

Ansty Manor, Wiltshire

This case study provides details of a biomass boiler in a large domestic house with a swimming pool. The property has a high heat load and therefore the suggested type of biomass installation would normally be an automatic wood chip or wood pellet boiler system. In this case however, the owner of the manor elected to have a log boiler installed; this requires manual lighting and fuel loading and may be impractical for other large houses but in this case it is a workable solution that utilises a local source of cheap wood and an existing member of staff.



Figure 1: Ansty Manor in Wiltshire

Background

Ansty Manor is located in the Cranborne Chase & West Wiltshire Downs Area of Outstanding Natural Beauty. It is a large, detached, listed 16th century domestic property with solid walls. The main house consists of 11 rooms plus a kitchen and three bathrooms with a total of 41 radiators. In addition, an indoor swimming pool is heated to 28°C all year round. The swimming pool complex has five associated rooms which also require periodic heating.



Figure 2: Google Earth Image of Manor House, Ansty.

A 70kW log boiler was installed in the spring of 2008 and provides around 85% of the heating and hot water requirements of the property. The principal reasons for considering wood heating were to reduce both running costs and carbon emissions.

Heating requirements

The house and swimming pool were previously heated using three 44kW Trianco Eurostar oil boilers (85% efficiency, non-condensing) installed in 2001. The annual average heating oil (28sec) consumption was 27,000 litres, equating to an annual energy consumption of 277,290kWh.

On a daily basis the property used 50 litres of oil for the pool (year round) and 50 litres for the house in winter (based on an average usage of seven hours per day). The hot water supply for the kitchen and one bathroom is separately heated by an oil fed Aga which requires 2,000 litres of oil per year. The two other bathrooms are only occasionally used and hot water in these is provided by electric immersion.

The boilers are located in the boiler house, a former stable approximately 70 metres from the house/pool. Heat is delivered from the boilers via an existing heat main, installed in 2001.

Project development

Initially advice was sought from the AONB in January 2007 who put the owner of the property in touch with the Centre for Sustainable Energy (CSE). At the time, CSE was running a regional programme called the South West Co-ordinated Woodfuel Initiative, which provided a free site visit and biomass feasibility study undertaken by an independent expert. This report gave the

owner of the manor the information needed in order to make a decision on the viability of woodfuel for the property. Unfortunately, this programme has now ceased.

Boiler choice

The feasibility study suggested that a woodchip boiler would be the most suitable option for the property; this was later ruled out due to the fact that there was no space for a wood chip store and the estate did not have a wood chipper.

A log boiler was preferred because it offered a solution at a reasonable cost and could utilise existing woodland and equipment on the estate. Despite being more "hands on" the activities relating to the boiler (fuel loading, lighting, ash removal etc.) could also be taken care of by an existing member of staff.



Figure 3: Froling 70 kW log boiler and accumulator tank (left).

Heating plant

Five tenders were originally sought but the occupier found Econergy to be the “most helpful and responsive”. The chosen system was a Froling 70kW log boiler installed along with two 1,500 litre accumulator tanks. It was decided that the boiler should be positioned in an adjacent stable next to the existing boiler house. This had the advantage that no planning consent was required. As the three oil boilers were only five years old and the boiler house was large enough to accommodate both these and a biomass system it was decided that they should be retained to provide back-up heating. The oil boilers cut in when no one is available to fill the wood burner.

Items were delivered over several weeks and this was followed by a three week period for installation. The system was plumbed in to the existing system by K J Cole of Salisbury and fully commissioned in May 2008.

Fuel Supply and Storage

The annual consumption of woodfuel in the boiler is expected to be in the region of 50 - 60 tonnes. Wood is obtained from three local sawmills (all within 25 miles) and is mainly soft slab wood although some hard wood is also provided. It is planned that approximately 20% of the fuel supply will eventually be sourced from the 12 acres of woodland on the estate.

The ideal log dimensions for the boiler are 50cm in length and 10cm in diameter but most slabs have less girth than optimum. Each slab wood bundle is cut to 50cm lengths by a member of estate staff using a long blade chain saw.



Figure 4: Slab wood

The slab wood has already been dried for 3 - 6 months when it arrives on the Estate. It then needs further seasoning to achieve a moisture content of less than 25% which is required for efficient combustion. Drying times vary depending on the type of wood being used: 6 months for soft wood up to 18 months for hard wood are typical.

The slab wood is stored on the Estate in farm buildings located one mile from the boiler house. The intermediate store is an open sided shed (approx 4m x 12m) and bundles are stacked up to 8 metres in height.

The price of slab wood (including delivery and allowing for handling costs) is around £25 - £30 tonne. This gives an annual woodfuel cost of £1,250 - £1,800.

Operation and Maintenance

The Estate has signed up for an annual maintenance contract with Eenergy but weekly and monthly servicing is carried out by Estate staff. The weekly activities include about one hour for sweeping out the boiler house and emptying the ash bucket. The monthly service includes cleaning inside the boiler and around the sensors which takes about two hours.



Figure 5: Boiler house and woodfuel store

In the height of winter the boiler is completely filled with wood fuel four times per day. As a rule this takes place at 8 am, 12 noon, 4pm and 10pm and overall takes between 15-30 minutes per day. The first three fillings are carried out by an existing employee but the 10pm slot and weekend fillings are carried out by the Estate owner.

Several times per week a new batch of wood fuel is moved from the intermediate farm store to the boiler house. This takes 45 minutes per trip and varies from 1-2 times per week during summer to 3 times or more per week in winter. This means that there are over 100 internal woodfuel movements during the year. By contrast the oil store which holds 8,000 litres would previously have needed only four fillings per year.

In total, the staff time spent looking after the boiler is about four hours per week. The total labour costs (calculated on an hourly basis at £12/hour) equals £48 per week or £1,200 per year. In addition, there is a further 2.5 hours per week of personal time (for loading late in the evening and at weekends) that are not included in the costings. The owner claims to actually enjoy this past time!

Capital and Operational Cost

The overall capital cost of the installation was £35,280. This includes the following:

- The boiler delivery, installation and commissioning
- All the pipe work, sensors, accumulator tanks and flue
- Plumbing into existing system
- Alterations to existing building
- Equipment purchased to transport and process the wood fuel
 - long blade chainsaw
 - ratchet straps
 - wood spreaders for storage
 - netting and polythene for drying /covering in store
 - moisture meter.

A grant of £2,500 was obtained from the AONB. Unfortunately this funding stream is no longer available. However, other grants are available from the following sources:

- Low Carbon Building Programme www.lowcarbonbuildings.org.uk
- Bioenergy Capital Grant Scheme (Round 4) www.bioenergycapitalgrants.org.uk

The estate is still using 3,750 litres of oil per year but this is expected to fall to 2,500 litres as the Estate become more familiar with the performance of the accumulator tanks.

The savings compared to oil (after deducting wood cost, labour cost, maintenance contract and the use of ongoing oil) and the time taken for the savings to payback the extra cost of installation are as follows:

Price of oil (p/litre)	Savings compared to oil	Payback (Years)
60	£10,925	3
50	£8,425	3.9
40	£5,925	5.5

Carbon savings

The heating demand of the house and swimming pool previously emitted about 75 tonnes of CO₂ per year. If the Estate was heated entirely with woodfuel this would be reduced by 67.5 tonnes with the remaining 7.5 tonnes produced from transport and processing of the woodfuel. Currently, oil provides 15% of the heating so the annual emissions are around 19 tonnes of CO₂. However, this still is a saving of 46 tonnes compared to the previous heating system.

Key Lessons Learnt

The owner of Ansty Manor suggests that the “biggest challenge” of this installation was getting the wood fuel supply in place. He would advise people following in his footsteps to get a certain supply ready in advance of the boiler being installed to ensure they have dry wood available when required.

He admits that having to load and light the boilers is a big “disadvantage” but feels that the effort is worth it because of the savings compared to oil”.

In hindsight he said “it would have been ideal if we could have got bigger accumulator tanks in the boiler room as this would somewhat reduce the daily loading ritual”. He states that he might retro fit another tank in due course which will cost around £1,000. He said that both he and his staff member were still “getting to grips” with the boiler and the accumulator tank and feel that by “fine tuning” the process they will use less wood and less oil. He admitted that at times they had wasted wood by loading fuel into the combustion chamber when the accumulators were hot.

He had been initially concerned by the height of the flue above the barn in the plans but this had been scaled down and now “it’s hardly noticeable”.

Summary information

Boiler type	70kW Froling log boiler
Installer	Econergy
Capital cost	£35,280
Heating requirement (oil)	27,000 litres
Amount of wood fuel used	50-60 tonnes / year
Savings compared to oil	£6,000 -£11,000/ year
Operation/Maintenance costs	£1,500/yr
Grant	£2,500
Payback	3 - 5.5 years
CO ₂ savings	46 tonnes/year

Contacts

Cranborne Chase and West Wiltshire Downs AONB

Tel: 01725 517417

Website: www.ccwwdaonb.org.uk

Email: info@cranbornechase.org.uk

Centre for Sustainable Energy

Tel: 0117 9341 400

Website: www.cse.org.uk

Email: info@cse.org.uk

Econergy Ltd

Tel: 0870 0545 554

Website: www.econergy.ltd.uk

Email: admin@econergy.ltd.uk

