NFU Briefing

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Solar photovoltaic electricity in agriculture – on your roofs and in your fields

Introduction

The NFU believes that its members are well-placed to capture renewable natural energy flows, while maintaining our traditional role in food production as well as the delivery of other environmental and land management services. It is the NFU's aspiration that every farmer and grower should have the opportunity to become a net exporter of low-carbon energy.

Solar photovoltaic (PV) power (generating electricity from sunlight) is one of a number of renewable energy technologies that have become commercially attractive in the agricultural sector, and is probably the fastest growing. Solar electricity has been supported since April 2010 under the Feed-in Tariffs scheme (at small scale), and more recently has also become viable under the Renewables Obligation (for large scale installations). Solar power is dropping rapidly in capital cost, and in some circumstances it may already offer a sound return on investment even in the absence of any renewable energy incentives.

According to the government, solar PV is one of eight key renewable energy technologies most likely to build a low-carbon economy in the UK. It is highly versatile and scaleable, with deployment possible in a wide range of locations: on both domestic and commercial buildings (including on farm buildings) as well as in ground-mounted "solar farms". Britain has already seen a significant amount of solar PV deployment over the past three years (nearly 3 gigawatts by the end of 2013), with installation costs falling by around 50 per cent between 2010 and 2012.

The Department of Energy and Climate Change (DECC) is aiming for up to 20 GW of solar power by 2020 (supplying about 15% of green electricity needs), based upon expectations of a continued decline in the cost of PV systems and a continued roll-out of both roof-mounted and ground-mounted solar installations. Solar roofs and solar arrays are set to become a familiar part of the 21st-century landscape in both urban and rural areas, making a growing contribution to energy security and national renewable energy targets.

Solar energy and farming

Solar power (often referred to as photovoltaics or solar PV – as opposed to solar energy for water and space heating, which uses different technology) involves the capture of light energy from the sun to produce an electric current. It is one of many land-based renewable energy resources available to agriculture, for self-supply and for export of energy services to others – alongside a wide range of bioenergy technologies (biogas, energy crops, etc.), wind power, small hydropower, ground source heat, etc. The NFU is technology-neutral with respect to choosing renewable energy options. We strongly endorse land-based renewable energy which supports profitable agriculture under the current market conditions and policy framework - for example, where farmers own their own renewable energy assets or otherwise benefit from harnessing renewable natural energy resources.

Growers and processors of food worldwide have a long history of using the sun's energy for growing and drying of crops, and solar PV adds a new twist to our relationship with the sun. PV panels or modules are long-lived (up to 40-50 years) and require very little maintenance since they have no moving parts. With its relatively modest visual impact, solar PV is regarded by many experts as one of the most environmentally-benign renewable energy technologies.

Solar electricity generation in the agriculture sector can take a number of different forms, and a wide range of products and financial packages is available - from leasing of roof space or field space, to joint ventures, to simple supply-and-install services. Despite the gradual reduction in the level of support under both the Feed-In Tariffs and Renewables Obligation schemes, solar PV continues to offer a typical return on investment of around 10% to farmers. As foreseen by the NFU just a few years ago, three main kinds of PV systems are popular, requiring different levels of investment and development consent:

- PV panels mounted on top of existing roofs, or integrated into new roofs and buildings
- Ground-mounted panels deployed on unplanted areas, e.g. around field margins
- Large arrays of panels deployed across entire fields

Costs have fallen from £2-3000 per kilowatt of installed capacity just a few years ago, to around £1000/kW today. Examples of popular sizes of installation are 50 kW of roof-mounted panels, which typically cost around £45-60,000; and 500 kW of ground-mounted solar modules, which fall in the range £400-500,000. Any necessary upgrades to electricity transformers and grid connections may add another 5-20% to these costs. Solar power is already one of the easiest renewable energy options to finance, regarded as fairly low-risk by banks and accessible to secured-loan borrowing.

Solar PV is a rapidly-developing technology which is expected to fall further in cost, becoming competitive (without subsidy) with retail electricity from the local grid within a few years, and one of the cheapest sources of wholesale electricity in the next decade. By 2014-15, the availability of on-site electricity storage and power management, using ultra-capacitors and modular battery banks, is likely to further increase its flexibility in meeting on-site power needs and utilising constrained grid connections.

Solar PV on farm buildings

Agricultural and horticultural buildings present ideal platforms for solar photovoltaics, and small-to-medium sized roof-mounted systems continue to offer a very sensible investment, with at least 10% simple return on capital achievable (and higher returns where a significant amount of electricity is used on site). More southerly parts of the country offer the best energy and economic returns, especially near the coast, but PV roof projects are successful throughout the length and breadth of Britain.

As expected, the majority of agricultural PV developments are on buildings with roofs facing south-east to south-west. Suitable agricultural buildings include barns, machinery sheds, grain and vegetable stores, livestock sheds, dairy parlours, etc. – with the greatest business opportunities on buildings that use significant electricity on site, such as intensive pig and poultry sheds, vegetable pack-houses, chilled storage, etc. Horticultural building manufacturers are also beginning to offer PV components for glasshouse areas where light levels are not critical (e.g. corridors, storage areas).

Apart from ensuring that any retrofitted building is strong enough to take the weight of the modules (as well as potential wind lift, snow and ice), the lifetime of the building needs to be compared with the length of the FIT contract (now 20 years) and the expected lifetime of the PV modules (40-50 years). The rebuilding of pig and poultry houses (typically every 10-15 years), as well as possible corrosion from ammonia emissions, should also be taken into consideration. In some cases, the replacement and proper disposal of an old asbestos roof may become affordable as the result of a solar roof retrofit.

Note that all equipment and installers for schemes under 50 kW must be registered with the Microgeneration Certification Scheme in order to receive the Feed-In Tariffs. Since April 2012, roof-mounted solar under 50kW has been covered by Permitted Development rights (as is the case for most domestic installations), subject to certain guidelines - for example, there should be a one-metre gap from the edge of the roof. For larger roof-mounted systems the local planning officer should be consulted to check whether a full planning application is required.

From April 2012, new solar PV projects under 250 kW are required to provide in advance an Energy Performance Certificate (EPC) of level 'D' for one of the 'relevant buildings' connected to the PV system. Although in many cases the necessary energy efficiency measures will make good business sense, it may be possible to demonstrate that an open-sided shed is not a 'relevant building' (i.e. a roofed construction which has walls, and for which energy is used to condition the indoor climate). A document signed by an accredited EPC assessor will be required, confirming that an EPC cannot be obtained. However, a farmhouse or farm office which is part of the same metered circuit, with the same MPAN (Meter Point Administration Number), would need an EPC. Detailed guidelines from OFGEM, "Feed-in Tariffs: Guidance for renewable installations (Version 5)" are available to download here:

http://www.ofgem.gov.uk/Sustainability/Environment/fits/Documents1/FIT%20generator%20guidance.pdf

Small arrays of ground-mounted PV panels

Deploying photovoltaic panels on ground-mounted frames close to on-site electricity needs may be cheaper in some cases than roof mounting, as long as they are not overshadowed by hedges, buildings or trees. Unused parcels of land or awkward field corners may be suitable, and linear arrays of solar PV panels located around field margins might offer a way of combining renewable electricity generation with voluntary environmental land management (such as buffer strips running parallel to water courses, pollinator habitat or wild bird seed mixes). A 50 kW array would require about 100-200 metres of field edge, depending upon the configuration.

Large solar arrays in fields

Field-scale deployment of PV modules, or "solar farms" are a relatively recent development, seen in Britain only since 2011, although they have been deployed in Germany and other European countries since around 2005. Typically, developers and installers require about 2 hectares of land (5 acres) per megawatt of power, with most solar farms ranging from 0.5 MW to 15 MW in scale, and a few larger projects on low-grade or brownfield land of 30-50 MW. From the outset, the NFU has been interested in exploring opportunities for integrating large-scale solar energy capture with agriculture, subject to the normal planning process and consultation with near neighbours over minimising and mitigating any local visual or landscape impact.

In anticipation of a possible public and media backlash (as we have experienced with polytunnels, wind farms and transport biofuels), the NFU has engaged with solar developers to develop voluntary Best Practice Guidance for deployment of solar farms. We have also helped the Solar Trade Association to develop its "10 Commitments" of good practice:

http://www.solar-trade.org.uk//media/STA%2010%20commitments%20v%2010.pdf

Where possible, solar farms should avoid the Best and Most Versatile land, selecting instead sites on lower grade fields. However, the accompanying notes to this STA guidance state that "possible

exceptions to such land use rules include: areas where all the land is of higher quality and it would be considered unreasonable to exclude development on these grounds alone"

The NFU has co-chaired the government taskforce on Land Use and Sustainability for DECC's Solar Power Strategy, of which a 'Roadmap' was published in October 2013, with further details to follow in Spring 2014. We also worked previously with Natural England and FWAG (Farming and Wildlife Advisory Group) in 2011 to draft the Natural England Technical Advisory Note 101 "Solar parks: maximising environmental benefits":

http://publications.naturalengland.org.uk/publication/32027

The majority of solar developers are actively encouraging multi-purpose land use, continuing agricultural activity (sheep grazing, free-range poultry) and paying for “environmental stewardship” measures such as creation of habitat for bees, other pollinating insects, over-winter forage for wild birds, nesting boxes, etc., which provide fenced “wildlife refuges” in the midst of more intensively managed farmland.

Depending upon weather conditions, initial construction work may cause muddy fields, but the grass grows back quickly the following year, between the rows of modules and also under them, due to diffuse light and wind-blown rain (just as grass grows under hedgerows). Rows of modules are spaced widely apart to avoid self-shading - typically they occupy about 35-40% of the area of a field. Local visual mitigation typically includes reinforced hedgerows and tree screening, and avoidance of sloping or overlooked sites.

If 10 GW of solar power were ground-mounted (half the national ambition for 2020 set by DECC), this would occupy at most 25,000 hectares - just 0.14% of total UK agricultural area (18 million ha) with a negligible impact on national food security. Solar farms are a temporary and reversible use of farmland - the modules are typically mounted on screw piles, to be removed at the end of the 25-year planning consent period, enabling land to return to agriculture.

You will need to consider the implication of large solar arrays in relation to the current Single Payment Scheme (SPS) rules: firstly, whether the land use is still considered agricultural for the purposes of claiming SPS; and secondly, if the land is considered to be in agricultural use, what area can still be claimed under the SPS. If the predominant use of a land parcel is for solar energy capture, rather than an agricultural activity, this may be considered as non-agricultural land and the whole land parcel would be ineligible for SPS. In 2013, the NFU published a separate briefing on how ground-mounted solar arrays might impact upon an SPS claim:

https://www.nfuonline.com/business/sps/solar-panels-sps-eligibility/

Where to begin – some figures and facts

In line with NFU energy advice elsewhere, you are strongly recommended to conduct a comprehensive energy efficiency audit to better manage your on-site costs before investing in renewable energy production. Seek professional advice for all the following steps – the NFU Farm Energy Service is a good starting point. Begin by collecting detailed monthly energy use data for your farm (you may need to look at sub-metering for different parts of the business), identify where you can make simple improvements to equipment or behaviour to save energy, and then look at more substantial upgrades to older equipment. Next, an ‘options appraisal’ of the many renewable energy technologies should determine which of them best suits your business. Lastly, think about scale – if you are considering solar power, do you want to power a remote farm building, meet the electricity needs of the entire farm, or generate power to sell to the grid?

Contracts with solar developers (e.g. for renting of roof space or land area) follow similar practice to agricultural wind farm option agreements and leases. An option agreement, for which the landowner receives a modest payment plus legal expenses, allows a prospective developer a limited time period (say 12-24 months) in which to work on the landowner's site and progress the project to the point of planning consent. A lease agreement covers the likely project lifetime (20 or 25 years), including fixed payments, rents and eventual decommissioning and reinstatement of the site. Liabilities, maintenance, insurance and transfers to third parties should all be covered by the lease.

Payments and rents are usually negotiated with reference to precedents and prevailing market rates. Ground rents for large solar farms appeared to have settled somewhere between £1500/hectare (£600/acre) and £2500/hectare (£1000/acre) or more, depending upon ease of access and proximity of a grid connection. Leases may offer to hand over ownership of the PV system to the landowner at the end of the project lifetime. Since the solar modules may last for up to 50 years, this could be an important addition to the asset value of the farm. The eventual liability for disposal of the panels and site equipment at the end of its economic life should not be underestimated, but a solar farm may have significant residual value. Although the electricity inverters and control gear will require periodic replacement (roughly once every 10 years), the PV modules are likely to be in working order, albeit with some degradation in efficiency. You should consider negotiating two options – either (i) complete decommissioning, or (ii) a requirement on the developer to refurbish the system at the end of the lease before offering it to you or your family for a nominal sum as a continued source of income. The future value of the solar electricity generated may greatly exceed the cost of maintenance, and your own business plan could then pay a proportion of the earnings in future years into a fund for eventual decommissioning.

If you are considering a large solar PV installation, you should give serious consideration to instructing professional advisers (your Solicitor and/or Land Agent) to assist you with any negotiations, written documents and agreements, and to advise you on costs and valuation issues.

There seems to be little to choose between solar module manufacturers, but you should seek “Tier 1” products with the highest standards of quality control. Many offer performance guarantees on power output (typically a gradual decline to 80% of rated output after 25 years). Performance of DC/AC power inverters is more critical, with the worst having 8% power losses compared with 3% for the best. Inverter lifetimes may vary; on average, they require replacement about every 10 years. Contact the NFU Farm Energy Service for detailed advice on choosing an installer.

In addition to having an ‘energy payback’ of about 18-24 months (the time taken to generate the equivalent amount of energy used in their manufacture), most PV panels are made of easily-recyclable common materials (principally silicon) and a Europe-wide scheme for collection and recycling of defective PV modules is already in existence – see, for example:

http://www.pvcycle.org/index.php?id=4

http://www.solarpartner.co.uk/page/about/pv-cycle

Sensitive approach to developing a large solar project

The NFU recommends that, in line with good planning practice, members considering large solar arrays should first consult extensively with neighbouring farmers and the community as a whole; then hold early meetings with local planners, and finally ‘go public’ through village meetings and exhibitions. As for potentially controversial wind farm developments, it may be helpful to set up a community development fund using a small portion of the project income. This can be linked to energy efficiency or micro-generation opportunities for neighbouring householders, farmers or community buildings.

Offering a stake in your project to members of the local community may be a good way of galvanising support and advancing the project quickly.

Examples of agricultural and land-based solar PV developments:

Worthy Farm, Somerset – in 2010, NFU member and Glastonbury Festival host Michael Eavis CBE installed what was one of the UK's largest building-mounted PV systems: 201 kilowatts on 1500 square metres of dairy shed roof:

http://www.solarsense-uk.com/about-us/case-studies.aspx (click on Commercial - Solar PV)

Westmill solar farm – commissioned in 2011, this 5-megawatt solar farm is cooperatively owned and was developed on NFU member Adam Twine's land near Swindon, Wiltshire:

http://www.westmillsolar.coop/

Further information

NFU guidance, news and briefings on renewable energy:

http://www.nfuonline.com/science-environment/renewables/

NFU Farm Energy Service – members should call 0870 844 5700 and consult Business Guide No. 855:

http://www.nfuonline.com/membership/farmer-grower/member-services/farm-energy-service/

Through its reciprocal exchange of membership with the Renewable Energy Association (REA), the NFU participates in joint communications, lobbying and publicity activities. We also worked closely with the Solar Trade Association (STA), e.g. on the drafting and launch of its Good Practice charter, the so-called "10 Commitments" to best practice in solar farm land development and management:

http://www.r-e-a.net/

http://www.solar-trade.org.uk/

http://www.solar-trade.org.uk//media/STA%2010%20commitments%20v%2010.pdf

See also the two STA solar farm videos which can be found here on YouTube:

http://www.youtube.com/watch?v=vqOTmyAveyk
http://www.youtube.com/watch?v=Qz5vJIR_n2g

The European Photovoltaic Industry Association (EPIA), based in Brussels, promotes solar PV at national, European and world levels:

http://www.epia.org/home/

DECC Solar PV Strategy: Roadmap

https://www.gov.uk/government/publications/uk-solar-pv-strategy-part-1-roadmap-to-a-brighter-future

National Solar Centre guidance for the development of large ground mounted arrays

http://www.bre.co.uk/page.jsp?id=3202

Centre for Alternative Technology information sheet on domestic solar PV:

http://info.cat.org.uk/sites/default/files/documents/SolarPhotovoltaics_4pages.pdf