

The Integration of Solar Technologies within the UK

Ian T Clarke and David W Adamson

University of Sheffield, Sheffield, England
University of Central Lancashire, Preston, England

ABSTRACT: This paper will explore the extent of solar renewable systems in the UK, its popularity, usage and economic viability. It will show the beginnings of a heightened visibility, particularly at the consumer level in domestic D-I-Y opportunities.

Solar thermal and Photovoltaic cells are the current two main solar renewable technologies used today within the UK.

Solar thermal systems have been available in the UK since the 1970's but relatively few homes are currently heated by this technology. This is because even during summer months insufficient heat gains are achievable to provide enough warm water for a typical house.

Photovoltaics are doing better as shortages in electricity generation can be made up by being connected to the national grid. A number of projects around the UK use Photovoltaic systems to help power buildings but the most visible use of the technology is powering small instruments such as gas metering equipment. This has become favourable as the installation costs are cheaper than laying cables in many areas of the UK (including built up areas).

The paper will show that there is increasing visibility of solar power in every day life. It will evidence that solar is starting to become an easily purchased public commodity with solar thermal panels available from national Do-it-Yourself stores and other retail outlets. Solar power does, however still require UK Government help (as in the form of the Low Carbon Buildings Programme) to become fully integrated as a source of energy in the U.K.

Keywords: Solar energy, Renewables, UK

1. INTRODUCTION

To understand the use of solar energy systems in the UK it is important to understand the advantages and difficulties of using such heat sources; as well as the political and social views of the systems.

2. ADVANTAGES TO USING SOLAR SYSTEMS IN THE UK

The advantages of using solar power in the UK are the same as they would be anywhere in the world. It is electricity or heat from a free source produced with out any emissions.

Because systems using solar power can be built to stand alone from power supplies, solar systems are therefore very beneficial in

both remote locations and crowded urban environments, which are both present in the UK.

3. DISADVANTAGES TO USING SOLAR SYSTEMS IN THE UK

Since the UK Climate is highly varied, large amounts of consistent sunlight cannot be relied on. This results in solar systems being dismissed very quickly on the basis of unreliability.

To deal with this problem backing up the solar systems with additional storage capacity or traditional energy sources is common practice, allowing solar systems to be a real alternative for primary energy production.

4. THE TECHNOLOGIES USED IN THE UK

The two types of solar energy systems used in the UK are Solar thermal and Photovoltaic, which provide heat and electrical energy respectively. Solar thermal works by heating a fluid with sunlight, then using this fluid to heat water for a distribution system. Photovoltaic systems convert solar radiation into electricity by using two dissimilar semiconductors to create a positive negative junction, which creates a flow of electrons when light falls on it¹.

4.1 PHOTOVOLTAICS

The use of photovoltaics in the UK has increased massively since 1998 driven by the UK Government's commitment to reduce carbon emissions (see section 5).

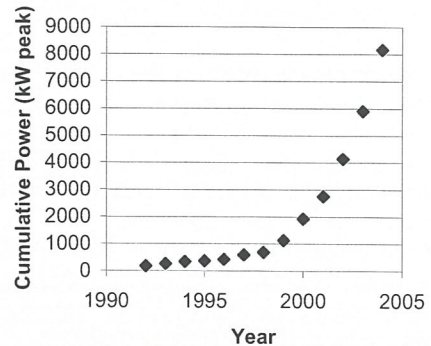


Figure 1: Cumulative Levels of Photovoltaic Installations in the UK Based on Dti Data from 1992-2004²

Photovoltaics are used in two main ways in the UK:

- To reduce or remove the need for electricity in a building which is connected to the national electric grid. (A grid system)
- To provide electricity to a system that is not connected to the national grid. (A stand alone system)

The use of photovoltaics on buildings in the form of grid systems and stand alone systems has been fairly constant throughout their development in the UK. There are numerous examples of domestic installations as well as high profile buildings such as the Doxford office building near Sunderland in the North East of England.

The rule of thumb for the cost of these types of building mounted systems in the UK is given as being between £4000 and £9000 per kWp installed³, with average properties needing 2 to 2.5 kWp of generation capacity. This means for an

average house a photovoltaic system would ~£13000, not a cheap exercise.

In recent years however the use of smaller off grid systems using panels of $\leq 1\text{m}^2$ has been increasing. This has been caused by the cost of producing and installing photovoltaic systems reaching a point where they are more economical option in remote locations than laying power cables. Quite the opposite to the expense of building mounted systems.

A particularly good example of the implementation of this technology is the use of solar power road monitoring equipment, which is now being used on the UK road network. This includes places where you would expect it to be cheaper to lay power cable, such as just out side urban areas.

This roadside application of the technology on motorways such as the M6 and M62, where the systems are installed at fairly regular intervals, makes photovoltaics highly visible across the length and breadth of the country.



Figure 2: A traffic monitoring unit near Warrington in the North West of England

4.2 SOLAR THERMAL

There are two main types of solar thermal systems, flat plate and evacuated tubes:

Flat plate heaters consist of a length of pipe work attached to a panel, which is solar

absorbent (e.g. a sheet of metal painted black as a simple example);

Evacuated tubes are two glass tubes; one inside the other with the air in space between them removed to create a vacuum and the inner tube is coated in a solar absorbent coating⁴. The inner tube absorbs heat from the sun to warm the fluid inside it and the vacuum between the tubes provides a highly insulated layer (such as in a thermos flask) to stop heat being lost.

Both systems transfer the heat they collect to a water storage tank, which feeds a heat distribution system (such as the existing central heating system in a house).

There are estimated to be over 70 thousand solar thermal systems in the UK with about 5 thousand new units being installed each year⁵.

The major problem with the technology is that it does not provide 100% of typical families hot water needs, even during summer. This was shown specifically by a 'side by side' trial of different solar thermal systems carried out for the Department of Trade and Industry (Dti.) in 2001.

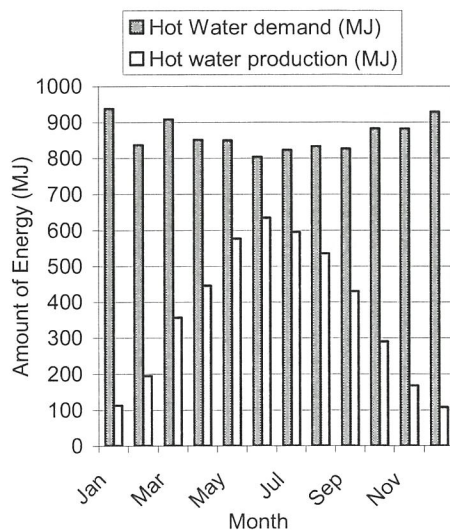


Figure 3: Graph of Estimated Solar Thermal System out puts against demand based on data taken from ETSU S/P3/00275/REP/2⁶

The energy it provides does reduce the need for conventional energy use, however because it needs electricity to run; the overall result on reducing the energy use of the building is not large.

Solar thermal is much cheaper than a photovoltaic system to install in the UK. Systems cost between £3000 and £4500⁷ depending on the type of system and difficulty of installation. This makes it an attractive way to add to an alternative energy project, or be a first step for anybody wishing to experiment with renewable technology, since it is generally the cheapest renewable technology around.

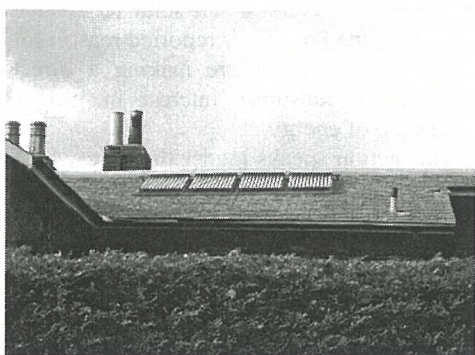


Figure 4: Solar Thermal panels on the roof of the Queen's head pub in Amotherby (a village in North East of England)

5. THE CHANGE IN POLITICAL OPINION TOWARDS GLOBAL WARMING

Global warming as a theory has been in the scientific and public domain for many decades now and the Kyoto Protocol of 1997 along with the self set targets for the UK means it has been firmly in the political sphere for a good period of time.

The UK Government says that it is on track to meet its Kyoto Targets though it appears that its own targets may not be reached. This shows that action has been

taken but only recently has it been publicised.

This year saw the first "Green" budget*. A sign that the Government feels it can take global warming to the core of British politics. The reason for this comes from two main points:

- The UK government through its chief scientific advisor Sir David King believes the evidence for global warming proves it to be a major problem⁸.
- The Stern Review⁹ carried out by the UK Treasury detailed the financial cost of global warming and showed it will be cheaper to act on the issue now, than to have to do so in the longer term.

6. THE GOVERNMENT'S APPROACH TO SOLAR SYSTEMS

The government mainly encourages the use of solar systems through an incentive and constraint programme for developing carbon saving technologies in the UK.

The incentive is in the form of Grants available through the Low Carbon Buildings Programme; which has different streams available to homes, businesses and public organisations. Photovoltaic systems are the most supported of these on a small scale, with £2000¹⁰ available per kW installed on private homes and they also benefit from the highest available grant of £2500.. Solar thermal is less supported with a maximum of £400 available for installations. The probable reason for these differences in available grants is the cost of the two systems and the amount of carbon saved by the technologies, since solar thermal needs electricity to run.

* In the UK the budget is the financial plan for the countries spending and taxation set out annually by the Chancellor of the Exchequer.

These Grants for household systems were launched in May 2007 as the second incarnation of the scheme under the Low Carbon Building Programme. This was due to the monthly limits of the first method running out within days in the first two months of 2007 and also because it was allocating large sums per month but not paying out due to projects running behind schedule.

The grant support for businesses follows a different format since there is greater diversity in the projects they can undertake and its object is to create exemplary schemes. As such there are two streams for different types of project with maximum grants of £100k for small changes to existing building and small new builds (<1000m²) and up to £1m for large projects, both grant types can only cover 40-50% of the project costs before VAT.

The other incentive method is to make it easier to install sustainable energy technologies by making planning permission easier to obtain, even going as far as to actively encourage the use of photovoltaics during the planning stage¹¹.

The constraints being used by the UK Government to bring in the use of renewable energy technologies is legislation. Part L of the UK Building Regulations is one of the best examples of this. It sets stringent targets on new buildings so that it must be as energy efficient as possible and include some form of fixed energy efficient technology¹², which includes solar systems.

7. THE SOCIAL VIEW OF SOLAR SYSTEMS

According to research done for the Dti. in 2003 into public attitudes and knowledge about renewable energy, Solar systems, hydroelectric and wind power are the most understood of the renewable technologies used in the UK¹³. Of these solar is the most approved of, (page 11) despite, out of the three (page 16), being the lowest

spontaneously mentioned method of electricity production. Further research conducted in 2006 again showed solar to be the most well known renewable technology with 90% of people asked knowing about it, with wind and Hydroelectric both having 82% of people knowing about them¹⁴.

This is only one way of looking at the image of solar in the UK however, media coverage can give a good idea of how a issue is viewed in a society and stories about solar systems are almost always positive, compared to wind power that has a more mixed reception.

Possibly the best measure of how solar energy is viewed in the UK is the fact that in 2006 Curry's and B & Q became the first mainstream retailers to sell solar renewable systems in the UK. Their reported reason for this was that they were making a direct response to consumer interest in micro-generation of energy.

This action speaks louder than the words of the reports or newspaper stories, because it highlights the increasing demand from the public for a mainstream supply of solar systems.

8. CONCLUSION

Solar systems are used all over the UK for a number of different applications, as has been shown by this paper. With increasing technological ability their range and scope of use will increase and solar systems will become yet more visible in the UK.

There has increased public awareness of solar technologies and their part to help against global warming. This is being driven forward by government investment and media coverage. These factors together mean that solar systems have enough support to become a strong part of the UK energy mix.

Their bright future is not yet here though, as the high cost of the systems means they are too expensive for most individuals. Therefore the funding provided through grants is very important in keeping

the technology financially viable to the public. This means government support of solar systems is still needed by the industry as it is not strong enough to support itself yet. However with solar systems now coming closer to being an of the shelf product the need for government support should drop as prices come down. So perhaps the point when solar technology will be fully integrated in the UK is with in sight.

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