



# Case Study 1:

## West Dean Estate, Sussex

First commissioned in 1981, this pioneering district heating scheme remains one of the largest of its kind in the UK. It meets all of the heating and hot water needs of West Dean College – a centre for the study of traditional arts, crafts and music – as well as parts of the nearby village. Woodfuel is grown on the surrounding 6,400 acre estate. West Dean House, which now contains the college, is a large stately home. Together with its five annex buildings, it accommodates up to 140 residential students, plus more than 70 staff running the diverse activities of the Edward James Foundation, a multi-function educational trust set up in 1964 by the last private owner, a poet and philanthropist.

The heating and hot water requirements have been likened to that of a large country house hotel with a significant office complex, requiring about 2.5m kWh per year.

### Objectives

- To replace 50-year-old coke-fired boilers which had been converted to oil in the late 1950s. Efficiency levels were about 40-45%.
- Seeking a more sustainable solution, the trustees commissioned a survey in the 1970s. This settled on woodfuel from the estate's 2,000 acres of woodland as the preferred source of fuel, having ruled out straw bales. Mains gas was unavailable.

### Actions

- Initially, two woodfuel boilers were installed: one of 770 kW and one of 465 kW. The smaller one was replaced in 2009 with a 1,200kW, 90%+ efficient version to allow for an increasing heat load.
- They burn chipped timber with a typical moisture content of between 25% and 30%, though the system is able to burn chips with a higher moisture content.
- The original system was manufactured by Argusfyr Energiteknik, of Denmark, and installed by Cabbage Machinery UK. The new boiler was manufactured in Austria by Gilles.
- An underground mains feeds the college, five large student residences and 6,000sq ft of new teaching and exhibition space, as well as glasshouses in the walled kitchen garden, nine estate houses, the gardens' visitor centre, an outdoor swimming pool and even the village church.

### Achievements

- 20,000 tonnes of CO<sub>2</sub> have been saved since 1981.
- Overall, the performance and technical status of this installation is comparable to and in some instances better than many recent, similar woodfuel system installations.
- More than 25 years of management for fuelwood supplies is evident in some significant beneficial effects in the woodlands, which has a general high level of quality, thanks to early thinning work. High levels of flora and fauna have been assisted through habitat variation, with thinning allowing more light into the woodland.
- Because labour comprises the biggest element of the wood chip cost, this option benefits the local economy.

### Fuel

- Mixed species wood is cut and extracted by a "shortwood" system, mostly between 2-2.5m lengths.
- A contract team usually carries out the felling and a small directly-employed estate team carries out extraction and subsequent fuelwood processing operations.
- Produce is stored in the round and air dried, usually at forest roadside in stacks – some covered – for up to two years.
- After transportation, this dried material is then loaded in the boiler house wood yard onto a moving 'live deck' in-feed chain conveyor, to filter out any stone or other contamination that would damage the chipper.
- An adjacent splitter is used to reduce any logs too large in diameter for the chipper, a Jenz drum model.
- Chips are fed from here to the store via an elevator; a walking floor system draws chips as required.
- Chip size is typically 25mm, with 1,200 tonnes of chips now processed per year. The chipyard can be used to store nearly two months' supply of wood, although in practice, a year's supply is stacked to dry naturally in strategic locations throughout the estate.

### Quotes

"The estate now supplies woodchips to two other sites, one on the estate where a separate 150kw Binder boiler serves a weddings and conferences facility, the other a private house just off the estate. This, and the continuing demand for woodchips for the college, has given purpose and cash flow to the forestry operation. Forest blocks can be thinned according to silvicultural needs as opposed to market demand, and the Foundation is able to make a significant contribution to reducing global warming."  
**Simon Ward, Estate Manager since 1991**

### Partners and funding

- **UK agents for Gilles Boiler are Broag-Remeha**
- **Mechanical engineering consultant – W G Environmental Services**
- **Some funding for the 2009 replacement came from the Department of Energy and Climate Change's Bio-Energy Grant Scheme**

### Lessons learnt

- One of the greatest attributes has been the ability of the whole management team to successfully work together to develop and maintain the system.
- A competently designed and installed woodfuel heating system and a readily available supply of fuelwood has provided an excellent foundation for success. The selection of the boiler is a minor part of the planning process. Every stage in the process - the conversion of roundwood to chips, the chip delivery, storage and feed methods - needs to be thought through carefully and in detail to ensure reliability, longevity and a fault-free operation.



## Case Study 2: Maidstone Borough Council

Following a review of its office accommodation, Maidstone Borough Council took the decision to consolidate its offices into a single, centrally located, accessible property in the town centre. It also wanted the new premises to be an exemplar of sustainability and decided in partnership with its landlord, the Mall Corporation, to install a biomass boiler as the primary heat source. The scheme provides approximately 50,000 ft<sup>2</sup> of new and refurbished office accommodation including a 'gateway' to shared services with Kent County Council and other partners from the community and voluntary sector.

### Objectives

- To reduce fuel costs and dependency on fossil fuels.
- To reduce CO<sub>2</sub> emissions.
- To make use of wood resources from within a 10-mile radius of Maidstone.
- To encourage a return to usage of managed woodland and the associated skills.
- To encourage other companies and authorities to consider similar installations.

### Actions

- A feasibility study was carried out to establish practicality and cost of incorporating a biomass boiler to provide 90% of the heat load in the Council's new office accommodation, Maidstone House.
- This study also looked at the return on investment from use of biomass fuel compared with fossil fuels and the CO<sub>2</sub> emissions saved.
- As the new accommodation is leased, the landlord was closely involved as a partner in the scheme.
- The boiler chosen is a Froling Turbomat 320, burning woodchip fuel delivered to the boiler by an augur and hook lift bin feed arrangement.
- The boiler is backed up by gas boilers that provide back-up heating at peak load times and periodic heating requirements outside of the main heating season.
- The installation heats approximately 50,000 ft<sup>2</sup> of offices and public reception areas.

### Achievements

- Because of various delays, the installation wasn't commissioned until the end of the heating season, and will remain dormant until autumn 2009. For this reason, it's too early to say whether the project has been a success.
- However, the original feasibility study estimated savings of 92 tonnes of CO<sub>2</sub> emissions and cost savings when compared to gas of around 40%. These figures will be checked after a full season's heating.

### Background

- The installation costs were abnormally high as the accommodation was a refurbishment rather than a new-build project, the costliest element being the incorporation of storage and transportation plant.
- The viability of the project was greatly improved by grant funding of approximately 37% of the total cost from DEFRA under their Bioenergy Capital Grants Scheme.
- The level of fuel in the bins is automatically monitored and the supplier is polled when the supply is at a specific level.
- Wood chip will be sourced from within 10 miles of the boiler and is supplied by South East Wood Fuels Ltd. under an energy supply contract
- The installation and commissioning of the boiler and controls were severely delayed by a combination of events, including delays by the local electricity supplier diverting a mains power supply and incorporating the control system into the computer-controlled building management system.
- It is intended that the installation will be accessible to businesses, schools and other local authorities as a promotional and educational resource.



### Quotes

"It's important the offices make sense environmentally and economically. The measures we've put in place save energy and money, so we're doing what we can to reduce our carbon footprint and cut down costs."

**Mark Wooding, Cabinet Member for the Environment**

"We're delighted with our new offices. Having all services together in the centre of town is better for both staff members and the public. We have also achieved a considerable level of sustainability which we hope will set an example for businesses throughout the borough."

**Trevor Gasson, Deputy Chief Executive, Maidstone Borough Council**

### Partners

**Froling (boiler supplier)**  
**South East Wood Fuels Ltd.(Wood fuel supplier)**

### Funding

**DEFRA (Bioenergy Capital Grant Scheme)**

### Lessons learnt

- The delays and difficulties experienced arose from the complex nature of the scheme and the interface with external bodies, over which neither the Council nor its landlord had any control, and not because of any inherent problems with a biomass boiler.
- Arrangements for a secure fuel supply to the specification required should be set up well in advance.
- Placing of heat meter in circuit after buffer tank provides difficulties in making accurate assessments of heat usage.
- The regular and periodic maintenance requirements of the boiler should be understood well in advance and robust arrangements should be in place before the boiler is handed over.
- Training in the operation and maintenance of the boiler is of paramount importance.



## Case Study 3: The Living Rainforest

Part of the Trust for Sustainable Living, The Living Rainforest in Berkshire is an eco-centre dedicated to educating people about threatened ecosystems and to exploring the relationship between humanity and the world's rainforests through education and research. The centre features a tropical rainforest-inspired ecological garden, which requires a large amount of heat to replicate the rainforest environment. Over 75,000 people visit The Living Rainforest each year, including over 18,000 children through school tours and educational trips. The centre completed installation and commissioning of a woodfuel boiler in summer 2006.

### Objectives

- To replace one of the existing oil-fired boilers with a small-scale wood-burning boiler in a redeveloped building complex, to provide a sustainable energy source for the Living Rainforest and a focus for education.
- To help ensure that the centre has a minimal energy or carbon footprint, which is an essential prerequisite to getting its message across.
- To test the hypothesis that the environmental impact of greenhouses can be significantly reduced through integration with other buildings and use of sustainable design, construction and operation.
- To develop in-depth dialogue with visitors about the environmental challenges facing society.

### Actions

- In 2004, Eenergy carried out a detailed specification of a wood-fuelled boiler system based on a Thames Valley Energy feasibility study. The study showed that, with a continuous need for heat throughout most of the year, a wood-based system was ideal to replace the fossil-based oil system.
- The first phase of the Integrated Greenhouse (IG) project involved the design and construction of a prototype visitor centre building, known as the Human Impact Building (HIB), which incorporated integrated biomass heating.
- Wood fuel is supplied to the Living Rainforest through TV Bioenergy and sourced from local estates, growers and tree surgeons. Sourcing fuel from adjacent businesses provides diversification, income and employment on the local estates for local people.
- It is anticipated that the boiler will utilise in the region of 200 tonnes of woodchip per year supplied in at 30% moisture.

### Achievements

- As the first public, indoor rainforest attraction to convert from fossil fuel to renewable biomass heating, TLR has reduced its carbon footprint by about 200 tonnes of CO<sub>2</sub> each year since 2006 as a direct result of the project.
- Before installation, over 100,000 litres of oil was consumed annually at a cost of around £37,000 per year. At current oil and woodfuel prices a payback on the total cost of installation, taking into account grants received, of 1.7 years is expected.

### Background

- The boiler is a Fröling Turbomat 220 kW automated woodchip boiler. This provides the base load supply to The Living Rainforest of at least 80% (610 MWh) of the year-round heating requirements.
- Using optimised control technology the Turbomat boiler is over 90% efficient. The Lambda control system guarantees perfect combustion.
- All functions are fully automatic, from the fuel feed and combustion control, right through to cleaning and ash removal. The high-tech Turbomat is designed to be easy to use and even easier to service and maintain.
- The fuel store is integrated into the boiler house and is filled with woodchip via a chip blower. The fuel is then fed into the boiler by a spring arm outfeeder with integral fuel auger system.
- The fuel store is approx. 48 m<sup>3</sup> and is designed to accommodate a full load of woodchip delivered in an agricultural tipping trailer. Woodchip is sourced from within a 10-mile radius, from local growers and tree surgeons.
- Visitors can view the heating system via the 'Exploration Walkway' as they enter the Living Rainforest via the main entrance. Tours of the woodchip boiler house can be arranged for specialist visitors.

### Quotes

"The Living Rainforest is an excellent example of 'thinking global and acting local' – linking local sustainable energy use to maintaining an ecosystem of global importance – in particular demonstrating the value to the very many young visitors to the site."

**Keith Richards, TV Energy Ltd**

"As an eco-centre, it's important for the Living Rainforest to walk the talk of sustainability. Our wood chip boiler does exactly that, reducing greenhouse gas emissions and future heating costs. The project has already become an important flagship for the SE region of England, encouraging others to follow in its footsteps and turn to wood."

**Karl Hansen, CEO, The Living Rainforest**

### Partners

**Econergy Ltd**  
**TV Energy Ltd**  
**Plant Research International**  
**Forestry Commission**

### Funding

**The European Commission Life Programme**  
**SEEDA**  
**Clear Skies Community Fund**

### Lessons learnt

- Switching from oil to wood chip has reduced The Living Rainforest's running costs by about 40%.
- Integrating the new wood chip system and the old oil boiler system proved to be challenging. This highlighted the importance of systems integration in the early design phase.
- Wood chip boilers can be a surprisingly popular educational resource. The Living Rainforest incorporates its heating system into a popular 'Sustainable Future' tour.



# Case Study 4: Beacon Community College

The award-winning green heating system at Beacon Community College in Crowborough, East Sussex, was installed in 2006. Beacon's biomass boilers use sustainable wood chips from local suppliers to fuel the heating and hot water at the college, reducing carbon emissions by 600 tonnes annually. Crowborough is surrounded by the High Weald Area of Outstanding Natural Beauty (AONB) and in the middle of the country's largest concentration of ancient woodland. In 2006, the system – believed to be the largest of its kind at a school in the UK – scooped a South East Renewable Energy Award.

### Objectives

- To act as a pilot heating system to demonstrate and promote the potential of sustainably managed local woodlands to provide wood fuel – a priority of both the AONB and the Forestry Commission.
- To use a renewable energy source to provide heating and hot water and reduce the college's CO<sub>2</sub> emissions.
- To reduce the college's heating costs.
- To raise students' environmental awareness and understanding.

### Actions

- The boiler was installed over the winter of 2006/07 and is the UK's largest school biomass boiler installation. Southern Heating Group retrofitted the boilers and fuel store into the existing plant room. The dimensions of this space meant size was an important factor in choice of boiler.
- By choosing biomass heating for the college, East Sussex County Council hoped to make a strong environmental statement and reduce its carbon footprint.
- Timber is sourced from the Eridge Estate, local woodlands and tree prunings.
- The boilers need a minimum of 1000 tonnes of woodchip annually. This is set to rise as a swimming pool and further buildings are attached to the heat main.

## Achievements

### For the college:

- The fossil fuel cost to heat the college was about £55,000 per year; the biomass fuel cost has been estimated at about £30,000 per year. It is estimated that the break-even point for pay back on the initial investment will be reached much earlier than the boiler's 20-year life expectancy.
- The college has reduced its CO<sub>2</sub> emissions by around 600 tonnes per year.

### For the County Council:

- This woodfuel pilot project has been closely monitored by East Sussex County Council, and so far it has performed flawlessly. The council is keen to install woodfuel boilers in other properties and hopefully the groundbreaking approach at Crowborough can become a blueprint for other schools in the South East.

## Background

- South East Wood Fuels Ltd (SEWF) delivered the first load of chip in heavy snow on 25 January 2007. Between 20 and 60 m<sup>3</sup> of woodchip are now delivered into the fuel store each week, depending on the weather. An 8-metre auger feeds the chips from the fuel store into the boilers.
- SEWF worked closely with Southern Heating to advise on the design of the underground fuel store, the delivery schedule and the chip specification.
- The system burns woodchip from the Eridge Estate in two 500 kW Hertz Biomatic Boilers, generating up to 1 MW of power to heat the school. Once dry the round timber is chipped using a Heizohack chipper which is hired in. The demand for chip has created a much needed market for low-grade timber.
- SEWF is continually monitoring the fuel entering the system and has provided a moisture meter to the college so that regular moisture tests can be carried out at the point of delivery.
- The woodchip for the boiler is produced by Home Counties Wood Fuel Ltd at their wood yard and chip store 6 miles from the college. The company is focused on providing a reliable and consistent supply of high-quality woodchip to meet the specification of the Herz boilers. The wood chips have a moisture content of 30% (W30) and are 0.5–30 mm in size (G50), with low levels of fines in order to pass through the auger without causing blockages.

## Quotes

"This system is a winner in so many ways – it's good for the environment by reducing carbon emissions; it saves the college money by lowering their heating bills and helps the local economy by using wood chips from local suppliers. The council tax payer is also a winner in the long run as we won't be reliant on other sources of fuel which have been subject to heavy price rises over the last few years."

**Spokesman for East Sussex County Council**

"This is an exciting venture which has seen our college and the County Council's Corporate Resources Department work together to install the biomass heating and hot water system. The initiative will, in time, yield financial savings but by being eco-friendly the project also sets an excellent example to our students and the local economy."

**Beacon Community College Head Teacher, Peter Swan**

## Partners

**Home Counties Wood Fuel Ltd**  
**South East Wood Fuels**  
**Rural Energy Ltd (boiler suppliers)**  
**Southern Heating Group (boiler installation)**  
**Hoare Wooten (managing design consultants)**

## Funding

**East Sussex County Council**  
**SEEDA**  
**Forestry Commission**

## Lessons learnt

Forward planning is essential, as felled timber needs to be naturally air dried for up to two years to reach a moisture content of 30% – the level required by the boiler. Suppliers currently struggle to provide woodchip of consistent quality. By far the biggest challenge in this project was sourcing sufficient seasoned woodchip of the right quality at short notice. Initially 400 tonnes of felled timber had narrowly failed to reach the target moisture content.