Briefing Paper:
Challenges to wind farm development from the Eskdalemuir Seismic Array

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Key Messages

- The Eskdalemuir Seismic Array, in Scotland is critical to global nuclear security under the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The Ministry of Defence (MOD) safeguards its monitoring capability through a **50km consultation zone (which extends into England)** and **a 10km exclusion zone.**
- Wind turbines generate seismic vibrations which have the potential to interfere with the Eskdalemuir Seismic Array's ability to detect faint seismic signals, posing challenges to the safeguarding of the array and the MODs commitment to the CTBT.
- In 2005, following the creation of the **Eskdalemuir Working Group (EWG), by Scottish Government, the MOD and industry**, the MOD set a ceiling for vibrations from wind turbines following the best science at the time. In 2014, the MOD agreed a revision **allowing 1.1 GW to be released** and the seismic array to continue to be protected. In 2018, the MOD objected to a project on the grounds it would breach previously set limits. From this point on, the MOD has objected to all proposed new developments.
- Following the 2022-2024 work of the EWG and the technical studies of Xi Engineering there has been new data and mathematics on the number of turbines that can be deployed in the zone without exceeding MOD limits. This could open **up 3-6 GWs of total capacity** based on the current best science practices. It involves creating a **Seismic Impact Limit (SIL)** for all future developments, a prediction based on the current understanding of wind farm vibration whilst continuing to protect the seismic array. This requires supporting regulation from Government, in particular the MOD as well as further work on an MOD tool and a developer tool to support engagement and management of the SIL.
- Supporting the new technical solutions at requires a significant financial commitment by the renewables industry (currently estimated to cost over £500,000) but could unlock a significant amount of potential onshore wind capacity currently in the UK. Currently there is **2.5 GW in planning** within the zone and **1 GW in scoping** and a further 2.5 GW proposed. With the potential of **£1.2m being payable to local communities** through community investment funds.[i]

Key Messages
• Immediate action is needed to align safeguarding policies with the Clean Power Action 2030 Plan's 27-29 GW ambitions, securing additional resource for the MOD and revisions based on current science. This requires collaborative efforts between the MOD, industry, and technical experts supported by the Onshore Wind Taskforce to resolve policy, regulation, funding and implementation challenges.

Background

There are a range of different factors that can produce seismic activity from natural events such as local earthquakes and atmospheric pressure to human-made factors including construction work and transportation infrastructure. These are all factors that need to be mitigated to allow for data to be collected and monitored.

The Eskdalemuir Seismic Array is a vital asset for monitoring seismic activity as part of the CTBT, requiring stringent protection from seismic noise. The MOD enforces a 10km exclusion zone and a 50km consultation zone around the Array to limit interference. Through work of the EWG and technical experts it was suggested that the 10km exclusion zone is an area that should not be developed on but that allowing development from 10- 50km in the consultation zone is possible based on the current science, maintaining the detection abilities of the Array.

Since 2005, technical studies through the EWG have allowed development in the area and have shaped the safeguarding policies of the MOD.

In 2020, a developer challenged the MOD safeguarding policy, which is first-come first-served until the noise budget was reached. This was deemed to be unlawful in its approach in a judicial review. The approach could create significant risk if definitions for terminology, such as "validation", and distinctions between the types of applications and their respective stages in the planning process, are not clearly factored into the processes determined by the MOD.

The 2023 Scottish Onshore Wind Sector Deal highlighted the need for new safeguarding approaches, based on a best science approach, as a large number of projects remain stuck in the planning stages, leading to key commitments remaining unfulfilled.
More recent science backed research indicates the possibility of 3-6 GW of additional wind capacity that could be safely developed. However, delays in verifying these findings and unresolved MOD safeguarding issues have halted development. The Scottish

Government is also considering extending the exclusion zone from 10km to 15km in recognition that projects closer to the Array use exponentially more available budget than those further away. One turbine at 10km from Eskdalemuir will use the same capacity as about 5000 turbines of the same type at 50km.[ii] This relationship arises because seismic vibrations from turbines closer to the Array experience less natural attenuation, meaning their impact on the seismic noise budget is significantly greater than turbines located farther away, where the vibrations weaken over distance.

Collaborative efforts are needed to align the MOD's safeguarding requirements with Scotland's renewable energy goals. The EWG continues to maintain these conversations and is supported by industry to find a solution.

The MOD in previous submission has stated that they are supportive of the work to be progressed by the EWG, and that this group is best placed to address ways to resolve the tension between the need to safeguard the Array and the deployment of renewable energy developments in the consultation zone.

Current challenges

Despite technical advances and new mathematics to future proof the safeguarding predictive tool, MOD safeguarding policies remain a barrier to wind farm development within the 50km zone. The current approach of first-come first-served has continued to pull on MOD resources and cause delays in agreeing the stages of a technical solution continue. The MOD team continues to rely on one internal technical expert to support this work, this not only highlights resource but leaves them in a precarious position for the future. Updating the relevant regulation and introducing the SIL will allow for aspects of future proofing this area until the MOD is able to gather more support.

The MOD's concerns over variability in turbine designs and the high cost of vibration testing for manufacturers remain unresolved. As a result, significant onshore wind capacity is stalled, impeding the progress of the Scottish Sector Deal and now potentially impacting the Clean Power 2030 Action Plan.

Solution

The MOD, industry stakeholders, and technical experts must collaborate to finalise the proposed technical solution, whilst supporting the MOD's safeguarding of the Array. This includes verifying and potentially adopting the SIL proposed by Xi Engineering, which has the potential to unlock 3-6 GW capacity. Supporting the development of an MOD tool and a developer tool to future proof the acceptable vibration limits.

The MOD should streamline the consultation processes, prioritise verification of technical studies and best science approach – in particular the baseline SIL study, and address the funding gaps through industry partnerships. Instead of first-come first-served approach members of the EWG have posed an approach that could minimize the use of MOD and other department resources at this stage.

The industry is concentrating where possible on combined approaches to Eskdalemuir, through supporting the EWG and funding where needed. It is important to acknowledge that individual developer engagement and inquires impact the MODs already constrained resources and time.

Recommendations and policy solutions

1. UK Government to develop supporting regulation to implement the Xi Engineering's Seismic Impact Limit (SIL).
2. The MOD to adopt and implement Xi Engineering's Seismic Impact Limit (SIL) framework. The MOD must verify and integrate the SIL into its safeguarding policies to unlock additional wind capacity without compromising seismic monitoring, protecting the Array.
3. UK Government to support MOD in streamlining their safeguarding processes and ensuring resource allocation. Address funding gaps and expedite technical assessments by leveraging industry contributions, tied to clear MOD responses to the validated technical outcomes.
4. UK Government to agree funding for a new supporting member to the MOD team dealing with Eskdalemuir to support the immediate and future progress of renewable development in the area.
5. Developers are prepared to fund the technical work needed but require a clear statement from MOD to ensure industry confidence.

[i] Research data provided by Muirhall Energy

[ii] Research data provided by Xi Engineering, commissioned by the EWG and Scottish Government