

Winner of the Award for Innovative Findings



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.

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 on the existing site), or to decommission, removing the infrastructure. However, despite the mounting urgency of renewable energy end-of-life issues, there has been a lack of consideration of how these decisions should be made or of what has been happening so far. The majority of social science research has focused on renewable energy project decision-making at the point of granting planning consent. In doing so existing research has largely ignored key temporal processes such as how the site or perceptions of the site may change over time, the implications of repowering or site closure for energy policy, or the factors shaping whether redundant equipment is actually removed. Such considerations are crucial for planning the long term future of renewable energy generation. From a social acceptance perspective, research has generally assumed that local acceptance will increase over time.

However, most research has only looked at changes in perceptions from pre-construction to shortly after construction, lacking consideration of how local perceptions may change over the full operational life of a scheme. Such considerations are crucial if we are to ensure that renewable energy deployment adequately considers inter-and intra-generational justice.

What is innovative about this research?

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. It drew on planning theory and sociologies of time to explore whose interests are included and excluded in that process and with what consequences. It also considered if changes over time in the surrounding physical, social, cultural or perceptual area, or shifting opinions of the site, developer, or technology influence considerations regarding duration and end-of-life options. It involved:

- An analysis of all relevant UK planning and energy policies.

- Data on the age and status of all UK wind farms, incorporating details of existing repowering and life-extension applications.
- In-depth case study research into four wind farms and one solar farm, including in-depth interviews with all relevant actors (developers, planners, opposition groups, communities etc).
- Surveys of residents living within 3.5km of two wind farms.

More broadly it set out a new research agenda, revealing the need to understand the long term lived experiences of those living close to renewable energy sites and how end-of-life decisions are made.

The results provided novel insights into how decisions are formulated, what interests are being reflected and what interests risk being left outside of decision-making. It revealed that the public often have little knowledge of the time-limited nature of sites or the opportunities to influence end-of-life decisions. 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. It also revealed a range of potential end-of-life challenges, most significantly the marginalisation of publics and landscape concerns and the challenges created by a lack of end-of-life policy. Additionally it identified the potential for infrastructure to be abandoned.

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?*

This research provided a new dimension to understandings of the social acceptance of onshore wind through investigating how the perceptions of local communities change over the life of operational wind farms. In doing so it revealed that the common assumption that acceptance will increase over time due to familiarity, will not always occur and thus acceptance should not be assumed. It revealed 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. It provided suggestions of how communities should be involved both over the life of an existing scheme and during repowering and revealed the challenges that arise when communities are not involved. The findings have been presented to developers at international industry conferences. The research 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 importance of meaningful community benefits has also been emphasised as not all communities will benefit from a traditional community benefit fund. 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. It also identified that not all sites will be suitable for repowering. These recommendations have been shared with policymakers in England, Wales, Scotland and Ireland.

"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. It revealed that in some cases community benefit funds have been hugely valuable to rural communities, particularly in less affluent areas and where communities feel that they can ask developers for support with local projects. However, the research also revealed that in other locations communities feel that they have not benefitted from an existing wind farm. 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 community 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 both industry and policymakers as well as academic audiences. Additionally, as a follow up to this project, I am currently undertaking a small research project with the community energy sector in Wales to explore the potential for community co-ownership of wind farms during repowering.

“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, adding an important temporal dimension to existing policies. It provided a number of recommendations for policymakers to ensure a good outcome and fair distribution of the costs and benefits of onshore wind. Firstly, 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. Secondly, it recommends greater support for local authorities. The findings identified that local authority decision-makers have struggled to make decisions on repowering due to the lack of policy and guidance and were particularly unsure of how much weight to give to local community views. The research identified the need to specifically involve communities in end-of-life decision making including in the design of a repowered scheme and through enabling them to specify what form of community benefit would be of value to them. It also raises the need to consider the development of new as well as existing onshore wind sites, as not all sites will be suitable for repowering. Finally, it revealed the challenges of using 25-year planning consents and particularly the need for a policy to address the issue of sites that do not have adequate decommissioning conditions in order to prevent abandonment.

