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New school of renewable energy technologies

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New school of renewable energy technologies



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THERE HAS BEEN MUCH DEBATE AND discussion around the generation of renewable energy required for the UK to hit ambitious emissions targets. The coalition government's manifesto included commitments to increase the UK's target for energy from renewable sources and to support an increase in the EU emission reduction target to 30% by 2020. The incentives in place for operators of renewable energy plants, which are covered later in this article, have led to an influx of renewable energy companies looking to capitalise on the opportunities. Development of the incentives regimes and political pressure to plug the energy gap have led to an emerging group of renewable energy technologies. Three such technologies are anaerobic digestion (AD), geothermal technology and solar photovoltaic (solar PV). This article provides an insight into these three technologies, how they are being promoted, and what issues operators face when looking to build and operate renewable energy plants using them.

RENEWABLES INCENTIVES

The UK's Renewable Obligation (RO), which was introduced in 2002, has been successful in many respects. Since its introduction, the Department of Energy and Climate Change claims that it has resulted in a threefold increase in the level of renewable electricity in the UK from 1.8% to 6.64%, and is currently worth around £1.4bn per year in support of renewable energy operators and investors. The RO is currently enshrined in the Renewables Obligation Order 2009 (as amended), which details how electricity produced from renewable sources is eligible for different quantities of Renewables Obligations Certificates (ROCs) per MWh, depending on the technology used. The banding of ROCs for different technologies was introduced in 2009, and AD, solar PV and geothermal were among the emerging technologies targeted by the government to receive double ROCs until at least 2013 (as detailed in 'The Renewables Obligation' in *IHL168*, p62).

A new form of incentive for small-scale, low-carbon electricity generation (ie up to and including 5MW) was introduced in April 2010 when the Feed-in Tariff (FIT) scheme was implemented by the Feed-in Tariffs (Specified Maximum Capacity and Functions) Order 2010 (FIT Order). While

the RO will remain the primary mechanism to promote large-scale renewable generation (above 5MW), the FIT scheme seeks to reward fewer technologies when these are used in sub-5MW generation plants and so increase the number of small generators in the market. A wide range of businesses and householders could gain from the FIT scheme, and its potential effect should not be underestimated.

The Renewable Heat Incentive (RHI) is a further scheme, which is due to be introduced in April 2011 under powers contained in the Energy Act 2008. The RHI will apply to the generation of heat from a range of renewable sources and will support heating at all scales from households to industrial processes.

The RO and FIT currently cover AD and solar PV energy but geothermal is covered only under the RO. It is intended that the RHI will capture all three technologies. These government incentive schemes are, to a large extent, responsible for the growth of the renewable technologies detailed in this article.

GEOTHERMAL

Overview

Geothermal energy is power extracted from heat within the earth. It is used in several applications including, historically, for heating public baths. In energy production it involves the extraction of heated water from hot subterranean rocks to drive turbines. The technology can be used on a large scale, with deep geothermal plants (which involves pumping water up to 5km underground). Hot rocks then heat the water, before it is pumped back up to the surface, either to be converted into electricity or used as a source of renewable heat. In contrast to some other renewable energy sources, geothermal power plants are able to operate 24 hours a day. Supporters of geothermal energy claim that it is a clean and efficient energy source, and, because such power plants do not burn fuel to generate electricity, the emission levels are claimed to be lower or non-existent. This view is not universally held and opponents refer to water and land use issues, as well as the effects on wildlife and vegetation.

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Cornwall is seen as one of the most suitable areas in England. Extensive research in the 1970s and the 1980s found significant opportunities for geothermal energy within the county's bedrock. In August 2010 Cornwall Council approved a 65MW geothermal energy project in Redruth owned by Geothermal Engineering Ltd. It is hoped that drilling could begin next year and that the UK's first deep geothermal power plant could be operational by 2013.

The UK lags behind countries such as Germany, which already has an estimated 150 geothermal power plant projects in the pipeline. Other European countries, including France, Italy and Spain, are also much further advanced in this sector and it is estimated that worldwide, approximately 10,715MW of geothermal power is generated in 24 countries. However, the government clearly views geothermal energy as a key constituent of the renewable energy mix and is taking steps to encourage growth in the technology in the hope that ultimately between 1GW and 5GW of renewable electricity will be provided by geothermal power by 2030.

Promotion

Under the RO, geothermal energy qualifies for two ROCs per MWh of electricity produced, which illustrates how keen the government is to see an increase in the generation of geothermal energy in the UK. The technology does not currently qualify for FITs, although it may be included in the scheme in future. There is support among operators in the geothermal sector for the RO to allow for four ROCs per MWh for geothermal. It remains to be seen if changes will be made to the RO to increase the support offered, but no such amendments have been proposed in the draft Renewables Obligation Order 2011.

Further support for geothermal energy was announced on 22 October 2009, with

the introduction of the Deep Geothermal Challenge Fund (DGCF). The government's Renewable Energy Strategy 2009 stated that the intention behind the DGCF is to help develop the potential of a deep geothermal sector in the UK by inviting applications for capital grant funding for projects exploring the potential for geothermal energy. The funding formed part of the wider Low Carbon Investment Fund, which provided £6m of funding for the DGCF. Almost £4m of grants were awarded in the 2009/10 financial year to three projects in Cornwall and County Durham, but the grants available in 2010/11 have been cut to £1m.

Issues

The key issue for geothermal energy is the initial investment required to drill test boreholes, to ascertain the viability of a proposed plant. Ground risk and exploration risk will be a focus for investors, though these risks can often be covered by insurance.

The subject of environmental consents will also need to be addressed to deal with any emission issues and discharges.

The other potential legal complication is in relation to the land on which a plant or drilling is located. This is a complicated area and property rights over mines and minerals often exist, even if they are not revealed through the usual registered title searches, leading to the risk of trespass.

SOLAR PHOTOVOLTAIC

Overview

Solar PV is a method of generating electricity by using semiconducting material, such as silicon, to convert solar radiation into direct current electricity. Panels can be mounted on the ground in solar parks but many will be more familiar with them in the context of roof-mounted

units. The more powerful the sunlight, the more electricity is produced but, contrary to popular belief, the technology creates electricity even in overcast conditions.

Solar energy was popular in the UK in the 1970s but the cost relative to the fossil fuel-based electricity generation meant that the technology was sidelined. As a result the UK is behind many other countries in the use of solar PV, with just 6MW of output in 2009. This is in stark contrast to other countries, including China, which is making significant investment in promoting solar PV.

Promotion

Solar PV plants with a capacity of less than 5MW qualify for FITs under the FIT Order at varying levels ranging from 41.3/36.1p per kWh for plants with less than 4kW installed capacity, to 29.3p/kWh for larger plants between 100kW and 5MW. Under the RO, plants qualify for two ROCs per MWh of electricity produced, which represents the highest level of support available under the RO. The FIT and RO support for solar PV appears to have had a substantial effect on the market, with a plethora of new and established operators flooding into the UK solar market, particularly in the south of England.

A further catalyst for the push into solar PV in the UK is the substantial reduction in the FIT in Spain. As a result of public spending cuts, Spanish operators have experienced reductions of up to 45% in tariff returns, which has led to an exodus from the Spanish market and into the UK market.

Solar PV projects are perceived as having fewer problems than some other renewables projects in attracting finance. This is arguably due to the fact that the technology is viewed as proven and the capital expenditure for projects is often significantly lower than for other technologies.

Issues

The main perceived problem with solar PV in the UK is that the country is not suitable meteorologically, due to the relative lack of sun. However, energy outputs of solar PV plants relate to latitude and sunlight hours, in addition to direct sunlight, and northern European countries are in fact well-suited to solar PV plants.

Solar PV is not immune to the UK's complications of planning and grid connection. Only certain smaller solar PV systems can escape the requirement for planning permission as a result of being classified as permitted development under planning legislation. Others, including the ground-based solar PV plants, will require planning consent and may face opposition depending on the degree of visual effects they have on the surrounding area.

While the production of large-scale solar panels is facing a pinch point at the moment, the downturn in the Spanish and other European markets also indicates a higher availability of equipment in the medium term.

ANAEROBIC DIGESTION

Overview

AD is the process by which biodegradable material is broken down by microorganisms in the absence of oxygen. A wide variety of materials can be used as feedstocks, ranging from catering or supermarket waste (ie vegetable and animal waste) to sewage sludge. The process yields two products:

- i) Biogas: composed largely of methane (60%) and carbon dioxide (40%).
- ii) Digestate: the residual fibrous material left at the end of processing. End uses range from landfill cover, spreading to land for agricultural purposes or the production of a high-quality soil conditioner.

The biogas is combusted to produce electricity and heat, or directly injected onto the gas distribution network. The digestate is then either, depending on its constitution, spread to land as fertiliser or disposed of as a waste. AD enables waste material to be used as a resource to produce renewable energy.

The UK government has indicated that it is committed to making AD a major player in its climate change, waste management and wider environmental objectives. However, the number of AD plants in the UK remains relatively low for feedstocks other than sewage sludge, and has always been considerably lower than many EU countries and the US.

Promotion

As for solar PV, AD plants with generation capacities over 5MW qualify for two ROCs per MWh, while those under 5MW generation capacity qualify for FITs at 11.5p/KWh for plants with a generating capacity of less than 500KW and 9p/KWh for those with a generating capacity of more than 500KW. The FIT tariff levels are considerably lower than those for solar PV, and the difference in terms of financial benefits between FITs and ROCs for AD is marginal.

The coalition government has indicated its support for AD with a commitment in its manifesto to introduce measures to promote 'a huge increase in energy from waste through anaerobic digestion'. The full details of how the government intends to facilitate this increase have yet to materialise. The first sign of action can be found in the proposed amendments to the Environmental Permitting (England and Wales) Regulations 2010 (the 2010 Regulations) to remove the requirement for compliance with pollution prevention and control requirements for AD plants where biogas is transported offsite for combustion.

Issues

Faced with high waste disposal costs, corporate social responsibility pressures and concerns about the security of electricity supply, many businesses are looking at embedded AD plants that work particularly well in locations where the residual heat from the generating station can be used or sold in the vicinity of the plant. Speculative plants will need to secure medium-term feedstock arrangements and contracts to receive the digestate after processing.

AD plants require site development planning consent according to the planning legislation. The perception among local authorities is that AD plants represent a new form of industry that is likely to evoke emotive issues, such as frequency of vehicle movement, biohazards and odour, among the community. As a result, AD developers are required to provide detailed justification

that the AD plants are suitable in the vicinity.

Several activities involved in the operation of AD plants will trigger either the need to register an exemption or apply for an environmental permit under the 2010 Regulations. The extent of environmental authorisation will depend on the size of the AD plant, type of feedstock, specification of digestate and use of biogas. Digestate specification causes significant issues for operators who must ensure that digestate meets a quality protocol, the requirements of which are stringent, to escape the need for waste management control for digestate transportation, storage and use.

CONCLUSION

It is inevitable that more technologies will come to the fore as the government develops its long-term strategy for incentivising the production of green energy. The driver is often to increase investment into new technologies that have the potential to deliver low-carbon, sustainable energy more efficiently. Operators will continue to look to those technologies that;

- have a proven track record for reliable energy production;
- require lower capital expenditure requirements; and
- provide the most attractive range of financial incentives.

The coalition government has indicated that it will maintain a full system of FITs and banded ROCs, and many projects are being financed on the basis of continued support. However, the experience of solar PV operators in Spain should stand as a stark warning to operators of solar PV, AD and geothermal plants against overreliance on the financial incentives for renewable energy generation.

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