The poor man of PV

Photovoltaics

Britain is lagging way behind most other parts of the world in solar PV development, production and installation. Can we rely on the government's current PV installation grant scheme to lead us to a brighter, more energy independent future or is the UK going to be left floundering in the dark beneath sunny skies?
Keith Howarth investigates ...

Under the DTI's £20million Photo-Voltaic (PV) MajorDemonstration Programme (MDP) announced in Nov 2001, government grants ranging from 40 – 65% are considered the critical tool for kick-starting mainstream consumer interest in - and uptake of - solar photo-voltaic technology in the UK. This three year programme aims to have 5,000 PV roofs installed on 3,000 homes and 140 medium/large non-domestic buildings by 2005, and a total of 9 MWp installed power.

The governments's stated rationale for the programme is:

- to boost the UK's renewable power base
- to help create a PV production base in the UK
- to create employment in this new sector.

All very laudable intentions. However, according to the following figures from the Energy Saving Trust (EST) website, there has been very limited uptake of the scheme to date:

- for small applications (0.5-5.0 kWp); grants have been offered for 203 projects of which 87 installations have been completed, – with cumulative installed power of 410 kWp.
- for medium / large applications (5 kWp upwards); grants have been offered for 45 projects worth £5.6m[1], ranging in size from the 5.02 kWp installation for St. George's VA School Eco-Centre, to the 280 kWp new Cambridge University Science Centre colonnade.[2]
- total installed power of approximately 1 MWp for the whole scheme so far.[3]

As can be seen from the above figures, the DTI is a long way from achieving its targets, which now appear to be little more than optimistic projections.

So why the apparent lacklustre interest in PVs here in the UK and this scheme in particular?

What makes PVs unattractive to the UK public, whilst they are so

popular in many other parts of the world, from Japan to Mongolia, and Germany to California? In these countries photo-voltaics industries are enjoying boom conditions.

Well, it seems that it is more than simply the amount of grey clouds in our skies that are getting in the way of a sunny future for PVs in Britain. It seems to be a complex combination of diverse factors, which in the final analysis can probably be boiled down to one word - Culture.

Economics does of course play a major part in the equation. Many British consumers have blindly accepted the philosophy of the market economics, where cheapest possible provision of goods and services, combined with maximum consumer convenience, rule their decisions. Instant gratification and ease have become the order of the day, with almost total disregard for any other considerations, such as environmental accountability or sustainability for the future, - at least in terms of their decisions and actions. This particular brand of popular mass culture, reinforced by a political culture of conservatism and inertia dedicated to the status quo, is the major stumbling block to uptake of renewable energy technologies, such as PVs. Half-hearted government support for renewables, such as the current PV grant programme which is unlikely to appeal to the average UK consumer, is hardly likely to result in a transformation of our energy base needed for a sustainable future.

Which leads me to the first point regarding PVs here in the UK.

They are just too expensive for the market, especially when installed in compliance with the requirements and regulations of the current PV grant scheme.

To be eligible for grant funding the installation must:

- be grid connected (Kyoto CO_2 accounting?), a condition which - due to the necessity for dedicated and approved full sine-wave inverters and line controllers - escalates the base unit cost (at the time of writing there are only two DTI-approved manufacturers of these components)
- be installed by an approved installer, of which - due to lack of suitable UK-based training for PV installation technicians, even as add-on units for general electrical fitter training - there are very few.

The net effect of the above requirements, is that of making the domestic PV grant applicant subject to a virtual cartel, and consequently inflated total installed system costs averaging £7,000 per kWp[4], regardless of the 50% grant.

Regardless of the 50% grant, this figure looks very high when compared with system costs in the 2-3 kWp range in Germany of £4,700 per kWp, and in the USA of £3,600 per kWp (year 2000 figures), and may well explain some of the aversion of UK investors who otherwise may have been drawn towards the small scale domestic PV part of the grant scheme.

The picture is not quite so gloomy for the medium / large public installations. These applications receive a higher grant payment of 65% of installed cost and there are the obvious benefits of economies of scale.

Though installed costs vary considerably, it is apparent that the larger the installation, the lower the system cost. For instance the smaller 6 kWp system at Cardiff Bay Development's Techniquest Science Discovery Centre is budgeted at £12,800 per kWp, as against the larger 67.7 kWp system at Woking B.C.'s Priorcroft sheltered housing development at £4,380 per kWp[5] (see photos page 10).

However, base installed system cost is just the beginning of the story. Investors and lenders expect to see a decent financial return from their investment, and solar PV is seen as an investment in financial, as well as Renewable Obligations (RO) terms. In the case of investment in energy producing equipment, such as PV systems, this return is of course achieved by way of the price paid/saved for the energy produced.

Currently the price paid by the utilities for PV generated electricity entering the grid is just 6.25p kWh. A simple calculation taking averages of 800 kWh energy output per annum per kWp installed, and £3,500 per kWp unit installed cost (after receipt of the installation grant), it is apparent - given a return from energy produced for the grid of £50 (800 kWp x 6.5p) per annum per kWp installed - that it will (in financial terms), take 70 years to recover the initial installation costs[6] (interest payments and maintenance costs excluded. This is an excessively long pay-back projection.

Considering that most PV arrays

So what's happening elsewhere?

To encourage a move away from heavily subsidised nuclear generation and its potential health risks, many countries have introduced extensive financial packages in support of carbon-neutral energy production and efficiency measures. These vary considerably from region to region, state to state, and country to country and cover a range of direct capital installation grants; guaranteed low cost loans; premium renewable energy payments; and tax breaks; subsidies, grants and license agreements for manufacturers of PV equipment - particularly in support of R&D and production of solar PV cells and arrays.

Europe

Across Europe subsidy and support for PVs is widespread, with government intentions clearer than in the UK. For instance Italy has its own 10,000 roof programme and Spain a 25p per kWh PV energy tariff scheme. However as far as Europe is concerned, Germany is the outstanding success story. The German government started its own PV programme way back in 1988, and has achieved a cumulative installed grid-connected power of 100 MWp and 14 MWp of off-grid power by 2000. For the current 5 year period (1999-2003) Phase IV, the *100,000 Roofs Solar Power Programme*, granted power amounting to 300 MWp.

This programme, supported by low interest loans (1.9%) and a guaranteed buy-back tariff of equivalent to 36p per kWh, provided for by the Renewable Energy Law established on 1 April 2000[7], is a far cry from the current UK scheme and its paltry 6.25 per kWh.. Regarding payback - from the above figure of about 36p per kWh, and taking a UK estimated mean of 800 kWh per annum - an annual return of £288 is achieved; this, on an initial PV system outlay of £4,700 per kWp installed, gives a pay-back, break-even period of 16.3 years, a somewhat more acceptable timescale than the 70 years for the UK, and incidentally one achieved without capital grants on system installation costs.

Research in Germany on regional tariff variation and experimental reductions has clearly indicated that premium tariff payments and subsequent short pay-back period play a fundamental role in ensuring continued growth of PV uptake there.[8] This, in combination with lower system prices goes some way to understanding the success of their 100,000 PV roofs programme which by 2005 will have achieved the installation of an estimated 140,000 roofs in Germany, a figure second only to that of Japan, which by the same date will have installed in excess of 370,000 PV roofs.

carry a 20 year guarantee, and have a life expectancy of about 25 years, it is obvious that the economics for PV in the UK do not currently add up, and create a very gloomy picture for would be investors and for the future of PV here.

So is cost the bottom line for PVs in the UK?

There is another, perhaps more fundamental factor, which I touched on briefly earlier - *culture*. How - in a country with one of the highest per capita incomes in Europe, and in fact in the world - can the problem of low take-up be attributed solely to high initial cost and long pay back period?

Whilst there may be a high degree of inequality between the haves and have-nots in 21st century Britain, there is nevertheless a mass of disposable income and readily accessible, and relatively cheap finance (though not at fixed rates as low as the German 1.9% PV loan rate) which the Brits are not averse to spending on luxury goods and services like cars and overseas holidays. As money spent on holidays and in restaurants is 'blown away' in a very brief moment, and cars depreciate at such alarming rates – up to 30% in the first year, and 80% in the first 5 years – it seems, in these instances, we're not particularly careful with our finances. However, foreign holidays and BMWs are different from PVs, they are bought for their own sake, and for people to feel that they are better than their neighbours in being able to show that they can afford them. A BMW is a status symbol, whereas the same cannot be said of a PV array, which except in very small circles, is likely to mark one out as a 'green nerdy type'. Unlike cars, green energy is not, definitely not, sexy, at least here in the UK.

European culture

So are there significant culture differences between the countries where PVs

are experiencing increased popularity and here in Britain?

Well it appears that there are. In Europe, the Germans have been in the forefront of green awareness and activity for many years, probably due to their proportional representational electoral system, and the fact that the German Green Party has held a much stronger position than its counterpart in the UK, and thus has been able to actively represent a sizeable percentage of the voting population. Consequently in Germany, if you've 'green' leanings you can make them count democratically, have a louder voice, are more acceptable and have more clout as a consumer on a whole range of issues, from packaging reduction and recycling at the supermarket checkout, to the silencing of light aircraft.

Germans are also disenchanted with nuclear power generation. This has already led to a search for, and adoption of alternative energy resources to replace both fossil fuel and nuclear generation plants, and of course, the early adoption of energy saving measures in industry, and the domestic environment through ecological building practices to reduce demand.

Additional to the basic political and cultural background in places such as Germany and Scandinavia - where hi-profile interest, and active participation in environmental issues is not just considered OK, but a citizen's right and duty - is the larger percentage of budget capacity available for renewables due to lower subsidy rates for nuclear energy production, and much lower percentage expenditure on the military than in the UK (also a feature common to Japan). Unfortunately, here in the UK, such participation in environmental issues is often judged and labelled as the NIMBY or crankish behaviour of a few bearded, sandal wearing, tree hugging eccentric lefties.

The UK government may consider that the current DTI Solar PV Grant Scheme

And the USA?

The USA has a long history in research and development, production and use of solar photo-voltaics - where they were developed as power sources for the NASA space programme, and have, since the late 1960's, been used as essential power sources for military and civil satellites. Indeed, PVs have been, and still remain to be seen as one of the 'sunshine industries. Until recently (unlike Europe) most consumer solar PV in the States has been applied to stand alone systems. The large landmass and off-grid isolation of many remote 'backwoods' lots, farmsteads and lodges; the huge market for outdoor leisure, mobile homes and yachts; individualism and pioneering spirit; and the 'lifestyle' choices of the 'self-sufficiency', 'back to the land movement', have for decades combined with high solar input, relatively low costs and high disposable incomes to create a ready-made market for PVs.

Of late however; the exhaustion of US territorial-based oil supplies thought to be within the next 10 years; public and financial/underwriting industries' concerns about nuclear power; power supply shortfalls and failures; fears regarding continuity and security of Middle Eastern oil supply – viz the latest Iraq war; combined with rapidly escalating and inflated electricity prices, have ushered in a new era of investment in all areas of renewable energy across the states. Many individual states have introduced support schemes for consumers and producers. California introduced a state support and licensing deal to industry for the development, manufacture and installation of PV systems, and renewable energy supply contracts. With their hi-tech NASA associations and the autonomy and security of supply they provide, PVs are, to the gadget dependent American, beginning to be seen as an intelligent and trendy investment, whether in stand alone or grid connected form.

Major failures in electricity supply in California and Auckland, N.Z. must have had the effect of making the residents of the affected areas feel the real value of the service they would normally take for granted, and perhaps precipitate action towards measures such as PV installation. In the states it's happening because it makes sense, and fulfils a perceived need.

America, for all its bad points, boasts a massive and thriving sub-culture of community spirit, self sufficiency and determination. This is witnessed in the popularity of magazines such as Homepower, Mother Earth and others.

to be a Major Demonstration Programme. However, £20m. over 3 years is barely chicken feed compared with the investment in PVs by other comparable industrialised nations. The recent £461 million bailout of Nuclear Energy, and the £2 billion modernisation programme of the Aldermaston Atomic Weapons Research facility show where our government's priorities remain.

As Britain seems to be at least 15 years behind Germany in terms of PV installation, and has little indigenous PV industry, it is hard to believe that such a watery commitment as this programme is going to adequately demonstrate Solar PV in the UK, let alone even begin to provide the education necessary to encourage the British public at large out of its current culture of passive energy consumption into one of active participation in PVs and renewables in general.

How much energy is needed from renewables?

80% of grid generated electricity is lost in transmission leaving only 20% of all production to actually power our homes and industries. Therefore, it is surely obvious that if the energy is produced at the point of consumption – as in the case of stand-alone PVs, (and other renewables, such as: hydro, wind, tide, biomass) – then overall, only 20% of the current production capacity will be required - a 5:1 advantage over grid supply. When employing CHP/Heat Recovery/ Heat Pump technology the efficiency rates and advantages just escalate. The implications of this one simple point are so immense that it is vital that we ask why this option has so far received so little attention.

Additionally, it is a proven fact that it is easier and more cost effective to reduce energy demand, by means of energy saving measures at the user end of the chain, than it is to just try and create more power. This magazine regularly reports on new developments in the energy-efficient buildings, including super-insulated houses, which do not require heating systems. The adoption of readily available, high-efficiency domestic appliances and industrial machinery would reduce demand still further, with guaranteed immediate CO_2 emission reducing effects.

Stand-alone systems do have their limitations, particularly their need for energy storage capacity - for the times when there is no sun shining, wind blowing or water flowing - usually in the form of batteries. Batteries are bulky and expensive pieces of hardware, but - even though technology is advancing, with batteries getting smaller and more efficient, and with the introduction of renewably produced hydrogen, and its use in fuel cells (Woking again, see caption below)

The UK is not without its exceptions. The Brockhill project in Woking is a world class PV demonstration project and there are a number of others. Perhaps we have already proven the point and we should now be moving on from demonstration project funding to real mass market funding (see Building For a Future Vol.11 No.4 page 12).

- this need not necessarily be a bad thing. It has the effect of placing physical and economic constraints on demand, and placing the bulk of energy responsibility and action on the consumer. A stand-alone system is self limiting; use too much and the lights go out until the storage medium is replenished again by the sun's rays, the wind, water or biomass fuel.

Schumacher said 'small Is beautiful'

It will require mass change to individual, personal responsibility and direct action, to transform from the huge, corporate controlled, centralised, grid-connected, fossil-fuelled and nuclear-powered generating model, to a sustainable future of multiple, small-scale, clean, point of use renewable-energy production. How this change will be brought about is uncertain, though I for one do not see it being the result of present government initiatives.

In Britain, we have apparently forgotten the inconvenience caused by the blackouts of the 1973 Suez crisis and the miners' strikes in the 80s. We have become complacent in our expectation of supply continuity and security, almost invisible in-house delivery and low electricity prices - provided by heavily subsidised nuclear, and ecologically unsound fossil fuel power stations. We bury our heads in the sand and carry on having a good time, whilst waiting for the next nuclear disaster, the wonderful technological fix to safely sort out hundreds of thousands of tonnes of nuclear waste, and the effects of global climate change.

Is it not possible for Britain to learn from the plentiful experiences gained in alternative technologies in other parts of the world? Does our nationalistic ego always have to make us go back to basics and re-invent the wheel whenever it comes to applying something like photo-voltaics?

It could still be a sunny future for PVs in the UK , but it will need a major change of heart, culture and behaviour first.

Here's to the future.

Keith Howarth

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