

# Dartington

## Biomass & Solar PV

Like many owners of large historic estates, the Dartington Hall Trust is continually looking to balance its financial position and the significant costs associated with maintaining such complex and challenging buildings and infrastructure. As a diverse and responsible local enterprise the Trust also set itself the ambitious target of reducing its reliance on fossil fuel energy with a proposed 50% reduction in carbon usage by 2015.

The estate benefits from infrastructure installed in the early part of the C20th that provides amongst other things; a single point of supply and estate distribution for its electricity; a private water network serving not only the core estate but private properties off the estate; and numerous oil fed boiler houses serving the individual groups of buildings. Such infrastructure brings significant management responsibilities and maintenance costs and an over reliance on fossil fuel.

At the current time the Trust spends in the region of £1.5 million annually maintaining the buildings and infrastructure on the estate, excluding the grounds and gardens.

Before the installation of the solar PV and the 2 biomass wood boilers the estate consumes in the region of £600,000 per annum of electricity and heating oil, in the process generating 1,850 tonnes of carbon dioxide.

The Trust has implemented a number of initiatives to reduce its energy demands further, including voltage regulation, low energy electrical systems, insulation upgrades and building management technologies. Given the nature of the estate, with many historic listed buildings, the ability to implement more radical energy savings solutions involving alterations to the fabric of the buildings is limited (and often expensive) without detriment to the character or appearance of the buildings and their setting.

The alternative to saving energy is to generate it in a more sustainable way. Small scale roof mounted solar PV (5kW) on a former Craft Education Building at the Schumacher College campus and a small hydro-generation scheme at the Old Mill were the only alternative energy producing sources on the estate before the installation of the solar PV and Biomass.

During 2015 the Trust invest a further £1 million in providing alternative energy generation during to address the above issues, utilising the current Feed in Tariff and Renewable Heat Incentive grants to help offset the initial capital outlay.

By introducing a 950kW biomass woodchip boiler system for the Courtyard, and a ground mounted 500kW solar PV array for the estate as a whole, it was estimated that £165,000 of savings will be generated in year 1, with a total cumulative income of almost £4 million over the twenty year life of the projects. This will see a return on the Trusts capital investment within 5 to 6 years, as well as a reduction in carbon emissions of 735 tonnes per annum or 40% of the current total.

The financial savings are significant and can be seen to account for almost 30% of current annual expenditure on energy costs. Not only will these technologies shield the Trust from rising energy prices, they will provide an important and significant source of financial reinvestment into the fabric of the estate and further energy saving measures.

## **1) Courtyard Biomass heating system**

The core estate is not connected to mains gas, and its older buildings rely upon oil as the main source of heating and hot water. The estate has a number of large oil fired boiler rooms serving individual groups of buildings that between them use upwards of £350,000 of oil per annum.

Of all the sites the Grade I Listed medieval Courtyard, being the oldest and largest complex, uses around 50% of that oil, which can equate to 8,000 litres of oil every week in the depths of winter. The Trust has for many years explored all possible alternatives, from mains gas through to combined heat and power district heating and energy systems. However, the most cost effective and carbon reducing option in these circumstances is to install a biomass woodchip boiler, with the potential for further dedicated boilers for each of the other main building groups. The Courtyard biomass is a 950KW boiler and wood chip store that utilises the existing former farm buildings.

This location enables the system to be a visible indication to all those visiting the estate of the work the Trust is undertaking to improve its sustainability credentials. Furthermore, with the innovative work taking place with the Forestry Commission on wood chip and proposed agroforestry trials on the estate, the opportunity may arise at a future date to form an onsite wood chip supply operation to capitalise on the estates wood fuel stocks.

## **2) Estate wide Solar PV electrical generation system**

The Trust is in an enviable position of having its own High Voltage electrical distribution network serving the core of the estate (Courtyard, Aller Park, Higher Close, Lower Close, Old Postern, Foxhole, Old Parsonage Farm and some of the shops). This means that the Trust purchases its electricity for the main estate through a single meter point and then distributes it on its own network around the estate.

The total energy used on the core estate is in the region of 1.5MW of power per annum, which equates to approximately £140,000 per annum in costs.

A review of the electricity demands demonstrated that solar PV could provide almost one third of this energy usage with 500kWp of panels, with 80% of the generated energy able to be used on the estate. Requiring a space of 3,300sqm, roof mounted options are unavailable due to either the impact on the historic buildings, poor orientation or roof loading impacts.

However, the Trust identified through its land use review a suitable field based location adjoining the estates private water reservoirs and the main electricity sub station serving the entire estate. This connects into the estates own HV distribution network and enable the most efficient use of the electricity generated on the estate. Being less than 2 hectares in size, this ground mounted array is all but hidden from local and wider views whilst providing energy for the estates use.

At the same time, the Trust are keen to explore in more detail the benefits of farming and conservation on such ground mounted arrays, something which doesn't seem to happen with the large solar farms.