

Woodfuel in Low Carbon Building Design: Hillcrest Housing Association

Why use Woodfuel?

Energy efficiency and environmental sustainability were key objectives for Hillcrest Housing Association (HHA) when it began the process of planning its new headquarters building in Dundee. The aim was for the new building to showcase the design approaches that can be adopted in modern affordable housing.

The architects selected for the Hillcrest project, Nicoll Russell Studios, investigated various renewable energy options but a biomass heating solution was chosen as part of the final design. The decision to use biomass was based mainly on the fact that it reflected HHA's desire to develop a low carbon building with BREEAM Excellent rating and fitted well with the building design. The biomass project was paid for as part of the overall construction package of the building and is now managed and maintained by Angus Biofuels.

Design Choices

- // It was decided to keep the boiler house away from the main structure for fire separation. However, the boiler house is linked below ground to the plant room in the main building. This suits the topography of the site and reduces the land taken up with infrastructure for the biomass system.
- // The area to be heated is 8,700m³ and the boiler is a 185kW Binder biomass boiler, with two 100kW gas boilers also installed as back-up. An accumulator tank was installed to smooth out peak demands.
- // During the winter months, 5.5 tonnes of woodchip is required per week to fuel the system. In summer this falls to around 2.5 tonnes per week.
- // Fuel is sourced from within an 18 mile radius and accommodated in a 70m³ underground store. The fuel store was designed in such a way that fuel deliveries are made from the staff car park, ensuring that delivery vehicles have a large enough turning circle.

Challenges – Air Quality

- // Biomass boilers must meet certain air quality standards to receive the RHI and must come with an RHI emissions certificate or valid environmental permit.
- // Burning fuel of the correct specification and moisture content, as well as regular maintenance of boilers and flues, will help to limit particulate emissions from biomass. What may also be required, especially where biomass boilers are located in local authority Air Quality Management Areas, are additional clean-up tools such as bag filters, scrubbers, ceramic filters and cyclones. These inevitably add costs to projects but can ensure that biomass systems are within the permitted emission levels.
- // Biomass boilers tend to emit “dark” smoke on light up. This is smoke which contains the highest proportion of particulates and oxides of nitrogen. On lighting and shutting down, dark smoke is permitted, as well as limited soot blowing.
- // The main challenges for this project came at the planning stage. The initial planning application was submitted in 2007 but the project was not approved until October 2010 due to concerns around air quality. Several planning appeals were lodged during this time and revised designs incorporated the best abatement technology to minimise the levels of coarse particulate matter (PM10) and NOx emissions there would be in the smoke.
- // An agreement was signed with Angus Biofuels, a local biomass Energy Supply Company (ESCo), to build, maintain and operate the boiler system, ensuring its design met air quality standards. They in turn used a contractor to carry out a range of air quality modelling exercises. They continue to maintain and operate the boiler and monitor emissions, as well as fuel consumption, ensuring the protocols for emissions as set out in the environmental agreement emanating from the planning permission process are adhered to.
- // In the original design, an exhaust flue of 19.5m with an accelerator on top was specified to blast the PM10s into the atmosphere. During the planning process, this design was deemed to be flawed as on damp, cold days the particulates would fall back to earth and affect air quality.
- // The final design, post planning appeals, included a ceramic filter to remove 99.99% of the PM10s before they entered the flue. The 19.5m flue with accelerator was retained to address the very small amount of PM10 that would remain.

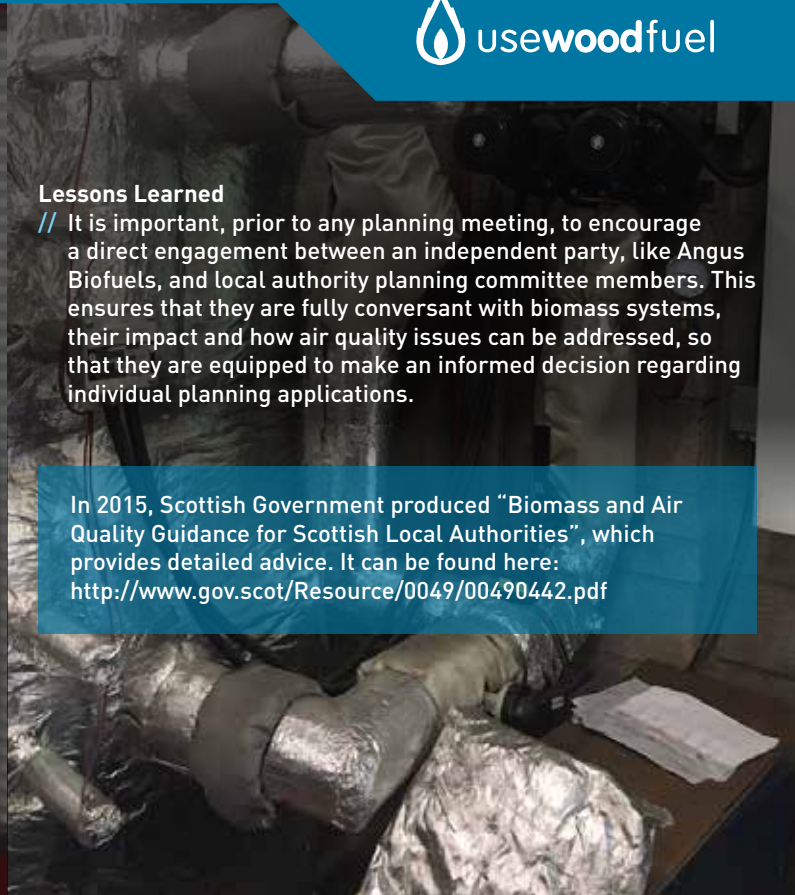
Key Benefits

- // Installing a biomass boiler has provided HHA with a sustainable heating solution that ensures heat is provided at a competitive cost from a sustainable fuel source that has security of supply.
- // The biomass system cost HHA around £160,000 to install but it has been accredited as part of the government’s Renewable Heat Incentive (RHI) scheme, which provides payments for renewable heat generated over a twenty year period. This provides HHA with around £22,000 per year of income in RHI payments.
- // HHA, as owners of the biomass system, purchases the heat generated (as measured by a Kamstrup heat meter) from Angus Biofuels via an ESCo agreement and receives the RHI payments. This agreement takes away much of the operational risk for HHA, effectively placing the efficiency of the boiler in the hands of the ESCo (Angus Biofuels). If the boiler uses more woodchip than is essential to deliver the required heat, then the cost is born by the ESCo not Hillcrest. Similarly, if the boiler emissions exceed the limits set out in the environmental agreement, then it is the responsibility of the ESCo to rectify this. The only thing that HHA pays for in addition to heat, is the regular servicing and elements of replacement, for which costs are also built into the ESCo agreement.

Lessons Learned

- // It is important, prior to any planning meeting, to encourage a direct engagement between an independent party, like Angus Biofuels, and local authority planning committee members. This ensures that they are fully conversant with biomass systems, their impact and how air quality issues can be addressed, so that they are equipped to make an informed decision regarding individual planning applications.

In 2015, Scottish Government produced “Biomass and Air Quality Guidance for Scottish Local Authorities”, which provides detailed advice. It can be found here: <http://www.gov.scot/Resource/0049/00490442.pdf>



KEY FACTS

Application	Heating and hot water for a modern office block
Max output of boiler	185 kW
Manufacturer	Binder
Fuel type	Woodchip
Fuel storage capacity	70m ³
Fuel storage type	Underground
Woodfuel specification	Locally sourced virgin timber G30 grade woodchip at 30% moisture content
Fuel delivery method	50m ³ tipped delivery
Back-up system	2 x 100 kW gas back-up boilers installed
Fuel delivery interval	Average woodfuel use of 3.5 tonnes per week (5.5 tonnes in winter and 2.5 in summer)
Installation cost	Boiler and boiler house cost in the region of £160,000
Annual RHI income	Estimated at £22,000 per year