investigated electric heating options which were deemed not practical for the site, and they have completed thermal efficiency projects to reduce heat demand. From 2021 to 2023, JS Ewers installed new two new 4.5 MWth dedicated biomass boilers in a new main boiler house, which replaced eight distribute coal boilers. They also converted five smaller boilers which total 3.3 MWth, from coal to wood pellets. The fuel switch from coal to biomass has resulted in the following outcomes costs and co-benefits:

- The total projects cost was $11.5M
  - The original estimated budget was $8M. Issues were encountered during the project that resulted in increased project costs from $8M to $11.5M. Such issues are listed below, note that the construction and installation was completed during the COVID pandemic:
    - Polytechnik went into receivership
    - Shipping costs increased
    - Scope changes
    - Increased costs of labour and materials, especially steel
    - The timeframe increased
  - The sub-total cost for the smaller conversion projects was NZ$430,000, which was higher than the estimated $200,000
  - EECA provided approximately $4M in co-funding through the Government Investing in Decarbonisation Initiative (GIDI)
- A reduction in fuel cost by approximately $2M per annum, accounting for less carbon charges through the ETS
- Annual maintenance costs have remained the same at around $60,000
- Operational costs on boiler operation have reduced to a fraction of previous levels
- The project payback period with the final project costs is approximately 12 years
  - This includes cost of capital, depreciation and labour cost savings
  - Without co-funding from the EECA GIDI co-funding then the payback period would be more than double
- Improved energy resilience and redundancy for JS Ewers, because the biomass is sourced locally, and coal or biomass pellets are still available as a backup to be fired in the old coal boilers (note that wood chips cannot be fired in the coal boilers)
- The reduction in carbon emissions is estimated at 18,500 tonnes per annum and the site has no scope 1 emissions for process heat
- JS Ewers are no longer exposed to carbon pricing for their process heat
- The glasshouse operation now meets an industry standard of having 90°C hot water available instantaneously, which enables to the glasshouses to maintain the required indoor air temperature even during cold spells in winter

Table 3: Summary of Shared Learnings

Category	Shared Learnings
Knowledge of best practice	▪ Engage suitably qualified resources to assist in the design development of the project ▪ JS Ewers engaged a range of local engineering firms, national consultants and an internationally based owner's engineer to obtain extensive 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 ▪ JS Ewers project managed the project and had a good understanding of the scope and provided feedback on the design and build throughout
Oversized equipment	▪ JS Ewers installed two 2000 m^3 stratified hot water tanks to act as thermal storage (4 million litres of hot water) to reduce the boiler capacity by around 3-6 MWth
Redundancy and resilience	▪ JS Ewers kept the legacy coal boiler in place and connected to the hydronic circuit. This allows the use of coal, or pellets, in the old boilers should the hog fuel or sawdust supply chain reduce, or the biomass boiler fail
Biomass supply chain	▪ JS Ewers had completed due diligence and were confident that the biomass supply chain could be secured once the demand was certain
Suppliers	▪ The fuel handling and boiler were designed and supplied by one company and mostly installed by one other company – this reduces potential issues with interfaces between multiple suppliers and installers ▪ This is suitable for smaller projects where engaging multiple suppliers and installers may not add value
Availability and quality of construction contractors	▪ JS Ewers had developed a professional working relationship with IMB Construction and Walkers Engineering. During emergency situations, both have assisted JS Ewers by installing a thermal storage tank when overseas contractors could not travel to NZ and rebuilding a boiler house and small boiler when it burned down
Schedule delays and cost increases	▪ A project contingency and growth allowance in the cost estimate, and associated project funding, would normally cover cost increases through schedule delays and cost increases in equipment and labour. Issues outside of JS Ewers control, as the boiler supplier going into receivership and the COVID pandemic, seem to have increased costs significantly ▪ To ensure that the final cost is near the cost estimate, the cost estimate should be detailed and based quoted prices where favourable and have Grothe and contingency funds for unknown events ▪ Despite the issues JS Ewers encountered, when they had committed substantial capital to the project, they remained committed to the project and worked with all stakeholders to complete the project. JS Ewers also consulted with other Clients in NZ exposed to similar risks, in order to work through the issues
Project Approvals	▪ This project showed the early engagement with key stakeholders on significant projects is key to obtaining approval without delay. This is evident with JS Ewers early engagement with their owner's board and with the local authority to obtain the resource and building consent

8 Useful Resources

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

8.1 References and Tools

Table 4: Useful Links

Organisation	Link
The Renewable Energy Hub UK	Biomass Boiler Types | The Different Types of Biomass Boilers
GREENIO	Biomass Boilers | Greenio
Polytechnik	Product portfolio - Polytechnik
Azwood	Choosing the correct wood fuel for your boiler
Energy Efficiency and Conservation Authority (EECA)	Biomass boilers for industrial process heat | EECA
Energy Efficiency and Conservation Authority	Co-funding and Support | EECA Biomass boilers for industrial process heat | EECA
Bioenergy Association of New Zealand (BANZ)	https://www.bioenergy.org.nz/
Enriva Pty Ltd	Enriva Pty Ltd | Energy | Engineering | Consulting

8.2 Contact Points

Table 5: Useful Contacts

Organisation	Individual	Expertise	Contact
JS Ewers	Pierre Gargiulo	General Manager	Pierre.gargiulo@jsewers.co.nz
MG Group	Kerry Wells	Executive Director	kwells@mggroup.co.nz
MG Group	Ellery Tappin	General Manager	etappin@mggroup.co.nz
Polytechnik	Christian Jirkowski	General Manager	c.jirkowsky@polytechnik.co.nz
Energy Efficiency and Conservation Authority	-	Leadership & Support	EECAEnquiries@eeca.govt.nz
Enriva Pty Ltd	Sohum Gandhi	Managing Director	sohum@enriva.com.au

8.3 Types of Biomass

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

Table 6: 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 7: Moisture Content

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

Table 8: Particle Size

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

Table 9: Fine Fraction

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

Table 10: 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