

Thesis Project Portfolio

Active Control of Wind Turbine Blades to Increase Efficiency

(Technical Report)

Exploring the Ecological Impact of Wind Farm Development

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

Astrid Henkle

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Department of Mechanical and Aerospace Engineering

Table of Contents

Sociotechnical Synthesis

Active Control of Wind Turbine Blades to Increase Efficiency

Exploring the Ecological Impact of Wind Farm Development

Prospectus

Sociotechnical Synthesis

With the speed at which the wind industry is growing, it is important to ensure that wind turbines are as efficient. The consumption of wind energy grew from 14% of renewable energy consumption in 2019, to 26% in 2020. Turbines are constantly growing in size and my technical project sought to find a way to improve on existing turbines and allow smaller turbines to create more energy. To do this we created an active control system that widens turbine blades to maximize energy production over a wide range of wind speeds. This project and the wind energy industry as a whole are an essential part of ameliorating the growing impact of human activity on the environment and therefore the human and social dimensions are important to take into consideration. To further explore wind energy, my research topic focused on the ecological implications of wind farm operation. This research was analyzed using the framework of Responsible Innovation, specifically focusing on the topic of sustainability. To conduct this research, I analyzed case studies focused on the ecological impact of wind farms on their surrounding environments throughout their installation and operation. To further this, I also assessed how these impacts are outweighed by the positive effects of wind energy usage. Through this research I found that even though wind energy is a clean energy source, there are still negative impacts that their construction, yet despite these findings, the positive implications of switching to renewable energy sources, like wind, outweigh the negative impacts. Because of the nature of climate change, wind turbines should be evaluated from a present but also future perspective to fully gauge their influence on the environment. As the wind industry grows it is important to understand its interactions with the environment and the steps that can be taken to help wind become a more efficient and prominent energy source, be that through careful consideration of siting or implementation active control systems.