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Repowering:
The future of wind farms

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Onshore wind is at the heart of UK government plans to achieve net zero emissions by 2050, but ageing assets present a challenge for expanding capacity. Here, experts from Fieldfisher, ThreeSixty Renewables and RenewableUK outline the legal, technical and policy considerations for replacing end-of-life wind farms.

The run-up to the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow from 31 October-12 November 2021 saw a flurry of white papers, strategies and manifestos for meeting key climate change objectives.

This included the UK government's Net Zero Strategy, which outlines the role of onshore wind in achieving net zero greenhouse gas emissions by 2050 and in helping to meet the UK Climate Change Committee's Sixth Carbon Budget by 2035.

In October 2021, RenewableUK, the trade association for the wind, wave and tidal power industries, published its Onshore Wind Prospectus , calling for a generation target of 30 GW per annum by 2030 and outlining the significant climate, community and economic benefits of achieving this goal.

Meeting this target will involve both a doubling of historic onshore wind installation rates and, crucially, the repowering of approximately 8 GW of existing onshore wind capacity over the next 20 years.

Why repower?

For those outside the wind energy industry, it is easy to forget that wind farms, once installed, have a finite life – typically 20-25 years on average.

Without a long-term plan for these wind farms, there is a risk of losing renewable energy capacity gains accrued over the last two and half decades at a time when the UK can least afford to go backwards in its efforts to tackle climate change.

As wind farms approach the end of their operational lives, there are three main options for what to do with these assets.

1. Decommission

Decommissioning is the default or backstop option for end of life wind farms, in that provision for decommissioning must be made in the project lease to obtain planning permission.

Decommissioning without extending the life of the wind farm is concerned with removing the infrastructure from site, rather than extracting further economic benefit from the assets.

Compared to other energy generation technologies (such as coal and nuclear), wind farms are relatively straightforward to decommission as there is less risk of leaving behind any pollution or indelible trace on the landscape.

While decommissioning may be unavoidable in some circumstances (for example, due to planning permission restrictions), removing capacity should generally be the option of last resort if the UK is to meet is 30 GW target for onshore wind power generation by 2030.

2. Life extension

Extending the life of a wind farm that has operated well gives project owners the opportunity to extract further economic benefit from the asset beyond its original design life.

Life extension is similar to repowering in many respects, and any decision will be partly based on knowledge of the site's climatic conditions and the performance of the asset over its lifetime.

When considering whether to extend the life of an asset, it is important to review the terms of the lease and planning permission early, to ascertain what extension rights exist and whether these can be exercised, or whether they have to be renegotiated with the relevant authorities and/or landowner.

Perhaps more importantly, it is essential to establish the structural integrity/general condition of the turbines, to see whether it is economically worthwhile extending the asset's life.

Given that the commercial context will have moved on since the wind farm was first commissioned, it is also necessary to determine what the best route to market for the wind farm's power will be, how the power is going to be sold and how to optimise generation.

Subject to the outcome of the turbine equipment review, extending the life of a wind farm should be relatively low capex and may also be a stepping stone to repowering further down the line.

3. Repowering

Repowering involves replacing old turbines with new turbines, taking advantage of more powerful and efficient types of turbine technology. Practically speaking, repowering a site is very similar to undertaking new greenfield construction project.

However, repowering an existing site has a number of important commercial advantages over building a new site from scratch.

One of the main benefits is the ability to repurpose/reuse existing infrastructure, such as access roads and substations, which unlike turbines tend to retain their economic value.

Operating sites also have existing connection agreements and generating licences and good historic data on yield/ how the site has performed, underwriting the economic case for repowering.

In the UK, most of the onshore wind sites coming up for repowering from 2021 onwards were among the first to be built in the UK, and were consequently located in the most optimal locations for wind power generation, giving them a clear advantage over greenfield sites in less windy spots.

If an existing site has a supportive local community, underpinned by a community benefit fund, local supply chains and other inward investment, this can all be captured in a repowering project. This is of course largely subject to the developer having cultivated good community relationships during the project's lifetime.

Crucially, the decision to repower a wind farm will largely be based on the potential to significantly improve a site's performance. This can principally be achieved by upgrading turbine technology and wind farm design, but there may also be opportunities to co-locate other technologies such as batteries or electrolysers for hydrogen production.

Developers should also have the ability to direct where the power derived from the asset goes, based on grid price, capacity and curtailment, which should lead to a more efficient generation profile.

Legal and practical issues for repowering

Project finance

When it comes to obtaining project finance for repowering an existing wind farm, many of the considerations will be the same as if it were a greenfield site.

Project finance providers will look at the projected cash flow of the wind farm, based on the bankability of the offtaker(s), any financial support mechanisms (such as CfDs) and the site's historic revenue data, as well as the track record of the developer and other risk factors.

Repowering may be undertaken by the same developers that constructed the original site, or possibly by new opportunist developers specialising in end-of-life assets.

Connection agreements

While existing wind farms will already have connection agreements in place, the maximum export capacity is likely to change once a site is repowered, as will the type of technology used (especially if co-located assets are envisaged).

Consequently, the connection agreement will require amendments or possibly an entirely new agreement, subject to the capacity of the network, any reinforcements required and the project timescale.

Landowner agreements

A wind farm developer's relationship with the site's landowner will be governed by the terms of the lease.

If the lease contains an option to renew, this will help considerably in moving the project forward.

However, in situations where there is no right to renew, or the lease contains limitations on land use (which may make reference to planning permission and type of technology used), this will require careful negotiation, particularly if the developer plans to introduce larger turbines or co-located assets.

As of 2017, landowners will have lost the right to financial support for new projects received under the UK government's Renewables Obligation (RO) scheme, significantly reducing revenue from sites, so project developers should factor this into future rent negotiations.

Local planning authority/generating licence

New planning consent from the local planning authority (LPA) is likely to be required for a repowering project, as planning permission for wind farms tends to be time-limited.

Historically, the UK planning regime has produced varying results for similar projects in different locations, and small community groups have the power to block or delay projects, making it challenging to deploy onshore wind capacity at the desired rate.

While the project's generation licence is not limited in same way, the extent of any exemptions in the generation licence will be relevant if the generation profile of a project will change once repowered.

OEM, EPC and O&M providers

The developer's relationship with its OEM suppliers, EPC contractors and operations and maintenance (O&M) providers are key and will need to be negotiated and settled as part of a repowering project.

Offtake arrangements

For most wind farms approaching the end of their design lives, the original power purchase agreement (PPA) signed when the project was first constructed is likely to have expired, meaning developers will need to make fresh offtake arrangements for the power they generate.

There may be appetite from the original offtaker to negotiate new PPA terms, or there may be new opportunities to enter direct agreements with corporates/other non-traditional offtakers under corporate PPAs (CPPAs) or similar contracts.

CfDs

In November 2020, the UK government announced plans to reintroduce Contracts for Difference (CfDs) for onshore wind projects, having withdrawn this support in 2015.

CfDs incentivise investment in renewable energy projects by providing developers with direct protection from volatile wholesale prices by guaranteeing a strike price for the power produced.

CfDs are currently tied to capacity auctions, however pressure is mounting to offer CfDs on an annual basis rather than leaving gaps between auctions, giving onshore wind investors a clear revenue pipeline to at least 2030.

Five tips for repowering wind farms

Aside from the legal and policy framework for repowering wind farms, there are also a number of technical considerations that need to be factored in.

A 2021 survey by Three Sixty Renewables highlighted some of the most common technical challenges that threaten to scupper repowering ambitions, if they are not identified and addressed early.

1. Repowering is appropriate for fewer sites than developers may think

It is easy to assume that any existing operational wind farm can potentially be repowered. However, changes in circumstances surrounding an asset may create hidden yet insurmountable hurdles to repowering.

For example, a number of existing wind farms are now surrounded by newly-designated environmental areas, affecting access routes such that renewing planning permission is impossible.

Changes to grid connections and other supporting infrastructure can also create difficulties with renewing/ renegotiating lease arrangements, effectively making it impossible to ensure the economic future of an asset.

2. Happy landowners do not automatically equal a repowered site

A common mistake is the supposition that satisfied landowners will be amenable to renewing lease arrangements on terms favourable to developers.

Given the growth of the onshore wind market in the UK and its well-publicised importance in achieving net zero, many landowners are motivated to negotiate terms that favour their own interests, including offering the site to competing developers when a lease is approaching expiry.

This has created a situation where the cost of renewing leases is generally more expensive than negotiating a lease for a greenfield site.

3. Standard due diligence is not enough

Recent experience of repowering negotiations has illustrated the need for enhanced due diligence.

There have been a number of cases where assets purchased with the intention of repowering have been downgraded to life extension projects as consequence of issues that have come to light after the purchase was completed.

To avoid nasty surprises, developers should consider undertaking a full repowering feasibility study at the due diligence stage to ascertain what has changed at the site since it was first designed, including:

- The right to renew leases/overholding clauses (where the commercial term of the lease has expired but the tenant continues to occupy the site on an agreed rolling basis);
- Existing and future environmental designations;
- New microwave links (for telecommunications) or radar limitations since the wind farm was constructed;
- New existing or planned dwellings; and
- New local grid issues that may affect existing unique grid connection arrangements.

4. Start at year 10

Given the average lifespan of a wind farm is 20-25 years, it is wise to start planning for the project's future as early as year 10.

Issues that need to be addressed early include a technical risk assessment of whether repowering or life extension is the more likely outcome for the project.

This assessment will cover key issues such stakeholder status, planning permission, site inspection, turbine inspection, a detailed maintenance review and grid connections covering the previous 10 years.

This will allow the developer to create a strategic lifetime plan for the next 10 years of a wind farm's life, identifying and prioritising the main issues that need to be addressed.

If life extension is more realistic than repowering, the developer needs to consider what can be done to ensure smarter operation of, and reduced loads on, the ageing turbines.

This will include detailed data collection and analysis of the turbines' performance, encompassing supervisory control and data acquisition (SCADA) and maintenance records (especially for major component replacement).

Thankfully, technology and experience has advanced to a point where there are now several options for ensuring smarter operation of turbines, even for ageing assets. These include the ability to:

- Introduce earlier cut-out to reduce loads on the turbines;
- Plan for strategic downtime during highly turbulent conditions;
- Retrofit condition monitoring systems (CMS); and
- Controller upgrades that allow developers to look at options like site-specific wake steering to reduce load.

5. Watch out for extra costs

Some developers base decisions on what to do with an end-of-life wind farm based primarily on cost.

Whatever the cheapest option appears to be, costs can still spiral out of control where there are onerous requirements for removing the turbines' foundations/ substructures or where landowners are bullish about lease renewals.

It is therefore important to allow for budget flexibility, whatever end-of-life option is chosen for a wind farm.

This article is based on a presentation by Fieldfisher, ENERGYPRO and RenewableUK to mark the launch of of Three Sixty Renewables , a joint venture between ENERGYPRO Asset Management and Adamas Wind, on 21 October 2021.