

Public Summary

Wind turbine design suitable for social acceptance in residential environments in The Netherlands

The current energy transition, aiming to shift from fossil-based fuels to renewables is essential for reducing carbon emissions. It now faces challenges like high costs, infrastructure needs, and the intermittent nature of renewable sources. Social acceptance and regulatory barriers also slow progress, requiring innovative solutions and policy support.

Residential wind turbines can be a valuable addition to generate clean energy, but they are currently not used to their full potential on urban and residential settings. Therefore, a thorough investigation was conducted to identify the factors and social acceptance issues that hinder residential wind turbines from becoming a common household solution, with a focus on developing these insights from a socio-economic perspective.

This thesis was carried out in collaboration with AXAL Power B.V., which aims to develop a novel small scale wind turbine designed for residential use in order to accelerate and “future proof” homes for the energy transition. This wind turbine will serve the dual purpose of generating renewable electricity at home to better suit the new coming challenges of the current energy transition by mainly focusing the electricity production to charge electric vehicles or home batteries. One of the major challenges with renewable energy technologies is the gap between production and consumption locations, as well as the mismatch between production and consumption times. To address this challenge, the wind turbine will mainly direct its production of energy to a bidirectional EV charger or a home battery, enabling to store excess energy in batteries for later use of electricity.

The importance of answering the research question brings us back to the energy transition. In the coming years, we will experience a change in the way we produce, use, transport and store electricity. This energy transition is a serious challenge and will only be solved with the help of several renewable energy technologies. Unlike fossil fuels, renewable energies are much less energy dense, therefore needing several sources like solar, wind or hydrogen to power our needs. As mentioned, we will change our ways of dealing with energy, potentially using our electric vehicles as a way to store renewable energy for later use. This, among many other solutions will allow a more sustainable future that is not dependent on fossil fuels.

The paper dives into the research, analysis and development of a solution for a residential wind turbine that aims to have a high chance of acceptance by consumers. With a focus on customer-centered design, the solution has been developed to meet the target customer’s needs.

The key barriers to adoption were identified and a proposed technical solution that address these primarily social concerns, while still meeting the necessary technical requirements was developed. In conclusion, the ongoing energy transition highlights the need for clean and decentralized energy sources to meet our energy demands. Although there is a presence of social acceptance challenges and technical obstacles, there is significant potential for widespread residential wind harvesting; provided it is approached in the right way.