Thesis Project Portfolio

Automated Solar Panel Cleaning

(Technical Report)

Solar Panel Electronic Waste

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Introduction

This synthesis examines the intersections between the technical report aimed at designing an automated solar panel cleaning device and the research report focused on solar panel electronic (e-waste) and recycling. Drawing from the Social Construction of Technology framework, the ways in which the technical and social dimensions interact are examined, while emphasizing potential impacts on solar panel lifespan, e-waste, and holistic sustainability of solar energy infrastructures.

Solar energy, a hugely important portion of renewable energy initiatives, encounters challenges at the nexus of technology, society, and environment. Solar energy requires solar panels containing photovoltaic cells in order to be captured and converted to useable electricity. As these solar panels become more pervasive, concerns have arisen about their lifecycle, maintenance, and eventual waste. The technical project of creating a prototype cleaning device and the research on solar panel e-waste and recycling elucidate these concerns.

Technical Report: Automated Solar Panel Cleaning

The primary objective of the automated solar panel cleaning device is to maintain the efficiency of solar panels. Dust, debris, and other obstructions can reduce the efficiency of solar panels. Maintaining the efficiency of the panels could also prolong the functional life of solar panels. A dedicated device ensures consistent and effective cleaning, aiming to sustain optimal performance.

The device not only offers a technical solution to the problem but also has broader societal implications. Regular maintenance can reduce the frequency with which panels need

replacement, potentially delaying or mitigating the volume of e-waste generated by solar panel replacement.

Research Project: Solar Panel E-Waste and Recycling

As solar panels reach the end of their lifecycle, they contribute to the mounting electronic waste problem. The materials within panels, if not adequately managed, can become environmental hazards.

Research indicates that the lack of robust recycling mechanisms leads to accumulating e-waste, prompting concerns over land use, toxic leaching, and resource inefficiency.

Intersections

The cleaning device's potential to enhance solar panel lifespan interfaces directly with the e-waste challenge. By delaying the need for replacements, the device indirectly contributes to reducing e-waste generation rates for solar panels.

Beyond delaying waste, the device, when considered in tandem with recycling research, points towards a holistic approach to solar panel lifecycle management. Clean, efficient panels reduce the demand for new panels, while effective recycling can reclaim valuable materials, forming a sustainable lifecycle for solar panels.

The development of the cleaning device can improve the efficiency of solar panel maintenance. In turn, emphasizing solar panel recycling research can catalyze societal conversations about sustainable energy consumption and waste management.

Conclusion

The convergence of the technical report and the research report reveals the inextricable links between technology design, societal practices, and environmental implications. By viewing the prototype solar panel cleaning device and the e-waste research as components of a larger

sociotechnical system, we can discern potential pathways to foster sustainable and responsible solar energy practices.