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Energy SSH INNOVATION AWARDS for Early Career Researchers

End-of-life challenges for the wind and solar energy sectors

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Abstract. Many wind farms are reaching the end of their consented or operational life, creating a growing need to consider how decisions should be made regarding their future. In order to achieve decarbonisation of the energy system, maintaining and expanding renewable energy remains vital. Increasing the output of existing sites through repowering (removing existing infrastructure and replacing with new) provides a clear opportunity to increase energy output, avoiding the uncertainties and potential conflicts of new sites. However, consideration needs to be given to whether infrastructure is situated in the best locations and how communities are impacted and involved in end-of-life decisions. In response to such uncertainties my research investigated how decisions regarding end-of-life procedures for solar and wind farms are considered and made by developers, landowners, and planners as well as the communities in which the facilities are located. These findings have been shared internationally with both industry and policymakers.

Why is innovative research needed?

Wind farms are starting to reach the end of their operational or consent life. When they reach end-of-life, site owners have three key options; to repower (remove existing infrastructure and replace with new), life-extend (increase the planning consent), or to decommission, removing the infrastructure. Such decisions are complicated by the use of time-limited planning consents (the UK has commonly used 25-year consents) and the pace of technological development meaning that turbines are far larger and more efficient than they were 20 years ago. There is an industry assumption that communities living near an existing wind farm will become accepting of the wind farm over time. There is also often an assumption that if the value of the community benefit fund increases then local people will not object to a repowering application. However, such assumptions fail to consider the experiences of those living close to existing infrastructure including what may have changed over time in the surrounding area. Meanwhile, the planning system appears to have given relatively little consideration to these issues. UK wind farm developers and local authority decision makers have faced difficulties in making decisions in the absence of policy. Addressing this gap, my research provided the first systematic assessment of how end-of-life decisions are made, exploring how different actors consider the duration of sites, how perceptions may change over time and how this is reflected in decision-making. These findings were then used to provide recommendations for communities, developers, planners and policymakers.

What is innovative about this research?

The research took an innovative approach through considering if changes over time in the surrounding physical, social or cultural area, or shifting opinions of the site, developer, or technology influence considerations regarding duration and end-of-life options for onshore wind and solar farms. Significantly, it revealed that the public often have little knowledge of the time-limited nature of sites or the opportunities to influence decisions regarding repowering, life-extension or decommissioning. It also revealed that local

perceptions of a site often do not change over time and that familiarity will not always lead to local acceptance. Positive responses to repowering or life-extension were found to be correlated with good community-developer relationships and identifiable benefits from the existing site. The research also revealed a range of potential end-of-life challenges, most significantly the marginalisation of publics and landscape concerns and the challenges created by an absence of end-of-life policy. It also identified the potential for infrastructure to be abandoned due to inadequate decommissioning conditions. These findings have been shared with policy and practice in the following ways:

Government policymakers

The research identified gaps in the knowledge of policymakers regarding end-of-life decision-making for this infrastructure and a desire to learn from my research. The findings directly led to the development of a policy for repowering and life-extension in Wales. The findings have also been shared with policymakers in England, Scotland and Ireland through presentations and policy briefing notes and through co-organising and speaking at a parliamentary event for MP's and industry leaders in Westminster to discuss the future of onshore wind.

Wind energy / renewables industry

The research findings were presented to an international audience of wind energy industry members at the WindEurope end-of-life issues and strategies conference 2020. This led to follow-up discussions, requests for further information and the sharing of infographics and my academic paper. These contacts will shortly be receiving a report of my research findings and recommendations. Of most interest and use to industry were the findings regarding community responses to repowering and the desire for alternative forms of community benefit.

Planning industry

Findings were shared through writing for the Royal Town Planning Institute blog and speaking at events such as the Scottish Renewables Planning for Net Zero seminar.

How does this innovation help address the Priority Questions? "Renewables" Question 33: *What drives the social acceptance and trust of renewable energy technologies; and how can local involvement in renewable energy be promoted, as part of ensuring a just transition?*

There is often an industry assumption that communities will become accepting of wind farms over time. However, this research revealed that this does not always happen. It identified a number of factors that appear to influence social acceptance and trust over the life of an existing scheme, most notably good relations between the community and developer and recognisable and meaningful community benefits. From these findings recommendations were provided to developers at international industry conferences and through blog posts, infographics and videos. The recommendations advise developers to engage with communities over the life of an existing scheme, providing opportunities to address concerns and misinformation rather than only engaging during planning applications. The research findings have been used to highlight the need for improved local involvement in repowering, suggesting that communities need to be involved from the very start of a repowering scheme, having the opportunity to shape both the design of the scheme and the form of community benefits. The recommendations on community benefits and involvement have been shared with policymakers in England, Wales, Scotland and Ireland through presentations and briefing notes. I am currently also advising Scottish Government on their new onshore wind policy, with a focus on community benefits and involvement.

"Renewables" Question 50: *How can renewable energy installations support the rural development of the communities hosting them?*

The research enabled an exploration of how rural communities have benefitted (or not benefitted) from living with a local wind farm for 20-25 years. There is an industry expectation that communities will benefit from a community benefit fund. This research revealed that while in some cases community benefit funds have been hugely valuable to rural communities, in other locations communities feel that they have not benefitted. It identified that community benefit funds have not been well used in some locations, particularly where very small communities have one or more large

community benefit funds and not enough community projects. In such cases there is a desire for other forms of benefits such as reduced energy bills or co-ownership. The research highlighted the importance of using end-of-life as an opportunity to reconsider how renewable energy installation can benefit the rural development of the local community. This recommendation has been shared with industry through speaking at international wind industry events, creating infographics, blogs and videos and through a forthcoming report. It has also been shared with policymakers through a policy brief and presentations. Additionally, I am currently undertaking a small co-produced research project with the community energy sector in Wales to explore the potential opportunities and barriers to community co-ownership of wind farms during repowering. The findings will be shared in a report for wind farm developers and a policy brief will be provided.

"Renewables" Question 47: *What types of policies should be implemented to ensure a good outcome and fair distribution of costs and benefits of renewable energy?*

The research revealed the need for a more detailed end-of-life policy for onshore wind farms. It identified that greater weight needs to be given to community opinions during repowering and life-extension, particularly in cases where communities were 'promised' that a development would be removed after 25 years. It suggested that repowering should also provide an opportunity to consider different forms of community benefit. It also raised the need to consider the development of new as well as existing onshore wind sites, as not all sites will be suitable for repowering. It recommended greater support for local authorities as local authority decision-makers have struggled to make decisions on repowering due to the lack of policy and guidance. Finally, it revealed the challenges of using 25-year planning consents and the need for a policy to address the issue of sites that do not have adequate decommissioning conditions. These recommendations were shared through a policy briefing note and presentations to policymakers in England, Wales, Scotland and Ireland. They have also been shared with the planning industry through blog posts (e.g. the Royal Town Planning Institute blog) and speaking at online events.