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SOLAR FARMS: WHY DO WE NEED THEM?

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Introduction

As part of its strategy to reduce greenhouse gas emissions and reduce dependency on imported energy supplies the UK Coalition Government is committed to meeting 15% of the nation's energy needs from renewable sources by 2020. Looking further ahead the Government has suggested *'renewables will also have a crucial role to play in the UK energy mix in the decades beyond, making the most of the UK's abundant natural resources'* (Gov. UK 2013). This mix currently includes wind, hydro-electric, tidal and solar power and biomass and the updated *'Renewable Energy Roadmap*' recognises that *'there are different approaches to energy policy in different parts of the UK'* and it *'sets out a cleaner, more affordable and more secure energy future for the UK'* (Department of Energy and Climate Change 2012). While the continuing development of onshore wind farms within the UK has stirred considerable political and media controversy and brought many local planning authorities, particularly in northern and western regions, into the public spotlight, the arguably less obviously visible development of solar farms is also presenting a number of planning challenges. This article provides an outline of the characteristics and development of solar farms and explores a range of planning issues associated with these developments.

Solar Farms in the UK

While there is no official definition of a solar farm it is essentially an area of land on which a large number of solar panels are deployed to generate electricity producing very little noise, having no moving parts and no harmful emissions. More specifically solar farms are large arrays of interconnected solar panels that work together to capture sunlight and convert it directly into electricity. The active elements within the solar panels are silicon solar cells which have at least two layers with a positive and negative charge. The electric field across the junction between the two layers causes electricity to flow when the semi-conductor absorbs photons of light and releases electrons. The electricity so generated is cabled to one or more (depending on the size of the solar farm) inverters, electrical power converters that change direct current into alternating current, electricity. The output can be connected to both local users and the national grid. Solar energy generation is at its strongest during the day time the demand for electricity is at its highest and when the solar farm produces more electricity than is required locally then the surplus is fed into the national grid and when there is a shortfall extra power can be drawn from the grid.

A typical solar farm generates some 5 mega-watt peak (MWp) which would provide electricity for up to 1,200 houses with a carbon dioxide saving of 500 grams per kilo-watt hour (g/kWh). Such a solar farm would require 15 hectares of land with about 30% of the total area being covered by up to 20,000 solar panels. The individual solar panels measure 1.6 by 1.0 metres and their upward facing surfaces are made from toughened glass with an anti-reflective coating to maximize the light captured by the solar cells. The solar panels are mounted in arrays on aluminum and steel frames and inclined at an angle of 25% between 1.0 and 2.65 metres above the ground, thus providing clearance for habitats and plants to remain in situ, and they are usually laid out in rows and interspaced to facilitate access and to minimise shading. Solar farms usually have a secure perimeter fence and are often sited behind existing or new hedges planted to screen them. Maintenance is normally straightforward and relatively minimal involving performance monitoring; defects analysis, diagnosis and replacement; landscape maintenance; annual inspections; and security. The theft of solar panels has been reported as an issue, particularly on large solar farms in relatively remote areas, and a growing number of operators are installing sophisticated closed circuit surveillance systems. Solar farms are generally thought to have a lifespan of 20-25 years and in some ways they can be seen as a temporary land use and there are no legacy issues in that the entire installation can be removed relatively easily and sites can, if appropriate, be restored to their original use.

While there is no national register, and hence no definitive information on the number of solar farms in the UK per se , the use of solar power has increased rapidly, albeit from a low base level, in recent years and anecdotal and trade evidence clearly suggests that the number of solar farms is rapidly increasingly. Solar Voltaic Energy (2013), for example, listed 91 major *'solar energy schemes'* as having been commissioned by April 2013 with a further 56 being classed as approved or under construction and a further 32 proposed or going through the planning process. The global irradiation and solar energy potential within the UK varies from 980 kilowatt hours per metres squared in the far north of Scotland to 1240 kilowatt hours per metres squared in the south west of England and it is the south west and south east of England where the development pressure, as evidenced by the number and the scale of solar farm projects, is greatest. While some solar farms have been developed on brownfield sites, for example, on disused airfields or former landfill sites, the many have been proposed and developed on agricultural land.

The growth in solar farm development reflects a number of factors. On the one hand the UK governments' positive approach to renewable energy and more specifically solar-specific Power Purchase Agreements (PPAs) and the government-mandated Renewables Obligation (RO) have been important in providing the initial impetus for solar power development. Solar farm operators sell electricity to utilities at a fixed price under the PPAs for every megawatt hour generated. The RO is the main support mechanism for renewable electricity projects in the UK and it places an obligation on UK electricity suppliers to source an increasing proportion of electricity they supply to customers from renewable sources. RO Certificates (ROCs) are issued to operators of accredited renewable generating stations for the eligible renewable electricity they generate. Operators can then trade the ROCs with other parties, with the ROCs ultimately being used by suppliers to demonstrate that they have met their obligation. On the other hand as the price of solar panels and system installation costs have fallen and the cost of electricity generation by traditional methods has increased so solar power has increasingly achieved so called 'grid parity' where electricity generated from solar sources becomes equal in cost, or less than, purchasing power from grid power, so this would seem to favour a continuing shift in generation patterns to solar sources.

Planning Policies and Issues

One of the twelve core principles within the National Planning Policy Framework (NPPF) is that *'planning should.....support the transition to a low carbon future in a changing climate'* by, inter alia, *'the development of renewable energy'* (Department for Communities and Local Government 2012). While the NPPF makes no explicit reference to solar energy or solar farms it does stress the need *'to help increase the supply of renewable and low carbon energy, local authorities should recognise the responsibility on all communities to contribute to energy generation from renewable and low carbon sources'* (Department for Communities and Local Government 2012). At the same time the NPPF also emphasizes that *'planning policies should....promote the development and diversification of agricultural and other land based businesses'* (Department for Communities and Local Government 2012).

At the local authority level planning policies generally reflect the spirit of this national guidance but there is little specific reference to solar farms per se. That said development proposals for solar farms have raised a wide range of issues. These include impacts on land, landscape and visual amenity; ecology and nature conservation: cultural heritage and historic environment; construction traffic and highways; security; economic benefits; and potential economic and social impacts within the community. Although many local planning authorities clearly support solar energy developments in principle they have often emphasised the importance of giving full consideration, where appropriate, to many of the issues listed above. In providing strategic planning observations to Newark and Sherwood District Council on a proposed solar farm at Bilsthorpe in Nottinghamshire in February 2013, for example, the County Council expressed concerns over the potential impact of the proposed development on the ecology, historic environment and landscape but reported that they could not make a formal recommendation until significant work had been undertaken and relevant information had been received from the developers.

More generally issues concerning land, landscape and visual amenity have focused, for example, on the impact on landscapes and agricultural land. In a report on a proposed solar farm at Great Glenham, presented to Suffolk Coastal District Council by the Head of Planning and Coastal Management in March 2013, it was argued that *'landscape impact is likely to be the most critical issue'* (Suffolk Coastal District Council 2013). While the report stressed that a Landscape and Visual Assessment Impact concluded that although the area of land covered by the solar farm was significant the structural form of the solar panel arrays would be low level and that the landscape impact would be limited and that the local pattern of topography, vegetation and development would limit the extent to which the proposed development would be more generally visible within the surrounding area. A number of objections to the proposed solar farm at Great Glenham focused on the loss of what was seen to be productive agricultural land but the report to the District Council emphasised that the development proposal was reversible and did not destroy the fundamental agricultural qualities of the land which could eventually be returned to full agricultural production.

In addressing ecology and nature conservation local planning authorities have generally looked to recognise that solar farms could have implications for habitat loss, fragmentation and modification and displacement of species. The nature and scale of any such impacts will clearly depend on the ecological features and the characteristics of proposed sites. On the one hand solar farms may reduce habitats but on the other hand they may also allow the integration of land uses and produce environmental benefits. Here a number of local authorities have employed ecology consultants and advisers in an attempt to mitigate adverse impacts and to maximise possible biodiversity enhancement. Solar farms can have impacts on a range of heritage assets, including sites, monuments, buildings and landscape, both above and below ground, though here the impact of solar farms will generally be site specific. However in Cornwall, a county where development pressures for solar farms are possibly greater than anywhere else in the UK, the County Council expects all development proposals to be informed by a consultation with the Historic Environment Record (HER) and has made arrangements for a priority service with the HER for proposed solar farm developments. An Archaeological Assessment of a proposed solar farm at Crantock in Cornwall conducted by HER in 2011, for example, provided a chronological summary of the site and its landscape and an inventory of sites within and adjacent to the proposed development area and reported that a number of the sites were considered to be of high significance and of national importance. That said the report concluded that the impact of the proposed solar farm on the archaeological resource was assessed to be minimal if recommended mitigation measures were undertaken. These measures included a geophysical survey prior to any construction work to allow the identification of any buried sites, careful design of the proposed works to reduce the impact on field systems and any documented archaeological sites, controlled soil stripping and the analysis of mitigating archaeological recording should be compiled , analysed and published.

While some concerns have been expressed about increased traffic flows and vehicle movements and more general disruption during the construction phase this is generally seen to have a very limited impact. Generally developers stress that it would be unlikely that any exceptional large or bulky loads would be delivered to solar farm development sites during the construction phase and they are always willing to agree traffic routing with local highway authorities and the police to minimise the impact of construction activity on local road networks. Many local planning authorities usually advise applicants submitting solar farm development proposals that they must provide full details and specifications of all security installations. More specifically the Devon and Cornwall Police Authority have provided advice on perimeter fencing, electronic security, closed circuit television surveillance and landscaping techniques designed to deter unwanted vehicle access .The Authority further suggests that thought should also be given to the wider issue of access around any site and it suggests that where land surrounding a solar farm site is under the same ownership, thought should be given to improving gates so as to provide layers of difficulty for potential criminals to overcome.

Within planning applications for solar farms a number of local economic gains have sometimes been claimed. The construction phase, which might last up to three months, can bring a number of short term benefits including increased demand for accommodation in local hotels and guest houses, increased patronage of local shops, restaurants and public houses by workers and contracts for plant hire companies, hauliers, electrical, groundwork, drainage and fencing contractors. In the longer term while the development of a solar farm might result in a fractional reduction in employment, ongoing site maintenance and management, environmental stewardship and the introduction of schools visits programmes may produce a small net gain in employment. More generally some developers have argued that the development of solar farms in rural areas will have a long term multiplier effect not only in terms of new employment opportunities but also in that workers will be exploring new opportunities outside traditional agricultural employment. A number of local planning authorities have been keen to suggest that community engagement should be seen as an integral part of the development process. Developers have often reported recognising the need for accessible and inclusive public consultation in order to allow people in the area surrounding proposed solar farms to express their opinions and ask questions within a timeframe that allows for a constructive dialogue and appropriate response but the level of public involvement has often been low and sporadic.

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