Thesis Project Portfolio

Automated Solar Panel Cleaning

(Technical Report)

An Analysis of the Influences Impacting Individuals Understanding of Global Climate Change

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Executive Summary

Introduction:

The focus of the design portion of the capstone project is to create an automated solar panel cleaning mechanism that stays attached to the solar panel. Automated solar panel cleaning mechanisms can ameliorate the need of having manual expertise labor which requires climbing on top of the roof to clean. The STS research paper studies how an individual is influenced by outside actors. Individuals can drive change and being educated on where their perception of climate change comes from and how they receive information is important in decision making. The research complements the capstone project as individuals should be aware of how their previous knowledge, or the way information is presented impacts their assessment of new technologies that are designed to assist carbon-neutral transitions.

Summary of Capstone Project:

Solar photovoltaic (PV) systems convert sunlight into electricity using solar cells. Solar Panels have decreased in cost since 2014 and are becoming a cost competitive energy source with more households and businesses using them on top of rooftops. Cleaning solar panels is necessary so that there is no energy loss from dirt, debris, or bird droppings blocking sunlight. The current state of the art to clean a solar panel involves hiring experts to climb up the roof and clean with water and a brush. The goal of the capstone design project is to design an automated cleaning mechanism that can stay attached to the solar panel and eliminate the need for climbing on to the roof every time a solar panel needs to be cleaned. The device must cost less than $600 to make and built to last against weather conditions such as sun, water, and snow. The safety of the attachment to the roof is important and must last against wind conditions. The goal of the automated solar panel cleaning mechanism design is to have a low cost, safely attached, weather durable, efficient cleaning device.

Summary of STS Research Paper:

The subject of the STS research is to study the relationship individuals have with global climate change. The STS research addresses the following research question: what are the influences that change an individual's perception of climate change? The Wicked Problem Framework is used to analyze the question since global climate change is a tangled-up issue with no easy solution. There are five groups analyzed and separated by topic: social media and news media, marketing and consumers, fossil fuel industry, government and policy, and beliefs and the individual. By defining the groups that have the power to change a person's perception and the method those groups use, individuals can be aware of how they are influenced and start to define what powers they have in acting against global climate change.

Concluding reflection:

Working on the capstone project has introduced me to creating a design from start to finish and has shown me the numerous considerations made before choosing a final design. The research project has taught me a lot about what influences my perception of climate change as well as the way I react to information presented to me. Understanding societal influences has allowed me to understand the obstacles in the sustainability movement. Designing a new mechanism to assist in solar technologies has shown me the challenges in creating a cost-effective product that is also sustainable. By studying both the social and technical challenges in transitioning towards sustainability engineers can understand their impact on the environment and society.