End of life decisions for wind farms: An opportunity for climate action and for energy communities

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Introduction

What happens to the old wind turbines ?

Repowering

Decommissioning

Life-Extension

CERTIFICATION OF LIFETIME EXTENSION

WindGuard Certification shows you condition and potential of your wind turbine

WINDGUARD Certification

Commissioning

Certificate of Lifetime Extension

Decommissioning

Type certified design lifetime (typically 20 years)

Lifetime Extension

Total Operating Lifetime

Image Lifetime Extension – Certification: © WindGuard Certification
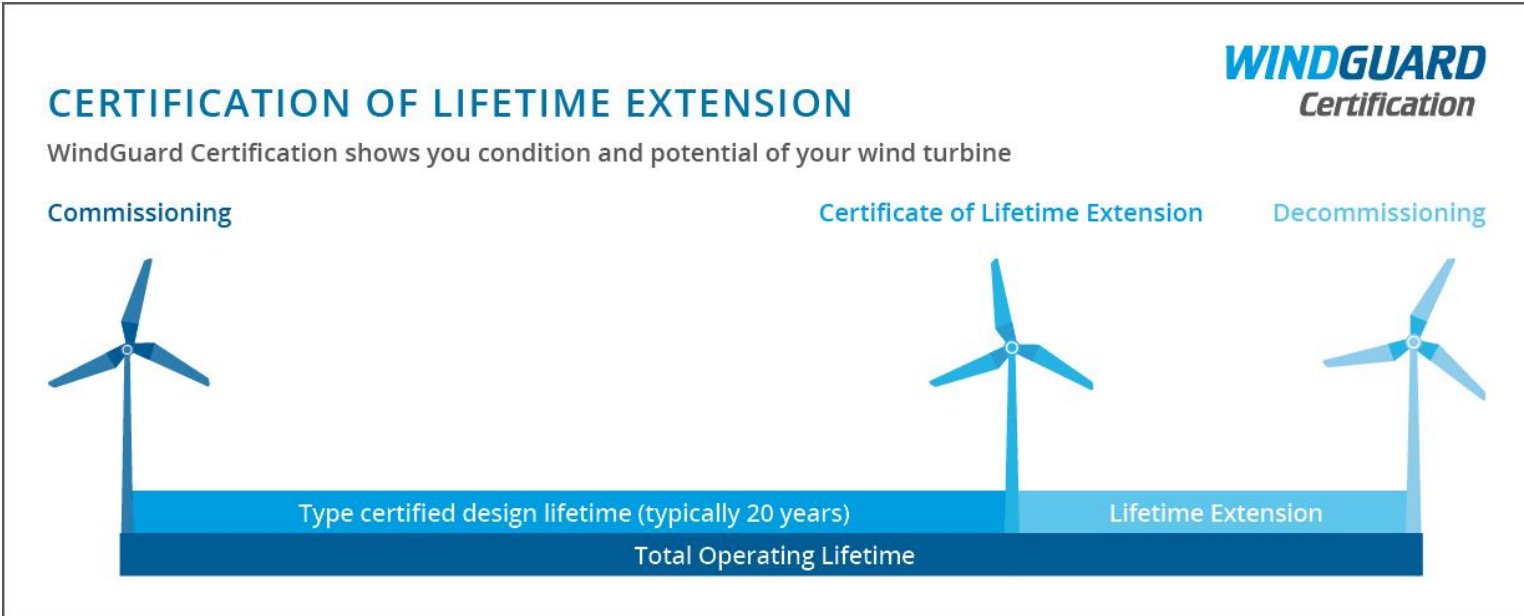
What to consider at the end of life

Operating permits
- A need for new permit
- Life extension certification

Electricity markets (price, regulatory policies, demand)
- Any regulatory support
- Electricity price trends
- Forecasted demand

Turbine condition (O&M, Availability, Profitability)
- What are the failure rates
- How high are the O&M costs
- Any financial risks involved
- What about risk to people and the environment

What end of life choice is economically viable?
- Decommissioning
- Life-extension
- repowering

Energy communities
- Community engagement
- How does it impact end of life choices

Two Research Objectives

1. To create a decision support tool which wind farm operators can use to estimate the financial outcomes from three alternatives (repower, life-extension, or decommission) and assess their risk profiles.

2. To investigate on the opportunities and challenges of co-investment between local communities and wind farm operators (creating energy communities).

1ˢᵗ Objective

- Article Published; The Boolean Journal; "Wind Value, end-of-life decisions for wind farms".

- Journal Paper Revised; Applied Economics Journal; The Financial Risks from Wind Turbine Failures: A Value at Risk Approach

- Conference Paper Accepted: How electricity markets affects the end-of-life decisions for Irish Wind Farms; A real option analysis.

Objective 2

Community risk preferences for investing in wind energy projects

Motivation of the Study

- The global shift towards sustainable energy sources has accelerated the development and deployment of wind energy projects.

- However, the successful implementation of these projects often hinges not only on technical and economic factors but also on the social acceptance and participation of the local communities.

- Understanding community risk preferences is crucial for the success of wind energy industry

Enhancing Community Engagement: Identifying community risk preferences allows policymakers and developers to tailor communication and engagement strategies, fostering an inclusive decision-making process that addresses local concerns and preferences.

Reducing Opposition and Increasing Support: Studying community risk preferences helps mitigate perceived risks like environmental impact, noise, and aesthetics, reducing opposition and increasing support for wind energy projects.

Promoting Social Equity: Understanding community risk perceptions ensures equitable distribution of benefits and burdens, fostering trust and long-term cooperation between developers and communities.

Addressing Uncertainties and Building Resilience: Studying community risk preferences identifies concerns and builds resilience, contributing to the stability of the renewable energy transition.

Facilitating Policy Formulation: Policymakers require comprehensive data on community risk preferences to formulate effective policies and regulations.

Improving Project Design and Implementation: Insights into risk preferences guide the design and implementation of wind energy projects, aligning them with community expectations to enhance feasibility and sustainability.

Research Questions

1. What are the energy community's risk preferences on wind energy investment?

2. What factors affect these risk preferences

Literature

Risk preferences on wind energy investments.(30th May 2024)

212 documents on Scopus when searching "Risk preferences on renewable energy"
176 articles
13 conference papers
11 reviews
7 book chapter
1 conference review
1 letter
1 editorial
1 short survey
1 Retracted

An analysis of the factors affecting Irish citizens' willingness to invest in wind energy projects (Sirr et al., 2023).

- Market acceptance is evident in the case of local wind energy projects.
- Citizens are found to prefer local over non-local or portfolio investments.
- Financial investment experience is found to affect citizens' investment decisions.
- Income and wealth are found to affect the size of citizen investments.
- Policies may be needed to ensure shares are affordable.

Study Questionnaire design

Government structure- Chinese people take significantly higher financial risks than Americans. This is because of the "cushion hypothesis", collectivist society will take risk as there will be help if things goes wrong (Hsee and Weber, 1999).

(Ireland, China, Tanzania)- for this study?

Social and Demographic factors -(Age, Education, Sex, Income, Occupation, Proximity to wind farms, and Location.)

Non-financial Risk factors (knowledge of climate change and climate targets, choice of energy sources, electricity provider,)

Risk taking attitudes - Higher order risk preferences are important determinants of choices under uncertainty. has a useful set of questions that looks at moments of returns (Colasante and Riccetti, 2020).

Methodology

Structured Questionnaires

Why?

- **Consistency-** all respondents answer the same questions in the same way.

- **Easy of Analysis** -easier to quantify responses and perform statistical analyses.

- **Data comparability-** uniformity in questions allows for direct comparison of data across different respondent groups or time periods.

- **Efficiency-** can be quickly administered to many respondents, making them efficient for large-scale surveys.

Methodology

Pre-testing: Conducted a pilot test to refine questions and ensure clarity.

Survey Distribution: Online survey

Data Cleaning - Use Exploratory Data Analysis (EDA) techniques to understand the data distribution, moments of return, correlations, and basic patterns. This can involve visualizations like histograms, box plots, and correlation matrices

Data Analysis: Quantitatively, machine learning for causal analysis
- Propensity Score Matching
- Causal Forests
- Instrumental Variables

Pre-Testing Survey (Trial)

- We conducted a community meeting and facilitated in person interviews.

- 20 respondents

- Location –MALIN HEAD IRELAND

Pre-Testing Survey (Trial)-Challenges

- The risk attitudes questions are somewhat tricky, for online survey respondents may end up guessing the answers

- Risk attitudes questions are many (15 questions), its tiring for respondents.

- Sample Size (Is having three countries viable?)

- How to get respondents? Apart from the link in wind value website

Risk attitudes QUESTIONNAIRES

Please choose the option for which you have a preference from the following scenarios. Each scenario requires a single choice

16 .You have the opportunity to participate in a lottery in which you have an equal chance (50%) of winning €100 or winning nothing. There is no fee to take part.
Option A: you participate in the lottery
Option B: you do not participate.
Skip to Next Question

17.You can choose between two investments:
Option A: offers an equal chance (50%) to gain €5 or €15
Option B: offers you a certain gain of €10.
Skip to Next Question

18. Suppose you have been fined and you have the opportunity to choose between two alternatives.
Option A: pay a fine of €10
Option B: have an equal chance (50%) of paying either €5 or €15.
Skip to Next Question
19.You may decide to participate to a lottery in which you have an equal chance (50%) to gain or lose €5000.
Option A: you will take part in the lottery
Option B: you do not participate.
Skip to Next Question

19. You may decide to participate to a lottery in which you have an equal chance (50%) to gain or lose €5000.
Option A: you will take part in the lottery
Option B: you do not participate.
Skip to Next Question

20. You may decide to take part in a lottery in which you have an equal chance (50%) to gain or lose €5.
Option A: you will take part in the lottery
Option B: you do not participate.
Skip to Next Question

7. What renewable energy technologies are available in your region?
Solar energy
Wind energy
Hydroelectric power
Geothermal energy
Biomass energy
Others, enter your answer ....

8. What is the main deciding factor in your choice of electricity provider? Single choice.
Price
Renewable Energy
Combination of Price and Renewable Energy
Skip to Next Question

9. Approximately, what is the distance from your home to the nearest renewable energy technology? Single choice.
Less than 1km
1km-5km
5km-10km
More than 10km
Skip to Next Question

10.What option below do you believe most accurately describes the purpose of renewable energy technologies? Single choice
Profitable Business
Climate Change Solution
Electricity Generation
Skip to next question

projects? Single choice.
Very likely
Somewhat likely
Neither likely nor unlikely
Somewhat unlikely
Very unlikely

12. If you were to consider investing in a renewable energy project, what is the minimum rate of return you would expect to receive on your investment annually? Single choice.
0%-5%
5%-10%
More than 10%
The return on investment is irrelevant, I would not invest in a renewable energy project.
Skip to Next Question

13. If you were to consider investing in a renewable energy project with an attractive rate of return, what is the maximum amount you would be willing to invest? Single choice.
1-20,000
20,000-50,000
More than 50,000
Nothing, I would not invest in a wind farm project
Skip to Next Question

14.Are you aware of the World emission reduction targets? Single choice.
Not Aware
Somewhat Aware
Very Aware
Skip to Next Question.

QUESTIONS / SUGGESTIONS?

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