Thesis Project Portfolio

Design of User-Friendly Electrodes for Real-Time Coating Condition Monitoring

(Technical Report)

The Impact of Public Opinion on Nuclear Energy Projects

(STS Research Paper)

An Undergraduate Thesis

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Table of Contents

Sociotechnical Synthesis

Corrosion impacts performance, safety, and cost of transportation vehicles. Thus, many vehicles such as the HH-60W Combat Rescue Helicopter (CRH) are coated with corrosion-resistant paint. However, testing the health of such paint has only ever been done destructively, meaning that the coating cannot be used after it is tested. Furthermore, many current coatings use chromium as a corrosion inhibitor. However, this material is highly carcinogenic. Different coatings are being explored with the goal of maximizing material performance without compromising operator health. Our capstone group aimed to aid the construction of a real-time, non-destructive device to test coating integrity. We performed research optimizing the material selection and geometries of user-friendly electrodes which could be permanently attached to the outside of a CRH and used to conduct electrochemical impedance spectroscopy tests. These tests will allow detection of coating defects before they develop into failure-inducing flaws.

Another technology which aims to maximize performance without compromising health is nuclear reactors. However, the success of nuclear projects varies greatly, from successful operation to denied-at-proposal to built then shut off early. I examined how public perception impacts the outcomes of nuclear energy projects in the United States. Everett Roger's Attributes of Innovations and their Rate of Adoption was the framework selected for my analysis. This framework breaks down how an individual or group's perception of a technology changes the speed with which they accept and use it. Thus, I used people's goals and affiliations to categorize them into different social groups and analyze each group's perspective on a given nuclear energy project. My research was conducted via case study analysis, comparing instances where nuclear projects were successful against instances of failure (shut down post construction or terminated before construction completion). I used Roger's framework for each case and justified why each project succeeded or failed. I found that public perception impacted the actions of elected officials. The cases examined showed that financial factors and safety concerns could change public opinion enough to terminate projects despite emission concerns. However, when organizations could put the construction financial burden on consumers, projects were more likely to be approved, despite such financial burdens being far beyond anything reasonable. Thus, it is the government's responsibility to protect consumers from such exploitation while still pushing for clean energy.

Both projects promoted the use of safer technologies. Through my capstone, I aimed to facilitate the decreased use of carcinogenic chemicals in protective coatings and then aimed to explain why nuclear projects failed, hopefully allowing for precise efforts which would increase the success rate of future projects and decrease global emissions. Together, I hope my efforts will help produce a safer, brighter future.