Energy

Grow your own

National Trust

We intend to reduce our use of fossil fuels for heat and electricity by 50% by 2020.

We will do this by:

– Conserving energy
– Growing our own electricity and heat
– Getting off oil
– Energy inspiration

Foreword

The National Trust looks after special places for ever and for everyone: from historic houses and gardens to beautiful countryside and coastline. We have a responsibility to sustain these special places for ever, requiring us to make long-term decisions that will protect them for future generations.

Energy is essential to our operations, as it is to all aspects of 21st-century living. The 300 historic houses and properties that we open to the visiting public, our network of 360 holiday cottages and the thousands of tenanted buildings in our care all require heat and power. In total the Trust spends almost £6 million a year on electricity, oil and gas. There is a direct business incentive for us to get smart with our energy use. By cutting our energy consumption and generating more of our heat and power from renewable sources we will have more to spend on our properties, countryside and wildlife, and on giving our visitors a great experience. We will also be a more resilient and adaptable organisation, better placed to face the future whatever challenges come our way.

Many of the places we look after remind us of how energy was generated in the past, whether from water, wind or wood. 'Harvesting' energy in those days took effort, so it was valued and used carefully. We can trace the innovation and ingenuity of communities and individuals who generated their own heat and power locally, from the resources they had to hand, and what happened when those resources became scarcer or more expensive.

The world now faces significant challenges, as energy demand escalates, fossil fuels become scarcer and more expensive, and the need to avoid dangerous climate change becomes ever more pressing. As a society, we need to move towards a better, more sustainable approach to energy use, based on energy conservation, localisation, and greater use of renewable sources. World leaders may have failed to agree a political solution to the climate change problem at the global scale, but that should not delay us from delivering practical solutions on the ground.

At the same time we need to treat historic buildings and green spaces in ways that are sympathetic to their beauty and historical significance. We have many positive and practical examples to share. We recently installed solar panels on the roof of Dunster Castle, a magnificent Grade I listed building, and on Greenway, Agatha Christie's Grade II listed holiday home in Devon. We can show how heritage sites can play an innovative role in generating renewable energy and demonstrate that even the most sensitive and beautiful sites can contribute to reducing fossil fuel use and greenhouse gas emissions.

We began our journey to find ways to reduce our energy consumption back in the 1980s. Much has been achieved since then but we now need to work much harder and faster to reduce our use of fossil fuel energy. Many properties in our care are based in the countryside, away from mains gas and in some cases from mains electricity. We have a special interest in helping rural communities find alternatives to coal and oil for heating and to contribute to a renewable energy grid. We want to help these communities escape 'fuel poverty', and demonstrate the practical benefits of going 'off oil' for good.

This report sets out the National Trust's ambition for harnessing renewable resources in a sustainable way and in harmony with our precious natural and historic environment. Our nation is gifted with abundant natural energy from the sun, earth, sea, wind, rivers and woodland. We need to utilise this as best we can, so that we can reduce our dependence on increasingly scarce fossil fuels and truly realise a low carbon future.

Fiona Reynolds.

Fiona Reynolds
Director General - National Trust

Our bright energy future

Imagine visiting your favourite National Trust site, perhaps a beautiful country house or garden. Now imagine that site is generating all of its own energy. As you wander around the grounds and the buildings, you discover carefully integrated technologies such as solar panels, wood fuel heating and energy-saving measures, often inspired by those who originally lived here.

Gibson Mill, a Grade II listed textile mill in West Yorkshire, is one of our properties where this is already a reality. Built in the 19th century, the mill has been restored for visitors. The whole site is now self-sufficient in renewable energy and water, powered by a combination of wood fuel and solar for heating and hydroelectric power and modern solar panels for electricity.

We now have more than 140 renewable energy systems in operation on our sites across England, Wales and Northern Ireland, with an installed capacity of 2.3 MW heating and over 1 MW of electricity generation.[1]

There are good business reasons for these changes, as we explain below. But in addition climate change is already having a major impact on our properties, and is one of the reasons why we need to act now, both to reduce greenhouse gas emissions and to adapt to change. To avoid more severe damage to our cultural heritage, wildlife and countryside in the future, we need to reduce our use of fossil fuels and increase our energy generation from renewable sources. We need to conserve energy and use it much more carefully than we have in the past.

The National Trust has a clear stake in the energy system as both producer and consumer. We are contributing to the transition to more sustainable forms of energy generation. We are committed to sharing our experiences with our visitors, supporters, policy makers, funders and industry as we learn how to 'grow our own' energy in amazing places and landscapes. We want to engage with the millions of visitors who come to our properties each year, and use our experience as a large landowner and tourism business to do this. Playing our part in the local community is important, as is our role as an investor in people and the economy. We hope that our experience can help give people greater confidence to make changes in the way they think about energy, and the way they use it.

[1] 1 megawatt (MW) is the same as 1000 kilowatts (kW), which would power 100,000 10W low energy light bulbs. 'Installed capacity' means the potential power output. We typically measure energy use per hour as kWh, so 1MW of installed capacity can generate 1000 kWh, which can light 100,000 10W bulbs for an hour.

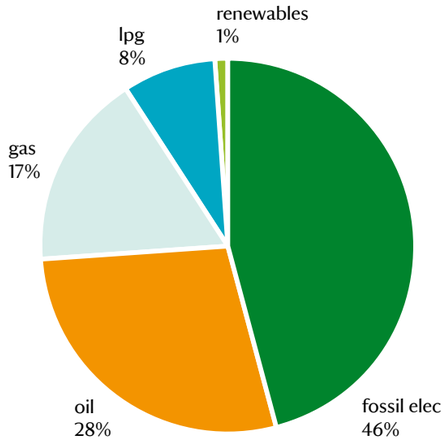
Our 2020 energy goal

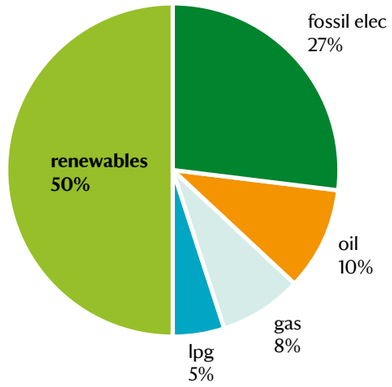
We intend to reduce our use of fossil fuels for heat and electricity by 50% by 2020.

In 2008 we consumed 86,193 MWh of energy in our own operations, emitting nearly 32,000 tonnes of CO_2.

Achieving this cut in our fossil fuel use will reduce our emissions to 14,423 tonnes per year of CO_2 by 2020, equivalent to removing the emissions from 4,500 family cars each year.

Energy shift 2008 – 2020





2008

Energy consumption = 86,193 MWh total
(of which c. 99% = fossil fuel)

2020 goal

(after 20% efficiency reductions)
Energy consumption = 68,954 MWh total
(of which 50% = fossil fuel)

Our action plan

The steps we're taking to reach our goal are based on the lessons we've learned from our own projects:

1. **Conserving energy.** We will reduce our overall energy demand by 20% by 2020, through implementing high energy efficiency standards in all our buildings and operations. We also use micro renewables such as solar hot water to reduce our use of mains electricity and heating fuels.

2. **Growing our own electricity and heat.** We will accelerate our programme to install small to medium scale renewable energy systems across our sites, to increase the production of electricity and heat in a sustainable way from local resources. We're also looking at the potential for medium scale electricity generation to supply not just our own needs but also for export to other users.

3. **Getting off oil.** We want to decommission all of our largest oil heating systems, which are expensive to run and can be highly polluting. We've already started with sites where oil spillage or pollution would be most damaging, such as near to rivers, streams or lakes or overlying aquifers. In mansions, visitor centres and tenanted cottages, we're switching off oil, and converting to low fossil carbon alternatives such as wood fuel heating (logs, chips or pellets) or heat pumps.

4. **Energy inspiration.** We will share our stories of saving energy and switching to renewable sources to inspire our supporters and visitors so that they make the switch too. We will show that this can be compatible with the conservation of historic buildings and precious landscapes. We're working with partners to share lessons, overcome barriers and look to future technologies as we continue to address our energy needs.

Growing your own makes business sense

Reducing our use of fossil fuels makes environmental sense, as it cuts pollution and reduces our carbon emissions – and we have to find alternatives to fossil fuels as they become scarcer. But investing in energy efficiency and renewable energy measures also makes business sense. We've tested the use of innovative renewable sources of energy on our estates, including in listed buildings and designated landscapes, accepting the up-front investment costs in our role as a conservation pioneer. We're confident that the systems we install from now on, such as solar panels, biomass boilers, heat pumps or small wind turbines, will be more cost-effective and should pay back their investment costs within ten years. Of course, these schemes will pay back their carbon costs in much shorter timescales – months in some cases.

Many of our installations to date have had their capital costs supported by grants and sponsorship (such as those from npower and the Big Lottery Fund). Ongoing Government support will be vital in ensuring sufficient investment to create the low carbon future that the Energy Act (2008) requires. The Government's new Feed-in Tariffs (FiTs) for energy generation and the Renewable Heat Incentive (RHI) will incentivise positive action at the local level for the smaller scale renewable energy technologies. We expect these subsidies will enable many more of us to generate renewable heat and power that we can use – and in the case of electricity export to the grid. Examples of how this might be achieved are shown below.Making the strictly financial case for investment in energy is complicated by the fact that the market price of fuels can fluctuate wildly over time, as does the cost of the various technologies.

Wood fuelled boiler

A 50 kW log-fuelled boiler, costing £31,000 and replacing oil as a fuel, will save our Carding Mill Valley Centre £4,000 each year. It will therefore take just eight years to recoup the investment. By using fuel produced by coppicing some of our Wenlock Edge woods, we will be saving 20,000 kg of CO_2 emissions from oil each year.

Installing wind turbines

Our micro wind turbines are already helping sites without mains electricity. We're now looking at the potential for small wind turbines on some of our sites to link with the grid. With the new FIT scheme a typical business case could be as follows: a 50 kW wind turbine for a site in the West Country costing £215,000 could generate a net income each year of approximately £51,000 from using the electricity generated on site and exporting the remainder to the grid. This means it would take less than five years to pay back the cost of installation.

Conserving energy

Delivering energy efficiency

Measures such as switching off electrical appliances and lights when they're not needed seem simple, but are the first step towards conserving the energy we use.

We're looking to improve the energy efficiency of our buildings and the equipment we use, by increasing standards of insulation and draughtproofing, using water saving devices and smart meters, fitting double or secondary glazing, using thermostatic heating controls, and installing ultra-efficient equipment and lighting. We're also installing micro renewable energy systems (such as solar hot water or small photovoltaic) as a means of reducing energy demand and so reduce our use of fossil fuels.[2]

Saving energy is of primary importance to the National Trust. By implementing energy efficiency measures, cutting out waste and changing our behaviour, we're saving money, reducing our carbon emissions, and safeguarding special places in the process.

Improving energy efficiency and reducing waste

- Over the next five years we will work on most National Trust buildings to meet our minimum environmental standards.
- This year we will be using 7000 m² of insulation that is 100% recyclable to improve the energy efficiency of all our mansions in Wales.

Case study
Ysbyty Ifan Estate, Wales

Ysbyty Ifan is the National Trust's single largest estate, with 51 farms and 40 cottages in North Wales. It is leading the way in energy efficiency by installing sheep wool insulation in all its cottages, demonstrating the value of using sustainable materials to reduce energy consumption and carbon emissions. It is estimated that tenants will see their energy bills reduced by 20%.

Wool's ability to manage heat and absorb moisture makes it a very effective insulating material for older buildings. It is renewable, recyclable, easily installed and uses less than a fifth of the energy needed to make glass fibre insulation.

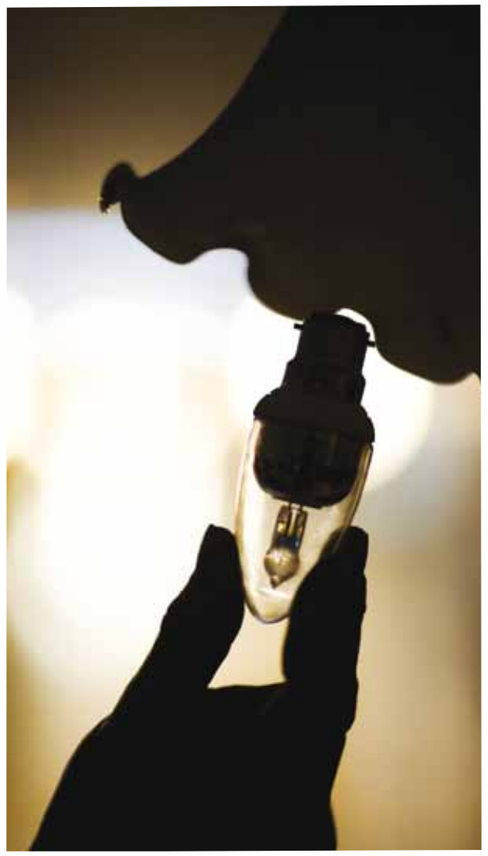
Environmental Practices Adviser, Keith Jones, says:

'The National Trust is showing how insulation can transform the running costs of these homes. It's easy to preach energy conservation, but with this project we can demonstrate the benefits of a local, natural solution that will pay for itself while at the same time promoting the wool industry. If only people could see the pounds that are escaping from their roofs into the air, it would be much easier to persuade them that insulation is vital.'

[2] The energy industry defines microgeneration as an energy demand management tool as it reduces use from the mains supply but does not contribute to the mains supply.

Case study
East Midlands Regional Office

Staff at our Regional Office in the East Midlands achieved a 21% reduction in energy use by small and simple behaviour changes such as turning off lights and electrical equipment when not needed, coupled with draughtproofing and insulation. This meant 13,007 kWh less electricity was used between June 2009 and November 2009 inclusive compared to the previous year. This translates to a £670 saving over six months, giving this simple work a payback of about ten years.



Case study
The Low Carbon Village Project

Residents living in two historic villages owned by the National Trust will be looking to reduce their CO_2 emissions and lower energy bills as part of a community-led programme.

The initiative will show how major energy efficiency improvements are achievable in homes of any age – not just modern buildings – with savings possible from the biggest mansion to the smallest cottage.

The Low Carbon Village Project, which is supported by £600,000 of funding from our energy partner npower, is being trialled at the Trust-owned villages of Coleshill in Oxfordshire and the Wallington Estate in Northumberland. As well as funding the project, npower is also giving advice on energy saving solutions for tenants of the properties.

The project involves 62 houses at Coleshill and 73 cottages and 14 farms at Wallington, with properties dating from the 1850s and 1750s, respectively. Through community engagement, each village will decide what measures to take to reduce their carbon footprints and make savings to their energy bills.

A website has been launched to follow the progress of the National Trust's low carbon villages. For further information visit **www.lowcarbonvillages.org.uk**

Growing our own electricity

Towards energy self-sufficiency

Taking inspiration from the local food movement, we want to 'grow our own' energy from local sustainable sources wherever financially and environmentally practicable. Our efforts will also help create jobs and service needs that will benefit local communities, for example by creating new demand for wood fuel supply or equipment servicing.

Most people would not naturally associate renewable electricity generation with historic buildings, assuming that solar panels or wind turbines would not fit into such places or be allowed by the conservation agencies. Yet we have successfully installed solar panels on the roofs of several listed buildings, showing how the clever use of fixings and location can minimise impacts on historic features and be invisible to observers. We have also installed new hydroelectric equipment into listed structures and brought historic equipment such as water wheels back into use again.

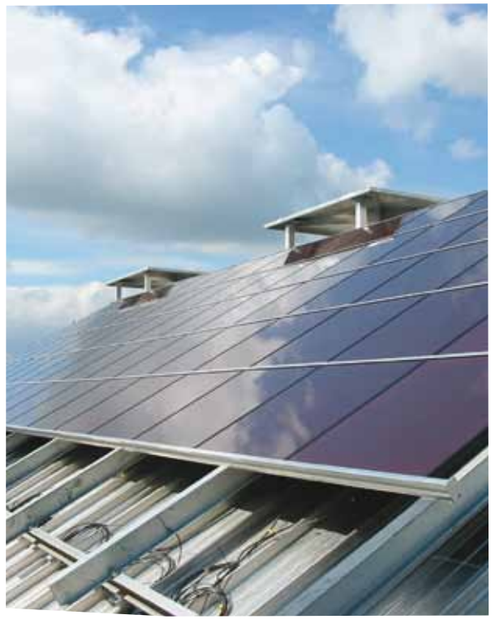
We're taking the same approach with new renewable energy systems in the countryside through careful selection of sites and attention to detail in design and installation. Small wind turbines and hydropower plants can be developed in harmony with their surrounding landscape, archaeology and ecology and can enhance people's enjoyment of the countryside. Indeed, we're sometimes simply putting back what was there before.

The solar slate panels on Kynance Café, Cornwall, are designed to look like conventional slates. The roof makes all the electricity needed and blends in with the coastal landscape. The café was the second place in the UK to use this innovative solar slate technology.

Solar electricity

Photovoltaic (PV) panels turn daylight into electricity. We know through our experience that they are most effective where sunlight is stronger and sunshine hours are longer, but they work anywhere in Britain.

- Solar PV is installed on 14 of our historic buildings.
- Our most remote solar PV installation is on the Farne Islands, Northumberland.
- Our smallest PV installation is on the Gower, used for battery power.
- Heelis, our central office in Swindon, is home to our largest PV installation.
- We use solar power systems in conjunction with other renewable energy technologies to make sure that we have year-round renewable heat and power.



Our central office in Swindon (above) is home to our largest solar electricity installation, with 1554 PV panels. In 2008 the panels generated 80 MWh electricity – providing around 30% of the building's electricity needs and exporting to the national electricity grid when office demand is low.

The Solartwin solar thermal panels at our visitor centre in Craflwyn, Snowdonia, paid for the cost of installation in around ten years – proving that they're a great choice even in one of the wettest valleys in the UK. These were paid for from EAGGF European funds and by the National Trust.

Case study
Dunster Castle

The National Trust's first renewable energy project on a Grade I listed building, Dunster Castle near Minehead, was runner-up in the Micropower Awards 2008, thanks to its innovative solar panels which are hidden inside the castle battlements.

The 24 photovoltaic panels on the roof supply the daily equivalent of the energy consumed by two family homes and in sunny weather provide most of the castle's daily electricity requirements. Saving almost 3000 kg of CO_2 a year, the carbon payback from the overall project is expected in four years.

The panels are part of a plan to turn Dunster into the greenest castle in Britain by saving energy across the property, as well as reducing water consumption, increasing recycling and promoting green transport.

Stephen Hayes, Property Administrator at Dunster, says:

'The PV panels are a great example of how the National Trust blends innovation with the historic integrity of buildings. They have allowed us to minimise the impact on the building without interfering with the roof. The panels have been secured to a framework attached to the walls, which will allow us to replace them with new technology if necessary. We hope to set an example for many managers of historic properties by showing that energy conservation technology is not just for modern buildings.'

Wind power

Today we have five micro wind turbines generating power for off-grid and demonstration sites. They help to reduce our demand for energy and our reliance on diesel generators.

Case study
Middlehouse and Tennant Gill, Malham, Yorkshire Dales

Middlehouse and Tennant Gill, two of Britain's most remote upland working farms, have been catapulted into the 21st century with new solar, hydro and wind power systems, proving that anything is possible with a bit of innovation.

High in the Yorkshire Dales, these farms are off-grid and until now relied on diesel generators for electricity. With the introduction of renewable energy, we did away with diesel for good, replacing it with renewable energy and battery stores. Both farms are now off oil and self-sufficient in electricity.

Tennant Gill Farm ran an experimental hydropower system for over a decade. Recently it has been modernised and linked to a solar panel and battery store for when the water flow in the stream is too low for the hydropower to work.

Middlehouse Farm will become free from a costly diesel generator through a micro (6 kW) wind turbine, which has just been installed. Alongside the Trust and the tenant, funding came from the Rural Development Programme for England, managed regionally by Yorkshire Forward on behalf of DEFRA and the EU.

Property Manager Martin Davies says:

'The turbine is unobtrusive. It's less than 20 m tall and set right against a limestone scarp. It's so windy up there, it would be mad not to use the wind instead of oil.'

We're reviewing the potential for some of our lowland farmland and developed sites to host small to medium scale wind turbines. To meet our renewable electricity target for 2020, we would only need to find room for five or six turbines of around the 1.5 MW size – or 30-40 of the much smaller turbines of the 50 kW type.

The siting of wind farms – especially very large-scale ones – is a particular challenge for the National Trust. Some of the windiest places are also the wildest and least developed. However we see the appropriate use of wind as a vital part of the energy mix so long as turbines are not too large for their setting and in acceptable locations, assisted by the proper planning, consultation and decision making processes. Our overall policy will continue to be to oppose planning applications for wind turbines where they would cause unacceptable detriment to landscapes and properties the Trust values – but to support proposals where they are fully compatible with these interests.

Water power

- We operate seven hydropower sites, making use of existing infrastructure such as old mill sites with dams and leats to harness energy sustainably.
- We first harnessed hydropower at Aberdulais in 1991, followed by Houghton Mill, Gibson Mill, Llanerchaeron, Fountains Mill and Bonfield Gill.
- From a survey of our 52 historic waterpower sites in the late 1990s, we identified ten that we could bring back to life relatively easily.
- We're planning the restoration of historic hydro systems at Castle Drogo (Dartmoor), Quarry Bank Mill (Styal, Cheshire), Dyffryn Mymbyr (Snowdonia) and Hafod y Llan (Snowdonia).
- We're currently investigating the potential for new 'greenfield' hydropower sites on Dartmoor, in Snowdonia and in Cumbria.
- We design our hydro schemes so that they enhance the water environment, in keeping with our commitment to looking after special places.

Case study
Bonfield Gill Farm

Our upland farm at Bonfield Gill, Bransdale in the North Yorkshire Moors National Park, uses an Archimedes screw to generate electricity from water power. The technology can be dated back to the ancient Greeks and was originally invented to lift water.

In this small hydro scheme, the screw pipe is fed with stream water from the top and the weight of the water falling down the pipe causes the screw to rotate. At the top of the screw shaft is a generator that makes electricity as it spins. The farmhouse does not have mains electricity, but the 1 kW generator running almost continuously gives enough electricity to keep a battery bank charged, so the farm is able to turn off its diesel generator, leading to substantial cost and pollution savings.

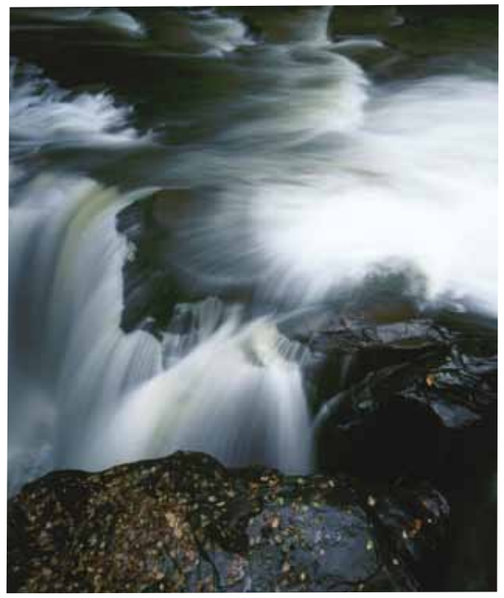
Case study
Aberdulais Falls

Aberdulais Falls, one of the most important industrial heritage sites in Wales, is tucked away in the picturesque Neath Valley. Until the 20th century the waterfalls provided the energy for the copper, milling and tin plate industry in the area for more than 400 years.

We restored the water wheel in 1991 and it's now the largest wheel in Europe used to generate electricity (50 kW). We also installed a higher output (235 kW) modern turbine to produce all the power needed by the visitor centre and associated buildings. The excess is sold to the national grid.

Property Manager Siân Jones says:

'A visit to Aberdulais Falls shows people how we can use the past as inspiration to meet the challenge of finding clean sustainable ways of creating and using energy. As well as learning about the fascinating industrial history of the site, visitors to Aberdulais Falls can experience renewable energy in action.'



Growing our own heat

In rural areas, where many of our properties are located, millions of people are dependent on oil for their heating and hot water as there is no mains gas grid. More than a third (36%) of all rural households have no mains gas and rely on more expensive heating oil, LPG and coal to heat their homes.[3] Consequently, just over a fifth (21.3%) of rural households suffer from 'fuel poverty' (because more than 10% of household income is spent on fuel).[4] In Cornwall as many as a half of all households are off the gas grid and a quarter suffer from fuel poverty.

Switching from oil to renewable heat makes sense as supplies dwindle and the financial and environmental costs of oil increase. The average household uses much more energy for heating than for electricity.

There are many reliable renewable technologies available to provide heating and hot water to homes, offices and buildings across the country. These include solar thermal panels for hot water, heat pumps and wood fuel systems.

Making the switch

Finding alternatives to oil: We want to reduce our dependency on fossil fuels and make the switch away from oil to improve our energy security, reduce financial risks and remove a major cause of pollution. We've developed a fuel hierarchy to replace our dependency on oil:

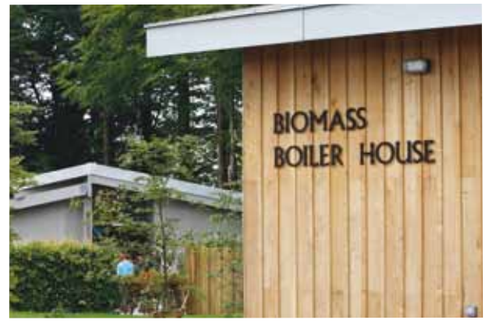
1. Solar thermal: Using solar thermal panels/tubes to heat water is very effective. Once installed it's passive and low maintenance – and it works all year round!

2. Wood: We can use wood to meet many of our energy needs. For example we use logs, from our own estates if possible, for our wood-burning stoves to heat rooms. We use high-quality woodchip for central heating on large sites where we can store it. For smaller boilers, especially in domestic settings, we use wood pellets – these need less space for bulk storage. We try to use only locally sourced wood and we're assessing all our wooded estates for the potential to sustain our woodfuel needs.

3. Heat pumps: We use both ground source and air source heat pumps on our sites, especially where we can install underfloor heating or radiant systems able to use the lower temperature outputs from heat pumps. These are highly effective, and a good way of using electricity for heat, especially when powered by renewable electricity. Water source (e.g. from a lake or river) heat pumps are also available.

4. Liquefied petroleum gas (LPG): Although a fossil fuel, LPG is cleaner to burn than oil, and with a much lower pollution risk, so it can be used as an interim step between oil and a fully renewable system.

[3] Centre for Sustainable Energy Report to Eaga Partnership Charitable Trust from July 2008
[4] BRE/English Housing Condition Survey 2006



Wood fuel

Woodland can be managed for wood fuel and harvested in rotation almost indefinitely, while providing a habitat for wildlife and beautiful places to explore and have fun. Using wood as a fuel allows us to continue the traditional management of woodland by coppicing and selective felling and also to make best use of land for intensive wood fuel production in plantations. The Trust has 25,000 ha of woodland, providing a huge potential for local supplies.

- We now have 44 biomass (wood chip/ wood pellet/log) boilers in our properties, with an installed capacity of 2.3 MW and producing approx 1500 MWh of heat per year, the latest being a 450 kW wood pellet boiler at Chirk Castle in North Wales.
- The Big Lottery Fund has financed 12 wood fuel projects on Trust properties worth nearly £0.5 million over the last two years.
- The award-winning 440 kW wood chip boiler recently installed at Castle Drogo on Dartmoor is expected to save £20,000 on previous oil heating costs and 325 tonnes of CO_2.
- We have plans to install more than 50 new wood fuel boilers over the next five years.
- Many of our cottages and farms use wood-burning stoves for domestic heating.

Case study
Carding Mill Valley, Shropshire

A new log-fired boiler in the Chalet Pavilion at Carding Mill Valley in Shropshire is expected to save £4,000 a year in oil fuel bills and reduce the carbon footprint of the mill by 20,000 kg per year. Funding for the project was received from the National Trust Green Energy Fund, in partnership with npower.

Carding Mill Valley is part of the Long Mynd at Church Stretton. Our Visitor Centre, café and wardens' base are now heated by a log-fired boiler instead of oil. The boiler will use 35 tonnes of logs a year from National Trust woodland at Wenlock Edge, a rare and special landscape stretching for 18 miles through Shropshire.

Kathryn Warren, National Trust Environmental Practices Adviser, says:

> 'Replacing oil with a log-fired boiler will provide the Chalet Pavilion with all its heating and hot water requirements and will promote better woodland management for the beautiful plants and animals of Wenlock Edge. The Centre also has a solar hot water system on the roof – and we're working on plans for hydroelectric power and rainwater harvesting.'

Case study
Sudbury Hall, Derbyshire

The installation of a new wood pellet fuelled heating system in Sudbury Hall – famous as the location for the BBC's adaptation of Pride and Prejudice – has cut the use of oil and carbon emissions dramatically.

Two new wood pellet boilers have been installed in the cellars of this spectacular 17th century mansion. The two 125 kW boilers replaced ageing, inefficient oil fuelled boilers and release around 90% less CO_2. Pellets were selected for this project instead of woodchip as storage space for fuel was very restricted. Elsewhere we are using woodchips from our own/local woodlands. Funding for the project was received from the Big Lottery Fund and from the National Trust Green Energy Fund, in partnership with npower. It will take fourteen years to pay back the £112,000 investment.

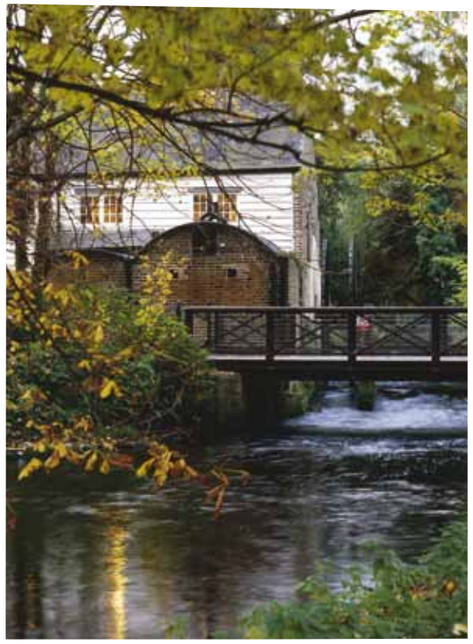
Lesley Law, Property Manager at Sudbury Hall, says:

> 'These new boilers have dramatically cut our CO_2 emissions, but also make us much more aware of the energy we're using every day, so we're looking for ways to further improve our energy efficiency. Having much less oil on site also means we've almost eliminated our oil storage risks.'

Heat pumps

Heat pumps are an effective way to use electricity to generate heat. In fact, they can use 1 kW of electricity to extract 4 kW of heat from the ground (or air). The technology works by extracting heat from the ground, from water or from the air to heat the inside of a property, using the same principle as used to keep fridges cool. Because the system requires minimal maintenance and is fully automatic, it's a simple alternative to oil, LPG or mains gas for central heating. Air source heat pumps, although not as efficient as ground source heat pumps, can still be very effective.

The National Trust has to date installed 11 ground source heat pumps, such as at Morden Hall in London and Brancaster in Norfolk, and 10 air source heat pumps such as at Trelissick in Cornwall and Erddig in Wales.



Case study
Morden Hall Park

At Morden Hall Park, 21st century low carbon technologies demonstrate how renewable energy can be applied to 19th century buildings.

Beneath the patch of grass at the tea rooms at Morden Hall Park in south-west London, visited by 110,000 people each summer, is a ground source heat extraction circuit. It feeds a heat pump supplying heat to radiators in the café and visitor areas. Funding for the project was received from the National Trust Green Energy Fund, in partnership with npower.

In the next few years, many changes will be taking place to make the Park even more sustainable. The next transformation will involve converting a nearby stable block into a sustainable living centre by winter 2011, which will provide members of the local community with advice on how to apply the National Trust's practical experience to their own homes. The centre will harness hydropower from a water turbine in the nearby River Wandle.

Alan Green, Gardener in Charge at Morden Hall, says:

> 'In addition to the ground source heat pump, we've fitted five 'sun pipes' in the building's ceiling, which 'capture' sunlight in the shallow translucent domes on the roof and 'pipe' it through mirrored tubes to the ceiling of the café. This gives us abundant natural daylight so we can switch off the electric lights.'

Case study
Mencap Walled Garden at Stackpole, near Pembroke

For the second time in its history, the Walled Garden on the National Trust's Stackpole Estate near Pembroke is at the forefront of technology when it comes to heating systems.

Back in the early 1800s, estate owner Baron Cawdor wanted to provide his family with exotic fruits and ornamental plants, so he constructed an underground boiler house and equipped it with coal-fired boilers with concealed flues and hot water pipes. These heated the four warmed forcing pits where the fruits and plants were grown.

The garden is used today by the local Mencap organisation to provide work experience and skills development for people with learning difficulties. The food grown by students is sold through the estate shop and restaurant. We've removed the coal system and visitors to the garden can see the new highly efficient air source heat pump in the greenhouses.

Mencap Gardens Manager, Rob Deakin, says:

> 'The system works like a fridge but in reverse, and will deliver significant pollution prevention and carbon savings as it allows us to produce heat without burning large quantities of diesel. It's great to think that history is repeating itself and that nearly 200 years after Baron Cawdor's innovations, we've again been able to introduce the latest technology to this remarkable place.'

Conclusion

Our target to halve the amount of fossil fuel we use during the next decade is based on us becoming much more energy efficient in our operations, and dramatically increasing the energy we generate from our own renewable sources. We're committed to doing this for good business reasons: reducing our dependence on fossil fuels makes us a more resilient organisation, better able to meet the challenges of the future.

Our starting point is the need to be effective and responsible stewards of the energy that we use, as well as the need to ensure that we're investing our funds as sensibly as we can. While many of our properties can teach us vital lessons from the past, we're keeping a close eye on modern technology as it develops. Increasingly, investing in renewable energy makes sound financial sense, as well as enhancing our self-reliance.

The examples in this report give an idea of what can be achieved as we learn to move to a low fossil carbon future. Hopefully our experience will help convince others of the benefits of moving towards renewable sources of energy. In particular we want to highlight the opportunities for those living in rural areas, who may not be connected to the mains gas grid, to find ways other than oil for meeting their energy needs.

We recognise that there is still much work to be done. The business case for investing in renewable energy systems is not always easily made, as a consequence of uncertainties in global energy supplies and the ever-changing offers of grants and subsidies. The announcement of the Government's Feed-in Tariffs in 2010 and the Renewable Heat Incentive in 2011 will need to strengthen the business case for investment if they're to be effective.

Looking longer term, of course, the case for switching to renewables, as well as for being more efficient in our overall use of energy, is obvious. It is part of our commitment to work with natural processes wherever possible, and to minimise the damage to the special places that we look after.

The next ten years will be exciting for us as we slash our dependency on fossil fuels. We will continue to share our achievements and solutions as we move towards our target.

Photo: www.alastairheseltine.com

Our nation is gifted with abundant natural energy from the sun, earth, sea, wind, rivers and woodland. We need to utilise this as best we can, so that we can reduce our dependence on increasingly scarce and expensive fossil fuels and realise a low carbon future.

This report sets out the National Trust's ambition for harnessing renewable resources in a sustainable way and in harmony with our precious natural and historic environment. We aim to 'get off oil' and become more self-reliant on our own sources of renewable energy. We hope that our experience will help inspire others to make changes in the way they think about energy, and the way they use it.

We would welcome your feedback – please contact us using the details below.

If you require this information in alternative formats, please telephone 020 7799 4541 or email externalaffairs@nationaltrust.org.uk

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