

End of life options for wind generation

Current state of play and the way forward

State of the wind industry

Sustainability is at the forefront of public consciousness after COP26, with a drive for clean energy at the centre of climate action. While the next 10 years have been dubbed the 'make or break decade', renewable energy has been gathering pace in the UK for some time.

Indeed, the UK's first commercial windfarm was commissioned in 1991. As more focus is placed on renewable energy and the drive for net-zero, the need to assess the current state of the wind industry becomes more pressing. In order to truly optimise onshore and offshore wind, now is the time to ensure the infrastructure is fit for purpose — and if it isn't, to put in place the changes needed.

Today 34,000 turbines are 15 years or older, representing 36 gigawatts (GW) of onshore wind capacity. Out of these 36GW, some 9GW came from 20-24 year-old turbines and around 1GW came from turbines 25 years or older. This creates a big market for decommissioning of onshore wind farms over the next decade.¹

For onshore wind farms, there are increasing repowering opportunities, such as replacing old models with newer and more efficient models.²

¹ WindEurope Decommissioning of onshore wind turbines – Industry Guidance Document November 2020

² Ibid FN1

“ By 2050 the global offshore wind industry will decommission up to 85GW of capacity (cumulatively, and assuming a 25-year lifecycle). The oil and gas sector will likely begin to decommission today’s composite pipelines around the same time.³ ”

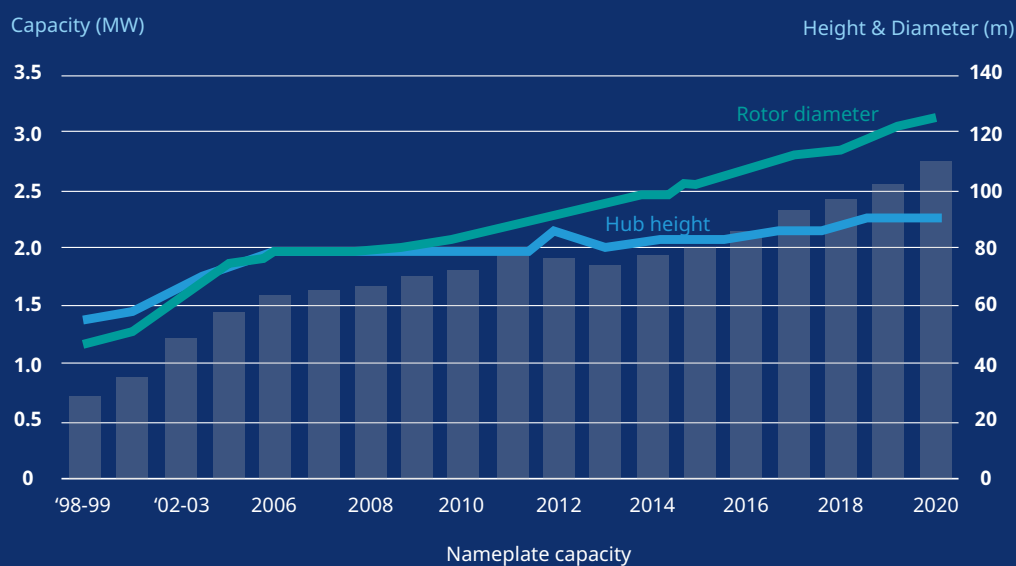
In this piece, we will explore the current state of the wind industry and the issues pertaining to turbine end of life.

³ ORE Catapult Report, ‘Sustainable Decommissioning: Wind Turbine Blade Recycling’ 7 April 2021

The future of end of life

Today, around 85% to 90% of wind turbines' total mass can be recycled. Most components of a wind turbine – the foundation, tower, and components in the nacelle – have established recycling practices. However, wind turbine blades are more challenging to recycle due to the composite materials used in their production.

Hub heights and blade sizes continue to increase — at the time of writing the longest blade stands at 108m in length. The average growth in rotor diameters and hub heights has more than doubled over the last 20 years. Not only is there a logistical challenge during installation, these blades present an ever-growing waste challenge following retirement or a loss.



Source: Office of Energy Efficiency & Renewable Energy, 2021

As corporate accountability grows, alongside the need for environmental, social, and governance (ESG) awareness and reporting, addressing the challenges associated with blade disposal is paramount. There is very little space for inaction from the wind industry with regard to discarded blades.

So what are the options when it comes to existing, aging wind farms, and when 30-40% of operational losses relate to turbine blades alone, what is the industry doing with them?

End of life

Extend

As assets age, there is growing interest in the relative cost-benefit of repowering existing sites rather than constructing new greenfield developments. The Wind Energy Technologies Office stated in their recent article:

"Wind repowering enables owners to retrofit power plants on existing sites with new and/or refurbished technology, including erecting taller, more efficient wind turbines to increase productivity. Repowered projects can often gain further cost-saving advantages, relative to new greenfield (or vacant-lot) developments, by using existing grid connections and infrastructure."

In fact, Det Norske Veritas (DNV) has developed a standard for lifetime extension of wind turbines (DNVGL-ST-0260).⁴

Repowering for onshore installations is an appealing option due to ease of access and reduced costs — offshore, on the other hand, is intricate and costly, with requiring the assistance of jack-up vessels. Repowering can potentially reduce the number of turbines by a third whilst tripling electricity output and in remaining at the original site location the repowered project can continue to experience an optimal windy environment.

WindEurope expects the repowering of ageing wind farms to be a major trend over the next decade. To date, Europe has successfully repowered at least 123 wind farms, and in the next 10 years WindEurope expects over 20GW to be repowered.⁵

Decommission

Eventually a wind turbine will need to be removed from site. Even though it is no longer capable to generate electricity it does have residual value in its component parts. It is important from both a cost and environmental perspective that such residual value is returned to the owners.

The decision to dismantle a single wind turbine or the complete wind farm can result from the following factors:

- A wind turbine generator suffering damage compromising safe operations in the area and/or an accompanying total economic loss.
- The end of the land use contracts being reached without ability to extend.
- Expiry of the operating licence.
- Continued operation no longer being economically viable.
- Repowering.⁶

Other important requirements are: a health, safety and environment management plan during decommissioning, together with a communication plan with stakeholders such as local authorities and public bodies.

⁴ Ibid FN1

⁵ WindEurope.org – What happens when wind turbines get old? New industry guidance document for dismantling and decommissioning, 20/11/2021

⁶ Ibid FN1

Decommissioning issues and options

An international standard for decommissioning wind turbines does not yet exist. However, in 2020 WindEurope launched a Task Force for Dismantling and Decommissioning to produce guidelines for sustainable decommissioning and dismantling steps for onshore wind farms.⁷

The dismantling of a wind farm is also dependant on different national guidelines for demolition. If not specified otherwise, once decommissioned, an onshore wind farm will have to restore the site to a greenfield.⁸

University of Kent's School of Engineering and Digital Arts ("EDA") has led a study that identifies c. 300 offshore wind turbines will need to be decommissioned by 2025 (within the next 3-4 years) and 1,600 before 2030.⁹

The study has highlighted the need for Government and Industry experts to focus on decommissioning strategies and associated costs. Such focus being directed towards the ability to reuse components to minimise the disposal burden of these decommissioned wind turbines.

In addition, it is key to maintain sufficient detailing of decommissioning programmes and cost estimates that would be expected for a construction programme.

Key takeaways

The next 10 years have been dubbed the 'make or break decade' for achieving the COP26 goals. With sustainability efforts ramping up, the UK – relatively advanced in its renewable energy journey – finds itself in a unique position. The UK wind industry will need to consider the following to ensure it maintains momentum on the journey to net-zero, despite its wind farms being at a later stage in their life cycles.

Assess the state of play: Is UK wind infrastructure fit for purpose? - With more than 34,000 onshore wind turbines 15 years or older in the UK, now is the time to make the changes needed in order to support the drive for net-zero.

Plan for end of life: By embracing repowering existing assets over constructing new greenfield developments could have significant cost-benefits - While decommissioning will ultimately need to take place when a wind turbine has reached the end of its life, the value of repowering ageing wind farms is expected to be a trend over the next decade.

Monitor sustainability of materials: With turbine blades and rotors continuing to grow in size, blade recycling challenges could affect ESG credentials - Turbine blades, which include hard to recycle composite materials, are at the heart of 30-40% of operational losses; establishing efficient disposal practices is paramount for progress in onshore and offshore wind.

Prepare for regulatory change: Though no international standard for decommissioning wind turbines is currently in existence, change could be on the horizon - WindEurope launched the Task Force for Dismantling and Decommissioning in 2020 to produce guidelines for sustainability for onshore wind farms. There are many decisions that your business will have to take on the journey to net-zero, lean on knowledgeable advisers, like Marsh, who can support you and offer specialist guidance.

⁷ Ibid FN1

⁸ Ibid FN1

⁹ University of Kent, 15 Feb 2021, Aging offshore wind turbines could stunt the growth of renewable energy sector



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