Age isn't just a number

Words: Neil Marshall, Advisory Lead for Onshore Wind at Natural Power

How do you solve a problem like ageing? We're now 30 years on from the commissioning of Scotland's first commercial onshore wind farm, and our sector is coming together to discuss the reality of what to do with an ageing fleet of turbines that are rapidly reaching the end of their financially useful lives.

By the end of this decade, the first tranche of utility scale wind turbines will have reached or exceeded their design life, and many will have become more expensive to maintain than the revenue they collect. By 2050, as many as 5,500 turbines in Scotland will have to be decommissioned.

To achieve the country's 2030 target, an additional 12 GW of onshore wind will be required. At the same time, it is projected to lose as much as 1 GW through ageing. This raises several questions; first, what do we do with 1 GW of turbine components when the Scottish government is committed to a circular economy? Secondly, what do we do with the prime wind farm sites that were selected due to their optimal wind conditions, grid connections and accessibility now that the turbines are no longer viable?

The task ahead requires a real cultural shift for a sector that has previously been solely focused on growth.

Decommissioning

Depending on which original equipment manufacturer (OEM) you speak to, it is believed that between 85 % and 95 % of a turbine can be recycled. To do so, a supply chain specialising in the repowering, refurbishment and re-use of turbine components will have to be quickly deployed, to avoid up to a million tonnes of industrial materials ending up in landfill. Steel from the turbine towers could be recycled and turbine

components could be refurbished, or used as training aids for colleges and universities. The greatest challenge remains in the disposal of glass fibre blades, where an effective, large-scale solution has yet to be developed. The industry must come together to find the answers. If we want to reduce the effects of climate change, we cannot be seen to generate millions of tonnes of industrial waste in the process. Realistically, however, if operators gain more from melting down materials than reusing or refurbishing, how do we encourage them to take the circular route, which may incur more costs or lesser returns? Perhaps the answer lies in policy drivers where recycling, reusing and refurbishing targets are added to decommissioning agreements, or governments are more strategic in their use of tax incentives.

The OEMs are currently exploring the issue of blade recycling, by developing different resins that can be dissolved after use to release the fibres within their wind turbine blades, making them reusable. Siemens Gamesa is looking to develop fully recyclable blades in its bid to meet its goal of making its wind turbines fully recyclable by 2040.

Vestas has announced a new process for separating the fibres and resin from its blades to allow circularity. Ørsted meanwhile is looking at reusing the materials from its blades to form fibre boards for walls and flooring. Indeed, the HS2 development has made use of worn out wind turbine blades, instead of steel, to create carbon-friendly reinforced concrete on Britain's new high-speed rail network. Silica recovered from wind turbine blades is also becoming a substitute for some of the sand and clay that goes into cement production. When used as a partial alternative to coal, it can reduce emissions up to 27%, according to GE.

There are also specialists, like ReBlade, which was the first UK company to decommission turbine blades without the use of landfill, pioneering innovative approaches to blade handling that enable circular end destinations for blade waste. The ideas are there, making them an integral part of every project lifecycle and financially viable is the challenge.

Repowering

Next, we look at the wind farms whose turbines are no longer viable. At what point should owners and/or operators start looking at next steps? There are many factors to consider. For example, when will a turbine reach the end of its profitable life, can that period be extended and what point does that OPEX become unviable? Is it better to repower, replant or decommission? Each site will present its own particular challenges and the planning involved in the next steps of development for these sites will have to be carefully considered.

There are many options. From reducing the turbine numbers per site but increasing their size, to adding complementary technology such as solar and energy storage. Our team is being increasingly questioned on this topic, along with the biggest of them all; when should we start planning for the next steps in a wind farm's life?

While there is no single answer to this as each site varies, from the expected energy yield should additional technologies by co-located, to the logistics of repowering or decommissioning equipment, the land agreements in place and the financial models on which to base future projections. What is true, is the earlier you begin asking these questions, the better prepared you will be.

When you consider the planning process timescales, five to ten years really isn't too soon. Early assessment is essential for planning and it's inevitable that pre-existing data from original planning consent work is limited. So, in essence, while you might think you have a head start with the existing infrastructure, you are really starting from scratch. In fact, there are many more complications to take into account the second time round.

The environmental considerations are more complex because we are now looking at sites with existing infrastructure that need to be considered within a planning process that is undoubtedly more stringent than it was 30 years ago.

Also, the social implications will involve careful handling. A site that is hypothetically being re-developed will potentially attract twice the volume of traffic on access routes, and new turbines that are two or three times the height of existing structures can cause controversy in local communities where the community benefit fund may well be exhausted in

terms of projects left to benefit. In such situations, we need to be very clear about the long term benefits of increased renewable energy output and the local employment opportunities brought about through repowering projects.

Planning

In Scotland, the National Planning Framework 4 (NPF4) was adopted on 13th February 2023 and now incorporates spatial planning and policy direction. As a result, NP4 will assume a greater role in the decision being made in the planning system. The strategic spatial strategy supports electricity generation and associated grid infrastructure throughout Scotland including repowering, helping to reduce emissions, and improving security of supply. This sends a clear message that additional electricity generation from renewable sources and repowering is considered a strategically important aim within NPF4. In terms of planning considerations, it lends greater weight to the policy direction supporting renewable technologies and grid resilience.

That said, it's early days, and we are still feeling our way across new territory with NP4 as the process evolves. Industry guidance is needed, and there are already calls for a more streamlined process when it comes to the planning process, for repowering in particular.

It was encouraging to see the very recent news that one of the UK's oldest onshore wind farms will soon be repowered so it can generate five times as much green electricity as it did in 1995, with almost half as many turbines.

ScottishPower's Hagshaw Hill wind farm began dismantling 26 turbines on its site in rural South Lanarkshire during mid July. This particular repowering project means the original, 28 year old, 16 MW wind farm, will have a capacity of 79 MW once complete, and will be equipped with a battery storage facility of about 20 MW to help make better use of the green electricity.

At Natural Power, we are currently awaiting a decision on a proposed repowering at Fred Olsen Renewables' Windy Standard 1 in Dumfries and Galloway. The site, which forms an integral part of an established 'cluster' of wind farm developments, currently consists of 36 wind turbines with a height of 53.5 m to tip and a combined rated output of 21.6 MW. The proposed development would more than double the generating capacity by utilising up to just eight wind turbines, each with a maximum blade tip height of up to 200 m above ground level and a combined generating capacity of approximately 49.6 MW. The outcome of the application is yet to be determined but is expected to go to full committee in September 2023.

From these two examples, we can readily see wind power technology has improved dramatically in the last 30 years and there is massive potential to increase the UK's renewable energy capacity by repowering its older windfarms using new technology.

What is noticeably clear, given demand for information requests and conversations in the industry, is that there is a strong appetite to get this right. There is however a ticking clock, so we need to start finding solutions, and quickly.

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About Natural Power

Natural Power is an independent consultancy and service provider that supports a global client base in the effective delivery of a wide range of renewable projects including onshore wind, solar, energy storage and offshore technologies.

It has a global reach, employing more than 450 staff across 14 international offices.

Its experience extends across all phases of the project lifecycle from initial feasibility, through construction to operations and throughout all stages of the transaction cycle.