

Boiler conversion results in 8 month return on investment and 60% lower emissions



Canterbury-based Verkerks recently converted their 1.2MW diesel boiler to burn tallow, resulting in a forecast fuel saving of \$150,000 p.a., virtual elimination of fossil fuel consumption, and a 60% reduction in particulate matter emissions.

About Verkerks

The Verkerk name has been synonymous with fine, traditional European small-goods and speciality meats since 1958. This was the year that Aalt Verkerk, a Dutch immigrant butcher and small-goods manufacturer, purchased a property on the corner of Armagh and Manchester Streets in Christchurch, New Zealand, and established his renowned butchery and deli.

Today you will find Verkerks salamis and other gourmet meat products in all good supermarkets and food stores throughout New Zealand. The company employs 200 staff, owns a farm, an abattoir, and a major meat processing facility, and still retains its city butchery and deli.

Boiler requirements at the Christchurch processing factory

Optimal performance and reliability of the boiler is essential at the Verkerks processing facility in Christchurch. The 1.2MW boiler produces steam for heating the smoke houses and fermenting rooms, and for producing hot water.

In particular, the production of salami requires precise and continuous heat control throughout a lengthy fermentation process. An unreliable heat supply could interrupt the fermentation process and spoil batches worth hundreds of thousands of dollars.

Until recently the boiler operated only on diesel, consuming around 7,000 litres per week.

Introduction of new ideas and experiences

Part of the Verkerk success formula is to be receptive to ideas that will increase efficiency and reduce waste. Just a few of the many examples of this include capturing and reusing the waste heat from their cool rooms, establishing a worm farm at their central Canterbury abattoir to convert thousands of tonnes of waste to vermicast, and a new project looking at separating and baling waste plastic for export.

Verkerks Engineering Manager, Jerry Scales, is part of that formula and has an infectious enthusiasm for innovation and efficiency. Jerry immigrated from the UK four years ago and has brought with him new ideas and experiences. One of those ideas is the successful use of tallow, which is a bi-product of the meat industry, as a clean and renewable fuel source for boilers.

However, Jerry had his work cut out in convincing the Verkerks board to invest in the tallow conversion, in spite of a very positive looking return on investment. The reason for their hesitancy was that tallow has been tried before in New Zealand with unsatisfactory performance and reliability results, and a loss of

reliability could be disastrous for Verkerks. Jerry knew from his experience in the UK that tallow conversions are very successful, but only if done correctly and with the right level of investment. Understanding the characteristics of tallow is an essential part of doing the job right.



Jerry beside the 8,000 litre heated tallow tank

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Tallow as an efficient fuel source

Tallow is derived from the fat trimmed off meat carcasses. New Zealand produces around 150,000 tonnes per year, most of which is exported to countries such as China for the production of soap. There's an internal market for the trading and transport of tallow.

The interesting thing about tallow is that its energy value per litre is almost the same as that of diesel, yet when sold for use in soap its price is about one third of diesel.

The main difference between soap-grade tallow and fuel-grade tallow is that the latter requires an extra stage of filtering. This can increase its price to around two thirds that of diesel and it is an essential step in ensuring the performance, reliability, and clean burning of boilers. Part of the historical problem with tallow conversions in New Zealand has been to do with the quality and clarity of the tallow used. A further problem has been a failure to invest in the appropriate burner head and controller technology.

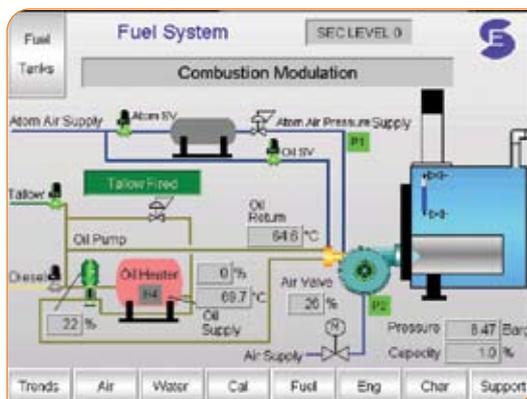


Boiler conversion design and costs

Most boilers require significant capital investment in design and equipment retrofit to operate successfully with fuel-grade tallow. At Verkerks, Jerry provided the design concepts based on his experience of tallow boilers in the UK, as well as managing the overall project. Key elements in the conversion were:

- Installing the tallow storage tank: An 8,000 litre stainless tank with an internal hot water coil that circulates waste hot water to maintain the temperature at 55°C (Tallow solidifies at 41.5°C), and a 15kW emergency electrical heater.
- Replacing the old forced-air burner head with a modern air atomising head and PLC controlled fuel and air pressure drive.
- Configuring the PLC controller to optimise burning efficiency for both diesel and tallow for an infinitely variable range of heat output levels (Verkerks now has a dual-fuel system, using diesel only as a back-up).
- Suitable pipe work, fittings, and lagging.

The cost of the conversion project was around \$90,000, and this included an estimated 300 hours of in-house engineering time.



Computer controlled screen for tallow fuel.

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The business case

On paper the business case was overwhelmingly in favour of proceeding with the \$90,000 investment.

Before the conversion, the Verkerks boiler was consuming around 350,000 litres of diesel per annum. At 90 cents per litre that's an annual cost of \$315,000.

The new burner head and control system alone is expected to improve boiler efficiency by 20% i.e. reduce fuel consumption to 280,000 litres. And with the cost of the fuel grade tallow at around 60 cents per litre, the annual energy cost drops to \$168,000 per annum. That's a saving of \$147,000 per annum, and a 100% return on investment within eight months.

However the absence of a successful track record of tallow conversions in New Zealand left the Verkerks board with significant concerns about the risk of the project. Even though the risk to performance and reliability could be mitigated by ensuring the conversion was to a dual-fuel system (i.e. it could always be switched back to diesel in about half an hour), there was still the issue of not getting the return on investment if the tallow system didn't work. Fortunately, the Energy Efficiency and Conservation Authority (EECA) was able to resolve that concern by providing financial support to the project, and so the board gave it the green light.



A slight glitch with the boiler could spoil highly valuable batches of fermenting salami

EECA grants

Grants for demonstration projects are available to businesses in energy intensive sectors. Grants of up to 40% of the capital cost of the project are available, with a maximum of \$100,000 for each grant. EECA is looking to support energy efficient technologies that are commercially available but are not yet common place in New Zealand.

EECA grants are available for businesses from the following sectors: heavy transport fleets, wood processing, basic metals, glasshouse crops, irrigated dairying, irrigated arable crops, food and beverage processing, fishing fleet operation and non-metallic products.

Other businesses where energy is greater than 5% of their total business costs are also eligible.

Jerry knew that similar schemes existed in the UK, and was quick to contact EECA and apply for assistance with his tallow project. The project was a good fit for the scheme because it involved:

- Exchanging fossil fuel consumption with a renewable energy source.
- Reducing overall energy consumption.
- Applying technology that was not yet proven and accepted in New Zealand.
- Applying a technology that has the potential for wide uptake in the industry sector.
- Reducing particulate matter emissions.

With guidance from the team at EECA, Jerry submitted a successful application and was granted a 40% subsidy on the capital cost of the project.

Jerry says: "The guys at EECA were very helpful and the grant made the difference for this project to go ahead. We'd certainly be prepared to go through the process again for other projects that carry a bit of risk."

Full details on the grants are available at: www.eecabusiness.govt.nz/eib

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Verkerks tallow tanker

Advice to businesses interested in tallow conversions

The tallow conversion at Verkerks is a success story. Apart from the usual hiccups and fine tuning during the first week, the boiler has been running for several months and has met all expectations for performance and reliability.

Verkerks Operations Manager, Dave Graham says: "I guess we had a few concerns about the reliability of the conversion, but frankly it's all gone smoothly and we're very pleased with the performance of tallow. The critical factors seem to be good quality tallow and proper investment in the right boiler technology."

Verkerks has established a reliable supply of fuel-grade tallow from their own abattoir.

There is also ample supply of tallow in other parts of the country to run a further 3,000 or more boilers, however special arrangements may need to be entered into with tallow traders or directly with meat-works for additional processing and delivery.

Verkerks and their business partners are happy to respond to enquiries from other businesses interested in the boiler conversion process and help with supply of fuel grade tallow. Their contacts are:

Reduced particulate matter emissions

The existing diesel fired boiler operated under a resource consent issued by Environment Canterbury. Converting to tallow required a full assessment of the change in emissions.

Jerry engaged specialists to conduct the testing and produce an independent report. The results, based on a burn rate of 135.2l/hr, were extremely positive:

| Fuel source | Contaminant emission rate at MCR (g/hr) | | |
|-------------|---|------------------|-----------------|
| | Total PM | PM ₁₀ | SO ₂ |
| Diesel | 33.0 | 18.1 | 798.0 |
| Tallow | 13.6 | 7.5 | 0.0 |

In essence, particulate matter emissions from tallow dropped to just 41% of that of diesel, and sulphur emissions were completely eliminated.

| Topic: | Who: | Contact: |
|--|-------------------------------------|--------------------------------|
| Project management | Verkerks | engineers@verkerks.co.nz |
| Boiler head and controls | Scotts Engineering Co. Ltd | scotteng@ihug.co.nz |
| PLC design & configuration | Professional Electrics Ltd (Prolec) | energy.management@prolec.co.nz |
| Boiler set-up | Aquaheat Industries Ltd | bharwood@aquahat.co.nz |
| Emission testing and resource consent applications | Specialist Environment Services Ltd | 03 3299 800 |

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CONTACT

For more information on EECA's technology grants and services, call 0800 358 676 or visit www.eecabusiness.govt.nz/eib