

# Explained: The efficiency benefits of modern steam boilers



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**T**here are numerous industries, processes and applications where steam boilers are still used. But thanks to their efficiency, versatility, and reliability in generating steam, they are widely used in food processing facilities for cooking and distilling applications for direct and indirect steam heating, space heating, hot water and process hot water production.

Processes and applications using steam in the food processing sector have revolutionised over the years, however, the same cannot be said for steam boilers themselves. That was until, in 2018, Fulton launched the VSRT vertical steam boiler.

Claimed to be the most radical change to vertical steam boiler design since it first pioneered the vertical tubeless boiler in 1949, Fulton's VSRT has rocked the steam boiler market since its launch to become class-leading and a symbol of efficiency, with many users benefitting from excellent savings in gas and water consumption and reductions in CO<sub>2</sub> and NOX emissions.

At launch, the seven-model VSRT range was available with outputs from 160 to 960 kg/h, but with demand increasing for an energy efficient boiler with larger outputs, Fulton is now expanding its range and introducing two new, re-designed VSRTs (VSRT-100 and VSRT-125) with outputs of 1565 and 1956 kg/h. But what are the benefits of these two larger output models for end users?

As Fulton's managing director Carl Knight



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explains, these models are ground-breaking for their output range: "When you consider the new models, there are no truly efficient tubeless vertical steam boilers in the marketplace with similar output ranges, the VSRT is the only tubeless boiler available with the capability of efficiently producing nearly two tonnes per hour of steam. In short, what we are delivering with these new models is much higher output versions without compromising efficiency!"

The new VSRT models maintain exceptionally high operating efficiencies (up to 86% gross thermal efficiency compared to approxi-

mately 80% from typical boiler designs), which results in lower operating and lifecycle costs and improved return on investment. In fact, using the lower-output VSRTs as an example, many of Fulton's customers are achieving fuel savings of between 20% and 30%, with Tracklement – a leading British condiments maker – no exception to this.

By modernising their steam raising equipment and changing their fuel type to liquid gas from Flogas, Tracklements were expecting an impressive 21% financial saving and a near 25% reduction in carbon emissions. In fact, these cost savings were based on gas oil prices from 2021, before the planned withdrawal of tax relief on red diesel in April 2022 and the recent price rises, so looking forward they're actually far more favourable.

Cost and carbon savings can also significantly increase by up to 30% when combined with the potential steam system efficiency savings by running the latest fully-modulating, high-turndown liquid gas boilers. What's more, Fulton's liquid gas-fired VSRTs will help minimise other pollutants for Tracklements, with NOx levels projected to reduce by 75% compared to the previous oil-fired steam boilers.

As Carl explains, Fulton fully expects the VSRT-100 and VSRT-125 to achieve the same savings. "Like lower output models, the latest VSRTs boast the same impressively high 10:1 turndown capability and continue to achieve ultra-low NOX emissions of less than 20ppm or 40mg/Nm<sup>3</sup> at 3% O<sub>2</sub>, which falls well below MCPD's requirement of <100mg/Nm<sup>3</sup>. The VSRT also therefore complies with the stringent City of London Air Quality Strategy requirements."

These advanced, energy-saving and environmentally beneficial features are standard across the now expanded VSRT range.



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Compared to other steam boilers, the VSRT is also a more durable and, in many cases, compact boiler that is energy-efficient, produces an increased output of higher quality steam and is easy to maintain.

So how do the new VSRTs compare to other steam raising solutions with similar outputs?

As already mentioned, the new VSRTs are the only tubeless boilers available with the capability of efficiently producing nearly two tonnes per hour of steam. To achieve similar outputs, end users would have to consider horizontal shell and tube boilers or steam generators.

The water volume of the VSRT is equivalent to or greater than these alternatives yet, combined with an impressive steam chest volume, can react quickly to changes in steam demand. And despite the larger water volume, the larger VSRTs still boast a start-up time of less than one hour (compared to between 3 and 24 hours for a typical boiler) and achieve a steam quality of >99.75%, a detail most manufacturers are unwilling to publish.

Thanks to its unique design, the VSRT's patented spiral-rib heat exchanger virtually eliminates thermal stress, so Fulton has therefore created a longer-lasting boiler that not only improves boiler efficiency but one that the company believes will beat the competition in every category of durability. This is why all VSRTs come with the assurance of a 10-year 'unparalleled' warranty on the pressure vessel, double that of the industry standard.

With features including a vertical tubeless design with no refractory whatsoever, and thanks to its industrial control platform and easy access to the pressure vessel, the VSRT is also extremely easy to maintain. Additionally, as it contains no refractory there is no requirement for five-yearly, non-destructive testing, which contributes to reduced lifecycle costs when compared to standard horizontal boilers.

Efficiency and operation stats aside, the VSRT's footprint can be as little as 25% of an equivalent horizontal boiler, a significant saving when designing buildings, and a major factor when considering the lease cost of real estate.

But what does this all mean for the end user in terms of lifecycle costs?

The following 15-year comparative costs example uses a single boiler installation. Here, a typical three-pass, horizontal shell and tube steam boiler (without economiser) is replaced by Fulton's new VSRT-125, both firing on natural gas, with each boiler having a steam output of 1,956kg/h. For this comparison, we have conservatively assumed the VSRT to be 20% more efficient than an equivalent horizontal boiler; and that each boiler has a total annual run time of 4,200 hours.

#### Lifecycle Service/Maintenance Costs (Inspections, etc.)

Horizontal Boiler: £68,700.00  
VSRT Boiler: £39,000.00

#### Additional Recommended & Mandatory Maintenance Costs (NDT, Inspections, etc.)

Horizontal Boiler: £36,954.00  
VSRT Boiler: £4,400.00

#### Extraordinary Maintenance & Repair Costs (D Patch, Re-tube, Refractory)

Horizontal Boiler: £44,000.00  
VSRT Boiler: £2,000.00

#### Fuel Costs (Based on 0.06p per kW/h inc. Standing Charge)

Horizontal Boiler: £5,862,213.00  
VSRT Boiler: £4,594,060.80

#### Footprint Costs (Based on £9/sqft/annum)

Horizontal Boiler: £74,250.00  
VSRT Boiler: £19,440.00

#### Total Lifecycle Costs (Exc. Supply and Water Treatment)

Horizontal Boiler: £6,167,765.00  
VSRT Boiler: £4,700,300.80.00

In summary, as these figures demonstrate, with lifecycle cost savings approaching £1.5 million over 15 years and payback achieved within a matter of months, Fulton's VSRT delivers a solution to help with both the financial and environmental challenges that are at the forefront of mind for many decision makers.



#### For further information contact

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With manufacturing facilities in the United States, Great Britain and China, Fulton is a global manufacturer of steam, hydronic and thermal fluid heat transfer systems. Backed by over 60 years of research, innovation and experience, Fulton is building on a tradition of success and is focused on improving life through heat transfer solutions. For additional information about Fulton, please visit [www.fulton.co.uk](http://www.fulton.co.uk).

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## HELPING YOUR FACILITY ON THE ROAD TO NET ZERO

Our class-leading range of fuel-fired and electric steam boilers and portfolio of aftercare solutions can help with your decarbonisation strategy and put your company on the Road to Net Zero.

As a complete solutions provider, Fulton can provide your food processing facility with:

- fuel-fired and electric steam boilers
- off-grid and point-of-use solutions
- ancillary plant / engineered systems
- steam surveys
- project management
- water treatment contracts
- accredited / certified training
- installation / commissioning / upgrades
- repair / service / maintenance programmes



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