GREENHOUSE INFORMATION SHEET

SOLAR ELECTRICITY

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WHY PHOTOVOLTAICS (PV)?

Climate change is now the greatest challenge facing humanity today. During the coming decades, we must significantly reduce the energy we waste and the CO_2 generated. Historically electricity and space heating have been provided by burning fossil and non-renewable sources (oil, coal, gas and uranium), these all generate carbon dioxide (CO_2) emissions - the main cause of climate change.

"We have to figure out how to live without fossil fuels some day anyhow – so why not sooner?"
Climate Scientist Professor James Hansen of NASA

Photo via http://www.sustainablemilton.org.

ENVIRONMENTAL (CO_2) SAVINGS

A typical home solar PV system could save over a tonne of CO_2 per year.

HOW IT WORKS

The sun's energy hits the solar photovoltaics (PV) and is converted into electricity. They don't need direct sunlight to work and can still produce some electricity on cloudy days. An inverter close to the solar panels converts the electricity for use in the building. When the solar energy system produces more electricity than is needed it is exported to the grid. When there is no day/sunlight, electricity is imported from the national grid in the conventional way.

Kilowatt hour (kWh):
1 kWh is the same as 1 unit on your electricity bill, and is enough power to light a 100W light bulb for 10 hours (or 50 hours for a typical 20W low-energy light bulb)

Kilowatt peak (kWp):
The power of a PV cell is measured in kilowatts peak (kWp). That's the rate at which it generates energy at peak performance in full direct sunlight during the summer.

PV SOLAR ELECTRICITY

The typical system size usually installed on a domestic property is 3.5-kilowatt peak (kWp). In the UK, a 3.5 kWp system is expected to produce about 3000 kWh - every year. The average household in the UK currently uses approximately 4,000 kWh every year.

The price for PV is determined by numerous factors such as the type panel used, the location of the array and the positioning. To make full use of the solar panels they should ideally be south facing and tilted at an angle of 30 degrees to the horizontal. To generate more energy in the winter a more upright angle is required (the sun is lower during the winter months).

THE GREENHOUSE HAS TWO SOLAR ELECTRICITY (PV) INSTALLATIONS

The small PV array on the front was installed in September 1999, as a test case of planning rules which restrict the ability of listed buildings to be sustainable.

The PV panels over the garden were installed in 2006 with a maximum capacity of approx 2.0kWp. The location of the panels was designed to publicly demonstrate the technology. They can be easily viewed whilst enjoying a coffee and cake in the Greenhouse garden and the benefits discussed by visitors.

THE PV SYSTEMS AT THE GREENHOUSE

The building has a long history of establishing precedents for installing renewable technology on a historic building (the Greenhouse is a listed II* building). In 2006 the Greenhouse became the first building in Norwich to install glass PV laminates over its Café courtyard garden. Hundreds of local people contributed to a fund to raise the £21,000 needed to deliver the original PV project. In 2006, the Trust was keen to support this particular PV technology, which at the time was very much in the research and development phase (the technology has moved on rapidly). Being part of the process of driving down PV technology costs was a key factor in the decision to install the glass laminates. Whilst the glass panels performed well for the first four years, the glass began to stress and crack, and it became clear that the glass laminates were unlikely to perform well for the projected 20+ years required to make such an investment economically and environmentally worthwhile.

REPLACEMENT OF GREENHOUSE GARDEN PV SYSTEM IN 2011

During 2010-11, the Trust negotiated with the manufacturers (Romag) and installers (Sundog) (with only a few days left before the Government cut the Feed-in-tariff rate), Sundog installed a replacement/upgraded PV array (2.10kWp). The Trust chose Good Energy as our energy supply company because they are fully engaged with the issues surrounding the Feed-in-tariff. Good Energy are at the forefront of bringing together the tens of thousands of families and businesses that seek to generate their own electricity and be part of the campaign to decentralise the UK's energy supply.

THE GREENHOUSE EXPORTS ELECTRICITY

On good sunny days the PVs provide sufficient electricity to run all the equipment in the Greenhouse when we are closed (Sundays and Mondays). During this time the building is running for free!

On average, the replacement PV system **generates 1800kWh per year** providing The Greenhouse with an **income of approximately £800** (Our feed-in-tariff rate is 45p per kWh). In addition, we make **significant savings on our electricity bill. There is also a wider benefit in the reduction of energy wasted during transmission from the grid.**

For more information about the Feed-in-tariff see our Feed-in-tariff brochure.

THE SITE LIMITATIONS OF THE GREENHOUSE SYSTEM

The Sun's apparent height in the sky changes from winter to summer. The PV panels at the back (north side) of the building highlight the issue of shading and shadowing which particularly in winter impacts on the amount of electricity generated.

PLANNING ISSUES

It is estimated that up to 50% of the properties in Norwich/Norfolk, along with the rest of the UK, could benefit from solar technology.

With 27% of current energy use being generated by household heating, lighting and appliance use it is important to challenge the myth that current building conservation policies will protect our heritage.

Tackling the high waste of energy in old buildings is one of the more pressing tasks if any meaningful CO_2 reduction is to be achieved.

Not only does solar and other forms or renewable energy actively enhance the cultural and social value of historic properties, the additional energy saved by not transmitting energy across the national grid would significantly reduce the burning of fossil fuels.

Whilst the refurbishment of industrial and pre-industrial architecture has it's own specific design challenges, generating a design aesthetic that communicates and engages the inhabitants of old buildings with the waste and misuse of energy is vital to human survival.

CURRENT UK PLANNING GUIDANCE

In England, Wales and Scotland, for most home solar electricity systems, you don't need planning permission, as long as they're below a certain size - but you should check with your local planning officer, especially if your home is a listed building, or in a conservation area or World Heritage Site.
Solar PV (roof mounted) are permitted unless;

- Panels when installed protrude more then 200mm
- They would be placed on the principal elevation facing onto or visible from the highway in buildings in Conservation Areas and World Heritage Sites.

National planning legislation is weak, and it is likely that you will need the support of your elected councillors to install PV technology and micro-renewables anywhere other than locations hidden from view. However, the PV panels on the front of the Greenhouse (The Greenhouse is a II* listed building) demonstrate that elected council members can counter the inertia of the planning system and hostility of the local planning/conservation officers.

Before considering PV technology it is important to maximise the energy efficiency standard of your building as much as possible. All grant schemes require you to demonstrate that you have done this before applying.

SOLAR CHECKLIST

- Insulated the whole of the loft of the property to meet current building regulations e.g. loft insulation
- Installed cavity wall insulation (if applicable)
- Fitted low energy light bulbs in all light fittings
- Installed basic controls for your heating system to include a room thermostat and clock/timer
- Installed all practical energy saving measures to electrical equipment in the house
- Studied a whole year's bill to see how much energy you use and see how much you can save
- Worked out how much electricity you use and calculated the area of PV technology you require
- Take photos, or draw diagrams of your roof to check you have enough roof space and to check that the roof is not affected by shade at any time of day
- Take photos, or draw diagrams demonstrating the roof is capable of taking the weight of the panels

OFF GRID

PV can be used to generate 'off grid' (not part of any electricity transmission network). However, 'off grid' generation requires the use of batteries (to store the electricity), which is less efficient, and the materials used in the construction of batteries raise separate environmental issues. Generally this isn't a sensible option for urban living.

USEFUL CONTACTS

Solar Trade Association - www.solar-trade.org.uk/faqs.cfm

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100% RENEWABLE ELECTRICITY

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