

OPTIWOOD

Improving the Performance and Efficiency of Biomass Boilers

A joint UK-France Project 2018-2020



Case Study 1 – Public Sector Offices and Records Storage Facility

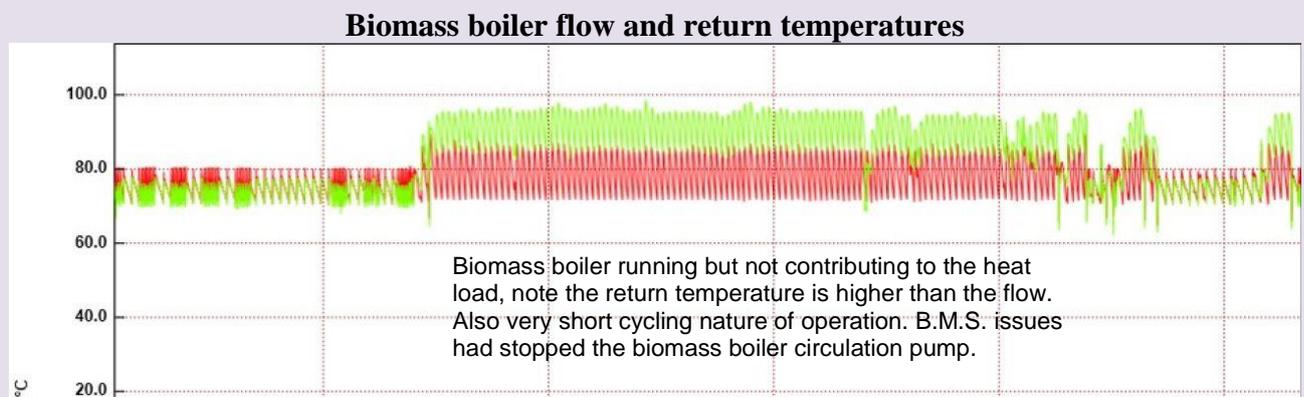
November 2020

Introduction: a 300kW Herz wood chip boiler, linked to a 5000 litre buffer tank. It has a modular back-up gas boiler system. The wood fuel is supplied via an underground silo. The biomass system has had a number of issues including serious water ingress into the fuel silo, faults with heat meter failure, BMS problems and valve failures. The boiler is over-sized for the actual heat load due to not developing the whole site as initially planned.

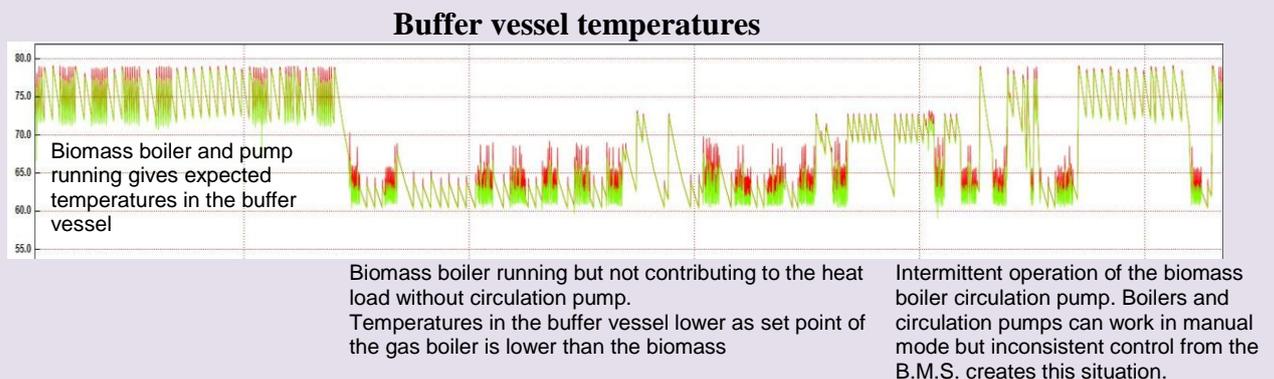
2018-19 Heating Season – Data Results and Recommendations

The results of the initial data assessment showed a very poorly performing biomass boiler with efficiencies below 50%. This was mainly due to an incorrectly programmed BMS system that did not allow the biomass boiler to take on its design role as lead boiler. Faults with non-return valves also meant that biomass outputs were not travelling through to the buffer tank and buildings. As a result of the above the boiler often showed poor combustion characteristics. The boiler system was also shut down for prolonged periods, often for relatively minor issues. After sustained dialogue, on-site meetings involving biomass, gas and BMS engineers took place on site, which led to changes.

Example Data Trends and Results 2019



On site personnel not aware of this condition, no control panel warning lamps

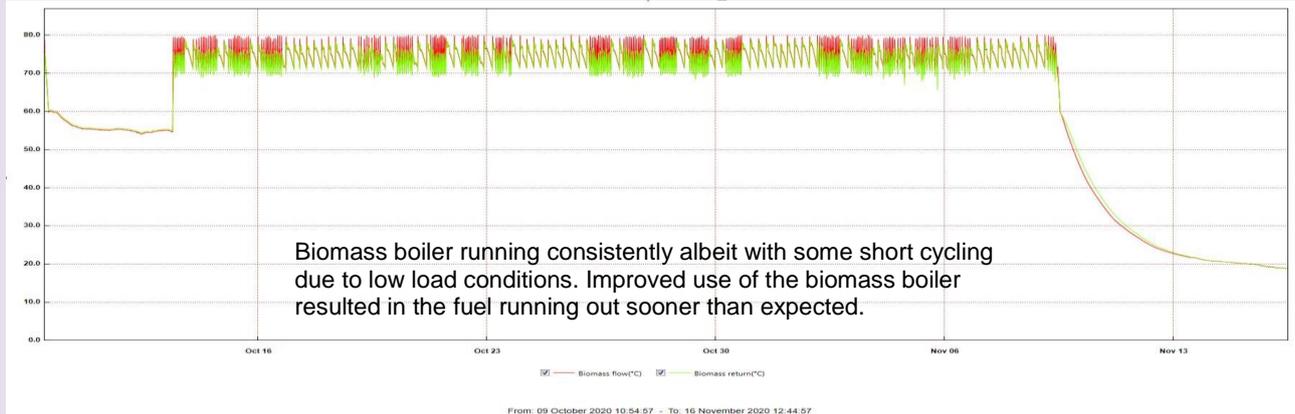


Frequent cycling of the boiler, and sustained periods of non-operational biomass boiler

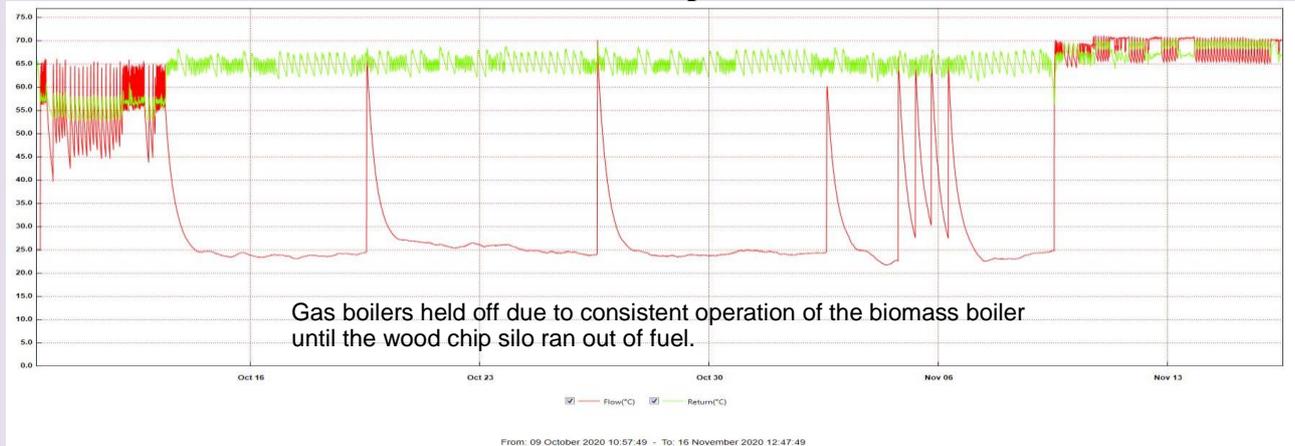
2019-20 Changes and Improvements

Following the site visits and testing by the BMS engineer we were able see significant improvement in the output and performance of the boiler in September - November 2020. Although short cycling of the boiler was continuing, this will be addressed by effectively de-rating the boiler maximum output from 300kW to a lower level. The likely efficiency improvements are expected to be around 30%.

Biomass boiler flow and return temperatures November 2020



Gas boiler flow and return temperatures November 2020



Pilot Project 1 - Public Sector-Offices Storage (300kW)	Wood Fuel Consumption (tonnes at 30% MC)	Wood Fuel Coverage (% of total heat demand)	Biomass Boiler Efficiency (%)	Costs of Wood Fuel	Tonnes CO ₂ Emissions saved (cf with equivalent gas)
Heating Season 2018-19	30	34%	42%	N/A	8.3
Heating Season 2019-20	35	27%	40%	N/A	9.3
Gain or Loss	+5	-7	-2%	N/A	+1
Estimated Additional Gains if Recommendations Carried out	+25	+35%	+30% (72%)	N/A	+5

Footnote 1: Boiler not operating for long periods due to control issues

Footnote2: Based on evidence of correct running operations

Footnote3: Based on short period of correct operations by biomass and conservative efficiency calcs

Footnote 4: Based on higher boiler efficiency levels and much longer running periods

Key Lessons

- Boiler over-sized for the actual heat load
- Poor control features due to incorrect BMS programming and testing
- Heat meter failures (2 of) as well as motorised valve failures
- Water ingress to the underground fuel silo