NFU Briefing

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Solar photovoltaic electricity in agriculture – on your roofs or in your fields?

Background

Government policy on cutting greenhouse gas emissions, and challenging national targets for renewable energy supply, are creating the right environment for investment in a range of clean energy technologies, including direct capture of solar energy. Since 1st April 2010, small-to-medium-scale producers of renewable electricity under 5 megawatts (MW) of installed capacity have been eligible for a new source of government-backed income called Feed-in Tariffs (FITs). It is the NFU's aspiration that every farmer and grower should have the opportunity to become a net exporter of low-carbon energy using a variety of renewable energy technologies.

Solar photovoltaic (PV) power (generating electricity from sunlight) is one of the qualifying technologies. Until 2012, the tariff for solar PV electricity ranges from 29 pence to 41 pence per kilowatt-hour for all generated power, on top of the savings in on-site electricity use and the value of electricity sold to the grid. This payment is guaranteed for 25 years and index-linked, making solar PV a much more attractive investment than it had been previously, with a typical return on investment from 8% to 12%. Feed-In Tariffs are set to be reduced or "degressed" gradually from April 2012 onwards, reflecting the anticipated decrease in the capital cost of PV equipment.

The UK market for PV in the domestic, commercial and agricultural sectors is expected now to grow rapidly, to as much as 250 MW of new solar installations in 2011, compared with about 10 MW installed in 2009. 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 support those that are commercially available and economic under today's market conditions and policy framework. 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 50 years), require very little maintenance since they have no moving parts, and with only a modest visual impact they are 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 financial packages is already being offered - from leasing of roof space or field space, to joint ventures, to simple supply-and-install services. With the Feed-In Tariffs offering a typical return on investment of around 10% to farmers who develop their own projects, we would recommend that NFU

members consider all their options before entering into a simple roof rental contract with a solar developer. The NFU foresees three main kinds of PV systems, 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

Solar PV on farm buildings

Agricultural and horticultural buildings present ideal platforms for solar photovoltaics, and small-to-medium sized roof-mounted systems are likely to be an attractive investment. The south west, particularly Cornwall, and the south coast, should offer the highest energy and financial returns, but PV roof projects are already under way throughout the length and breadth of Britiain.

The NFU expects many of the early developments in agricultural PV to take place on buildings with roofs facing south-east to south-west. Suitable agricultural buildings will include barns, grain stores, livestock sheds, dairy parlours, etc. – with perhaps the greatest opportunities on buildings that have significant electricity use such as intensive pig and poultry sheds, vegetable pack-houses, etc. Horticultural building manufacturers, particularly in the Netherlands, are starting 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 (25 years) and the expected lifetime of the PV modules (45-50 years). The rebuilding of pig and poultry houses (typically every 10-15 years), as well as possible corrosion from ammonia emissions, should be taken into consideration. In some cases, the replacement and proper disposal of an old asbestos roof may become affordable as a 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. It is anticipated that much renewable energy microgeneration equipment on non-domestic properties will be covered soon by Permitted Development rights (this is already the case for most domestic installations), but government consultations are still open in all areas of the UK. You should consult your local planning authority to establish whether planning consent is required for the scale and location of your proposed project.

A typical small system in the size class 4-10 kilowatts would earn a generation tariff of 36.1p/kWh. Sized at the maximum in this range of 9.9 kW, this would cost about £35-40,000 and would typically earn income of £3300-3800 including the generation tariff, on-site electricity use and exported power. Larger installations in the size class 10-100 kW will earn 31.4p/kWh, e.g. £300-350,000 for a 99 kW system earning about £30-35,000 per annum. Note that earnings are (obviously) a function of the “load factor” or “capacity factor”, i.e. the number of sunny hours per year.

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. Furthermore, linear arrays of solar PV panels located around field margins offer potentially a way of combining voluntary environmental land management (such as buffering water courses) with a renewable electricity income. At present, this is an experimental idea that the NFU is keen to investigate further with solar installers and agri-environment scheme stakeholders. There may also be possibilities for combining Environmental Stewardship measures with large field arrays (see below).

Large solar arrays in fields

Field-scale deployment of PV panels presents new challenges, with many developers typically interested in leasing about 2 hectares of land per megawatt (MW) of installed capacity, costing £2.5-3.0 million per MW. The NFU is interested in exploring such 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.

The agricultural sector should not overlook the possibility of a public and media backlash against the perceived annexation of agricultural land, with local opposition groups protesting about blighted landscapes and subsidies to farmers – as we have seen before with the media treatment of polytunnels, wind farms and transport biofuels.

In anticipation of this, some PV industry developers are already proposing multi-functional use of land, typically combining solar energy capture with small livestock production (free-range poultry, sheep). PV modules are usually mounted about 2m above the ground with substantial gaps between the rows of modules, providing both light and shade, and allowing grass to grow. In flat terrain, hedges about 2.5m high would hide PV panels from view, but discussions about measures to minimise visual impact are only just starting between prospective developers and local planners. Evidently, low-grade farmland and brownfield land are likely to be preferred over deployment on the most productive land.

You will need to consider the implication of large solar arrays in relation to the current Single Payment Scheme rules: firstly, whether the land use is still considered agricultural for the purposes of claiming Single Payment Scheme, and secondly, if the land is considered to be in agricultural use, what area can still be claimed under the Single Payment Scheme.

Where to begin – some facts and figures

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. Start 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) are expected to 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 (in this case 25 years, linked to the FIT), 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, but this is a very immature market at present. Figures quoted for ground rents on large field PV arrays range from a minimum of £700-1000/hectare to £2500/hectare or more, for the 25-year lifetime of the Feed-In Tariff. A critical factor will be size and minimum land area, since many developers will want more than just "those two poorly-drained fields at the bottom end of the farm". Likewise, leases for

roof-mounted installations are more likely to be available for larger roofs equivalent to around 100-300 kW of PV capacity (700-2200 square metres).

Some proposed leases promise to hand over ownership of the PV system to the landowner after 25 years. Since the solar modules may last for up to 50 years, this could be an important addition to the asset value of the farm. Liability for disposal of the panels and site equipment at the end of the lease period may not be a problem, because the PV system will 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 in year 25 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 years 26-50 into a fund for eventual decommissioning.

If you are considering a 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 PV manufacturers at present. 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. Inverters may also require replacement about every 10 years.

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. In some cases, offering shares in your project to members of the local community may be a good way of galvanising support and advancing the project quickly.

Grant funding and renewable tariffs

Some capital grant funding is still being offered for renewable energy equipment (e.g. through RDPE), but there is presently a degree of policy confusion between grant-giving bodies and central government over the compatibility of grant support with the Feed-In Tariffs. The NFU's view is that revenue-based financial incentives such as the Feed-in Tariff offer a more substantial and assured long-term source of income. At the very least, a capital grant application may delay your project, and more seriously it may render the project ineligible for the Feed-In Tariff unless you can prove exceptional costs.

Examples of agricultural and land-based solar PV developments:

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

http://www.solarsense-uk.com/glastonbury.asp?CaseID=31

The Tree Barn (Greenfield Farm, Watlington, Oxon.) – another NFU member, Andrew Ingram, has 28 kilowatts of PV generation mounted on a large shed, commissioned in spring 2010:

http://www.ownergy.co.uk/for/farmers/case_studies/

Further information

NFU guidance, news and briefings on renewable energy:

http://www.nfuonline.com/our-work/environment/renewable-energy/

NFU briefing on the Feed-In Tariffs scheme:

http://www.nfuonline.com/Our-work/Environment/Renewable-energy/Feed-in-Tariffs-explained/

Through its reciprocal exchange of membership with the Renewable Energy Association (REA), the NFU participates in joint communications, lobbying and publicity activities. REA Solar Power is a new technology group established within the trade association in August 2010 to represent solar PV:

http://www.r-e-a.net/REA/sector-groups/solar-photovoltaic-group

REA SOLAR POWER
The voice of solar PV in the UK
RENEWABLE ENERGY ASSOCIATION

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

http://www.epia.org/solar-pv/the-sun.html

Centre for Alternative Technology information sheet on domestic solar PV:

http://www.cat.org.uk/information/pdf/SolarPhotovoltaics.pdf