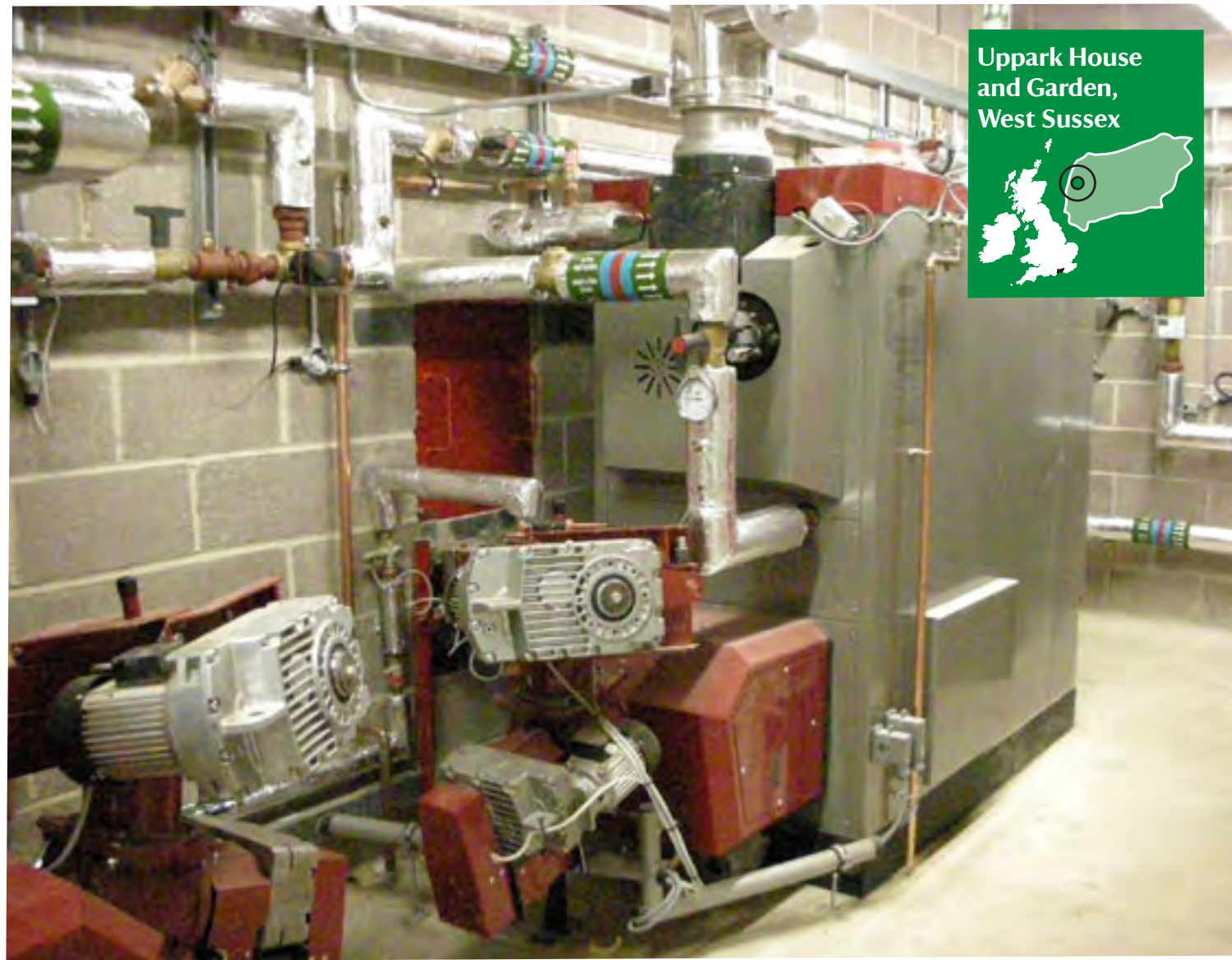




National
Trust

Sustainable technology case study

- two 100kW Gilles wood chip boilers with heat meter
- replacement of an oil-fired system
- locally sourced fuel
- highly commended sustainable tourism award



Biomass boiler

Biomass heating system to provide heat to the east pavilion and main house, December 2009

Background

■ The property at Uppark consists of several buildings; the Grade I listed main house and east pavilion, and stable block, with a total floor area of approximately 5,000m².

■ The two lower showroom floors of the house use conservation heating to stabilise humidity levels, whereas the upper two floors are residential and heated for comfort when occupied. The intention was to install a wood heating system to serve all three buildings.

■ The main house had been heated by two oil-fired boilers which were installed during its restoration. These boilers had past the end of their life span, regularly breaking down and costing increasing amounts to repair and maintain when they were in desperate need of replacement. The repair costs for the boilers increased as new parts had to be made especially. The deterioration of the boilers had led to two near miss incidents, with the flues unable to draw and smoke filling the boiler room. If the boilers had not been shut down the resulting incident could have been catastrophic.

■ The east pavilion had undergone major works which included the removal of electrical storage heaters and the installation of an oil-fired wet heating system. It would be possible to link this system to the biomass system without further alterations.

■ The consumption of oil and electricity for heating was costly and had environmental implications – with rising fossil fuel prices making this form of heating more expensive than in the past. At Uppark, the Trust had been spending around £30,000/year on oil (300mWh/yr) and electricity (180mWh/yr), with approximately half of the electricity being used for space heating. The cost of wood chip for the property is now approximately half of the equivalent oil and electricity cost.

■ Further savings could be achieved by switching to hot water heating provided from wood in the pavilion – which is currently supplied by electricity.



Biomass boiler | Uppark House and Garden

The project

■ It was proposed to install a biomass boiler in the gardeners' yard. The yard has access for deliveries and is away from the current visitor route.

■ The boiler would be contained within a wooden building, similar in style to the garden offices. This would house the boiler, feeding system and storage for the wood chip. There would also be a thermal store allowing the system to meet the demands of the conservation heating system within the house more efficiently. A large hot water tank would allow the conservation heating to draw off small amounts of heat quickly without the need for the boilers to fire, thus increasing the efficiency of the system.

■ Pipes would run from the gardeners' yard across the east lawns, past the east pavilion to the house, taking heat from the boilers and linking in with the building management system.

■ The project would remove the need for two 7,500 litre capacity oil tanks, thus eliminating the risk of oil pollution on the chalk downs that were soon to become part of the new National Park.

■ The system would provide heating for a donor family flat and staff flat within the main house, conservation heating in the show rooms and comfort heating and hot water for the office, shop and restaurant.

Left Valve and flange insulation

Design

- A new building had to be constructed to house the new biomass boilers. It was not an option to use existing buildings.
- The boiler house had to include the appropriate fuel delivery, storage, fuel bunker, fuel hopper and screw feed to the boiler.
- The system uses two 100kW Gilles boilers and runs by burning wood chip from early forestry thinnings and coppiced woodland, a process which is 95% carbon neutral. Most of the carbon dioxide released when the wood is burned is absorbed by the growing woodland and coppice.
- An auger and fan system is used to deliver wood chip to the fuel store.
- The wood chip is supplied by the nearby West Dean Estate, which has used a biomass boiler for many years.
- In large forestry estates it is essential to find viable solutions for thinnings and coppice. This improves the quality of woodland management, habitat diversity and helps sustain the rural economy and employment. Only around 70% of the annual incremental growth of the woodlands is harvested each year, so the operation is entirely sustainable.
- Access for deliveries of wood chippings was an important factor.
- Conservation heating regulates humidity levels within the house to help preserve the collection.

Funding

- Total cost including all fees and non-recoverable VAT: £350,000
- Funding: £131,000
- Bio-energy Capital Grants Scheme & National Trust Green Energy Fund (npower) grant

Carbon reduction

- The biomass boiler system has made a significant contribution to Uppark's carbon reduction.
- The property achieved a sizeable energy reduction against the 2009 baseline due to the installation of the biomass boilers. Consumption was reduced by approximately 338,000kWh, 6.4% of the 2020 target.
- Using locally sourced wood helps to reduce Uppark's carbon footprint even further.
- In 2009, before the installation of the biomass system, Uppark's fossil fuel consumption was 472,202kWh. The biomass boiler was installed in December 2009 and in 2010 the fossil fuel consumption was 128,101kWh. That is a 73% reduction in fossil fuel use and a saving of 93 tons of CO₂ based on Defra's 2009 conversion figures.
- This is not only a benefit to the environment; Uppark has also saved some money. 2010 energy costs were 5% lower than 2009 costs. If the property was able to supply its own wood chip, as at Scotney Castle, the difference in costs would be far larger.

Right Wood chip store

Review

Performance

- The nominal efficiency for the boilers is 94.6%
- The system is working well despite some teething problems.
- Uppark has experienced a range of problems from blown valves cascading water everywhere, to wood chip getting stuck, and the chimney air intakes getting tarred up. Despite all these however, the system generally is very good.
- The main issue the property has encountered has been with the delivery system getting chip into the wood stores. The wood chip is tipped into a mus max blower and then blown through pipework into the stores. This has taken some time to master and every so often the electricians on it play up. This is frustrating as it means deliveries have to be taken by hand; using wheelbarrows to get the chip into the stores. This is time consuming, although on the positive side, it is a good way to keep warm and burn calories.



Review

Energy generation

■ At the start of the year (2012), Uppark passed the 600mWh mark for heat generated which will have saved a huge amount of CO₂ in the last two years. Taking oil off the site has also lowered the pollution risk considerably. This is very important, as Uppark has a private water supply that could have become contaminated if oil had leaked on site.

Maintenance

■ Uppark has a maintenance agreement with a company that comes out twice a year to give the biomass boiler a thorough service.

■ Property staff empty ash once a fortnight, take deliveries and every so often trouble shoot if something happens. These things can be time consuming, but normally they are relatively straight forward. However, it is really important to have lots of staff and volunteers on side who understand the system, and can help to spread the workload.

■ The whole system is monitored through the Trend Building Management System. This means that staff can easily keep an eye on it and spot any problems that occur early on. This is useful, because if the system goes cold it does take some time to warm up again.

Engagement

■ A certain percentage of the work was carried out during the open season and this was described to visitors. Part of the requirements for the grant funding was the development of an interpretation strategy. As the entrance to the former house boiler room was on the visitor route, a small display area was used at this point to explain the project.

■ Table talkers and posters were created for the general public; visits were made by regional property staff and staff from other properties interested in similar systems; local parish council and council officers also visited.



■ Visitors to Uppark are often fascinated by the system; the new boiler room is therefore beginning to be included on tours of the property.

■ The system has been incorporated into the interpretation of other sustainable works at Uppark, including secondary glazing, roof insulation, low energy lighting and composting. All ideas visitors can take home with them.

Lessons learnt

■ The wood chip is supplied by a neighbouring estate which has run its own biomass system for nearly thirty years. This has been a great link to have established, as they are able to offer lots of useful advice.

■ In hindsight, it would have been worthwhile incorporating a way of generating electricity, either PV cells or similar, into the system. A new building was created for this project, so it would have been relatively straight forward to do. This would have made the system even greener, particularly as the system, especially the blower, is rather electrically hungry.

Future plans

■ The property is about to install some PV cells to recharge the electrical equipment used by the garden team - helping to drop its electrical consumption further still.

Above **Biomass boilers**

Review

Recommendations

- It is useful to bear in mind fire compartmentalisation when designing this sort of installation.
- Wood fired heating is recommended, but it is not suitable for everywhere. It is important to have a reasonably sized staff team to be able to manage it, as well as one that is enthusiastic about it, to make it work for you.
- At Uppark, the two boilers are fed by two separate wood chip stores, which run independently so that one can be running without the other. This has been invaluable – when there have been problems with one it has been possible to keep the system going.

- Having two boilers also helps the system run at greater efficiency by not running a larger boiler constantly. This would definitely be recommended in any system.
- Having the large water buffer vessel is also really useful. At 4,000 litres it is huge, but this helps when the house is pulling for conservation heating in the summertime.

Below Wood chip blower



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