AMP Infrastructure Ltd

Report on Biomass Installation at Lindhurst Lodge, Barnsley

Prepared for: Mark Tarry
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CONFIDENTIAL REPORT FOR USE OF INTENDED RECEIPIENT ONLY



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1. Executive Summary

The biomass boilers are generally in good condition but there are a number of issues which AMP would need to address should the purchase of the equipment proceed. The biomass equipment at the site consists of 2 No. Strebel KSM Multistocker 199kW boilers along with the associated buffer tanks, plate heat exchanger, pumps, valves, pipework and metering. The equipment is located within a purpose built plant room to the rear of the Lindhurst Lodge care home and is linked via approximately 10m of underground pipework. The boilers have a common hydraulic system and are considered to be a single 398kW unit for RHI purposes. We are satisfied that the boilers and heat meter have been installed correctly and that all heat used is eligible for RHI though documents relating to the RHI application have not been seen. The RHI application and associated heat loss calculation should be examined and confirmed to be correct prior to proceeding.

As with most biomass plant rooms, the most important H&S consideration is the establishment and subsequent spread of fire. Due to the incomplete nature of the wall dividing the boiler room from the fuel store, flat surfaces near the wall are covered in a thick layer of wood dust. There is a significant amount of work required to seal and fireproof this dividing wall whilst still maintaining the provision of access into the fuel store. The boiler room building has been struck by a heavy goods vehicle resulting in a hole in the fascia boards and significant cracking to the brick work.

The boiler flues are undersized, resulting in insufficient draught that restricts boiler output. Replacement flues will be required that are taller and larger in diameter than the existing items and a mast will be required to provide support. This may have implication relating to planning permission. The boiler heat meter is also undersized and will need to be replaced for a larger item or the pumps and boilers will need to be de-rated to ensure that the meter operates within its calibrated range.

The biomass boilers have produced 371,000kWh of heat since September 2015, it therefore seems unrealistic to suggest that 400,000kWh of heat will be sold to the client within the first year of AMP ownership. There are ongoing complaints regarding the availability of hot water within the care home despite sufficient heat being available from the biomass boilers. This is due to the interface pipework arrangement though it is likely that the hot water complaints will still be attributed to the biomass system unless there is a significant restructuring of the care home plant room pipework arrangement.

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2. Introduction

HWEnergy have inspected the biomass installation at Lindhurst Lodge, Barnsley, S71 3DD, on behalf of AMP plc. The purpose of the inspection and this report is to provide AMP with pre-acquisition advice, giving a technical overview of the installed equipment together with technical and operational risks. The biomass equipment at the site consists of 2 No. Strebel KSM Multistocker 199 XL boilers, operating on wood pellets, which provide heat to a common heat exchanger via 2 No. 2000 litre buffer tanks. The plant room is further equipped with all necessary interconnecting pumps, pipework, valves and metering. The heat from the plant is used to provide space heating and domestic hot water to the Lindhurst Lodge care home via approximately 10m of underground pipework.

It is understood that the scope of the potential purchase is limited to the biomass boilers and associated equipment up to and including the heat exchanger in the biomass plant room. Therefore, the plant room building, underground pipework and interface mechanical and electrical equipment would be excluded from the purchase.



External view of the plant room and fuel store

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3. Biomass Installation

3.1 Site Overview

The equipment is located within a purpose built plant room, measuring approximately 6m x 10m, to the rear of the Lindhurst Lodge care home. The building stands approximately 10m away from the care home plant room and incorporates a fuel store measuring approximately 6m x 3m.

The boiler room is generally well set out though the access from the double door set is restricted by a narrow entrance gap of 400mm between an ash bin and a buffer tank. Most flat surfaces within the boiler room that are close to the dividing wall between the boiler room and the fuel store are covered with a thick layer of wood dust due to the dividing wall not being sealed.



Entrance to plant room with restricted width

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3.2 Strebel KSM Multistocker 199 XL

The Strebel KSM Multistocker 199 XL is manufactured by the Danish company KSM and re-badged by Strebel to provide a circa 200kW boiler to complement their existing smaller boiler range. The boilers are generally in good condition with no visual signs of excessive wear and tear. They operate independently with separate fuel feed mechanisms and controls but have a common hydraulic system and are considered to be a single 398kW unit for RHI purposes. The boilers are fuelled by wood pellets with an auger system conveying the fuel into the boilers. Fuel burn back protection is in the form of a 'burn back flap' which opens electrically when fuel is being fed but closes using a spring during ignition and when the boiler is switched off with additional protection being provided by a heat activated water sprinkler system. Combustion products are conveyed to atmosphere via a twin wall insulated stainless steel flue. Each boiler produces low temperature hot water (LTHW) which is transferred to a pair of 2000 litre buffer storage tanks then onwards to a plate heat exchanger located in the corner of the plant room. The heat exchanger ensures that the biomass boilers are hydraulically separated from the existing heating system, eliminating the risk of contaminants in the older system causing problems with the biomass boilers. The LTHW system has been installed using pressfit carbon steel pipework and fittings which have been partially insulated using foil faced mineral wool insulation and a pair of 500 litre thermal expansion vessels have been connected to the system return pipework. The system is filled/topped up with water manually via a valve, indicating a direct connection to the mains water supply; this is in contravention of the Water Byelaws for any system with a rated output in excess of 45kW. There was no evidence of any way to introduce water treatment chemicals (e.g. corrosion inhibitor) and analysis of a system water sample indicated that corrosion inhibitor was not present.



Internal view of plant room showing both Strebel boilers

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The following tables shows the hours run by each boiler since commissioning in September 2015:

Boiler Serial Number	Boiler Location	Run Hours
15039	Left	16011
15040	Right	6715

This shows that the left hand boiler has run been running for 87% of the time since commissioning and the right hand boiler has been running for 37% of the time. During the visit, a Strebel engineer was also in attendance and the boiler settings were altered to favour the right hand boiler though it will take some time to even out the run hours. Should the equipment purchase proceed then it is recommended that the Strebel cascade system is purchased which will alternate boiler operation based on a time and heat demand schedule.

Despite the relatively high run hours of the boilers, the heat meter that is common to both boilers shows a more modest heat production of 371MWh (371,000 kWh), equivalent to 925 full load hours per year for a single 200kW boiler. This would suggest that the boilers are operating for long periods of time at relatively low output which correlates with the meter reading of 40kW boiler output that was observed during the visit. It is thought likely that an improper pipework setup and control strategy surrounding the buffer tank and heat exchanger is causing the boilers to behave in this manner, it is recommended that the pipework is revised if the purchase progresses.

3.3 Boiler Flues

Each boiler is currently fitted with a stainless steel flue with an internal diameter of 250mm. From the boiler connection, each flue travels horizontally for approximately 0.5m before entering a 90° tee and rising vertically through the boiler room roof for approximately 3m. Below each 90° tee is a flue draught stabiliser which controls the draught through the boiler and ensures optimal combustion. The flues are supported externally by a series of guy wires that are fixed to the external walls of the building. The Strebel engineer felt that the flues were too short based on his own experience and had previously highlighted the same to the current equipment owners. It was indicated that the boilers struggle to reach full output and it was thought that this was due to the flues providing insufficient draught. A further issue is that the flue arrangement prevents access to the heat exchanger cleaning hatch but there doesn't appear to be any way to avoid this given the plant layout and relative lack of height within the building.

Subsequent analysis using commercial flue sizing software Kesa-Aladin confirms that the existing flues are inadequate and require upgrading by extending the height, increasing the diameter or more likely both.

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Requirement	Form.	Unit	High Fire		Low Fire	
Pressure Requirement	PZ-PZe	Pa	-4.7	-	0	+++
Low Pressure Condition	PZ-PLU	Pa	0.6	+	2.1	+
Temperature Requirement	tiob-tg	°C	76.3	+++	31.7	+++

Extract from Kesa-Aladin showing that the existing flue design fails on High Fire

Maintaining the 250mm internal diameter would require the flue height to be increased by an additional 2.5m, giving a termination height of approximately 7.5m above ground level. This is not considered to be a practical solution given the complex support requirements, likely visual impact and potential planning implications.

To keep the flue height to a minimum but also incorporate a suitable support structure, the flues could be taken horizontally across the plant room, exit the plant room through the right hand side wall and rise vertically via a 45° elbow and tee rather than a 90° tee. With an internal diameter of 300mm, the termination height would be approximately 6.5m above ground level, around 1m taller than the existing arrangement. A purpose built flue mast would be required to provide suitable support.

The existing installation does not appear to have planning permission though there is planning permission in place for alterations to the care home itself. Progressing with the purchase of the site prior to investigating the planning status of the current and any subsequent flue installations would be considered a risk item.

3.4 Plant Room Building

Although the building itself is excluded from the proposed purchase, there are a number of issue with the building that could affect operation over the coming years. The main issue is with the stability of the building itself due to an HGV striking the building at some point in the past. This has resulted in a large hole in the fascia board above the access door and a number of cracks and loose bricks in the same area. There is another significant crack in the wall in the left rear corner when entering the plant room.

There is a significant amount of work required to seal and fireproof the dividing wall between the boiler room and fuel store. Flat surfaces near the wall are covered in a thick layer of wood dust and there has been no attempt to seal gaps around the auger penetrations. A domestic style UPVC window has been installed to view the fuel level in the store but this has become warped with the pressure of pellets pushing against it and does not close correctly.

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Dividing wall between boiler room and fuel store



External damage following vehicle strike

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The high and low level ventilation that has been installed for the provision of combustion air is insufficient, contravening building regulations and British Standard BS6644. The high level extraction fan should be removed and replaced with a 400x400mm vent. An additional 400x400mm vent should be installed at low level.

3.5 Pumps, Pipework & Heat Meter

Each boiler is equipped with a shunt pump that circulates water from the boiler to the buffer tanks via the heat meter and should be selected based on the system design flow and return temperatures. It was not possible to confirm the design conditions on site and they have not yet been confirmed by the current owner but the industry standards applicable at the time of installation can be used to get a best case scenario. Assuming a flow temperature of 80°C and a return temperature of 60°C then each shunt pump will need to be capable of pumping 8.82m³/h to achieve the full boiler output of 199kW, hence a combined 17.64m³/h for the combined 398kW. The pumps seem capable of achieving this performance, however, the heat meter is only rated to 15m³/h so would be out of calibration at full boiler output. To overcome this, the heat meter would either have to be replaced with a larger model or the boilers and pumps would need to be de-rated to stay within the capabilities of the meter. As noted above, this is a best case scenario, if the design temperature difference (ΔT) between the flow and return pipes is only 15°C or 10°C then it is likely that the shunt pumps and associated pipework would also need to be replaced for larger items.

Similarly, the technical efficacy of the equipment downstream of the buffer tanks – heat exchanger, pumps and pipework – would also be dependent on the system operating temperatures. Initial calculations for the suitability of these pumps suggest that they are borderline for a 20°C temperature difference but unsuitable for a reduced ΔT. It is recommended that the datasheet for the heat exchanger is obtained from the present owner as this will detail the design conditions for both the primary and secondary systems.

Central heating systems of a similar age to the current Lindhurst Lodge system are likely to operate on a 10°ΔT but if the proposed extension/replacement of the Home comes to fruition then the new system would have at least a 20°ΔT.

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4. Site Operation & Risk

4.1 Overview

There are a number of issues which AMP would need to address should the purchase of the site proceed, some of these have been identified earlier in the report but have been included again below for completeness. These issues have been broken down into Health & Safety issues, technical issues contravening statutory or manufacturer's guidance and operational issues which would need to be overcome to improve site efficiency and make the site more profitable.

There is a single RHI accreditation associated with the site though documents relating to the RHI application have not been seen. Since there is only a single heat meter on site, located within the biomass plant room, there must have been a heat loss calculation as part of the RHI application to take into account the heat lost underground between the biomass plant room and the Lodge. AMP should be satisfied that the calculation and application are correct prior to progressing.

4.2 Health & Safety Issues

As with most biomass plant rooms, the most important H&S consideration is the establishment and subsequent spread of fire. It has been highlighted earlier that there are areas in the plant room with a thick covering of dust due to the incomplete nature of the fuel store dividing wall. This wall should be sealed to prevent the ingress of dust and the transmission of fire/heat but will need to maintain the provision of access into the fuel store in the absence of an external door.

An additional light is required to provide adequate illumination for plant operation and maintenance and there are no emergency lights to allow safe egress during an emergency or power cut, nor is there any push bar escape ironmongery fitted to the emergency exit. It is recommended that these areas are addressed prior to completion.

The plant room area is not equipped with Carbon Monoxide or fire/heat detection. Although it is remote from the care home itself, installation of detection is still recommended.

Despite being excluded from the potential purchase, it is still likely that AMP or other appointed staff will require access to the basement plant room within the care home that contains the interface pipework and the gas boiler. Carbon Monoxide was detected within this area at a level of 20ppm. This is below the HSE long term exposure limit of 30ppm but sufficiently close to request that action be taken by the building owner to either identify the source and/or increase the fresh air ventilation.

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4.3 Technical Issues

The technical issues identified earlier are summarised below:

- Replacement boiler flues required
- Heat meter to be replaced or boiler/pumps to be de-rated
- Buffer tank and heat exchanger pipework to be reconfigured
- Boiler room ventilation to be improved
- System design temperatures to be confirmed
- Issues with the building structure to be addressed
- Pressurisation unit to be installed

4.4 Operational Issues

It was noted previously that the biomass boiler heat meter has recorded 371,000kWh of heat production since September 2015. It therefore seems improbable to suggest that 400,000kWh of heat will be sold to the client within the first year of AMP ownership, even if the footprint of the building is increased. It is recommended that further analysis is carried out to identify realistic figures for the business case.

There are ongoing complaints regarding the availability of hot water within the care home when the biomass boilers are operating, this was the primary reason for the presence of the Strebel engineer during the due diligence visit. It is understood that sufficient levels of hot water can only be guaranteed if the gas boiler is running but this is due to the interface pipework arrangement rather than a lack of heat production by the biomass plant. Although the interface pipework is excluded from the potential purchase, it is likely that the hot water complaints will still be attributed to the biomass system unless there is a significant restructuring of the care home plant room pipework arrangement.

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4.5 Remedial Costs

Budget costs have been worked up based on the operational, technical and H&S issues identified above:

System	Cost (£)
Replace Flues	7,500
Replacement heat meter	1,500
Pressurisation unit installation	1,300
Reconfigure buffer tank pipework	3,500
Reconfigure interface pipework arrangement	5,000
Electrical safety work and boiler controls	3,200
Building structure repairs, fuel store wall sealing, air vents and escape ironmongery	5,400

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Accreditations

- BSI: ISO 9001: 2008 Management Systems accredited
- MCS Accredited Installer No.1223 Biomass Systems
- Acclaim Accreditation Health & Safety
- Constructionline registered
- HETAS trained flue installation
- B&ES registered heat meter assessor
- Approved supplier Scottish Government Biomass Energy Supply Agreement Framework for public and third sector.

  Ranked number 1 in the tender exercise to identify framework companies
- NHS Scotland Carbon and Energy Reduction Framework.

  Ranked number 1 in the tender exercise
- Approved supplier Scottish Government Framework Agreement for Biomass Wood Pellet Supply.

  Ranked number 1 in the tender exercise to identify framework companies

Government Groups, Memberships and Affiliations

- Scottish Government Wood Fuel Task Force
- Biomass Air Quality Steering group
- Renewable Heat Task Group
- Renewable Industry Advisory Group to Scottish Government
- Scottish Government District Heating Expert Group
- Scottish Renewables Member
- Scottish Land and Estates trade member
- Confederation of Forest Industries

Awards

- Winner of 'Renewable Project of the Year – Public Sector' H&V News Awards 2014
- Finalist 'Service & Maintenance Initiative of the Year' H&V News Awards 2014
- Winner of 'Building Services' category of the UK wide Construction News – Specialist Awards 2011
- Winner of 'Green Apple' – Best Practice Award 2011
- Scottish Green Energy Awards – Nominated 2011

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