

Thesis Project Portfolio

A Systems Methodology for Informed Solar Energy Decision-Making

(Technical Report)

**Empowering Progress: The Intersection of Policy, Technology, and Community in U.S.
Solar Adoption**

(Research Paper)

An Undergraduate Thesis

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Jack Dreesen-Higginbotham

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Department of Systems and Information Engineering

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Introduction

My technical capstone project and STS research paper collectively explore the domain of solar energy adoption, but from two distinct yet complementary perspectives. In the technical capstone, alongside developing the model, my team and I engaged in comprehensive consultations with the YMCA to understand their specific energy needs, aspirations, and constraints. This model simplifies the complex decision-making process by providing clear, data-driven insights tailored to their specific operational needs. Meanwhile, my STS research takes a broader view, investigating how social, technological, and policy dynamics influence the adoption of solar energy across different communities and sectors.

Capstone Project

My capstone project, undertaken as part of a collaborative team with civil engineering students, focused on assisting the local YMCA in assessing the feasibility and potential benefits of adopting solar energy. This initiative was driven by the YMCA's commitment to sustainability and their interest in reducing operational costs through renewable energy sources. The project involved the development of a sophisticated decision-making model tailored to analyze the specific energy requirements, financial constraints, and structural capabilities of the YMCA facilities.

The model provided a comprehensive evaluation of different solar installation options, incorporating factors such as cost-benefit analysis, potential energy savings, and environmental impact. We utilized various data sources, including historical energy usage data, solar irradiance

levels in the region, and financial incentives available for renewable energy projects. The team also conducted site visits to better understand the physical layout and existing infrastructure, which were crucial for customizing our recommendations.

Research Paper

In my STS research paper, I explore the diverse factors that influence the adoption of solar energy in the United States. Through an extensive literature review and case studies, I analyze the impact of governmental incentives like the Federal Investment Tax Credit and various state-specific programs that encourage solar energy adoption. I also consider the impact of technological innovations in photovoltaics that have made solar more accessible and cost-effective. Furthermore, the research discusses the significant role of community-led initiatives in increasing solar adoption, emphasizing the importance of public engagement and societal values in shaping energy policies.

Utilizing the Social Construction of Technology (SCOT) framework, I delve into how solar technology adoption is shaped not only by engineering and economic factors but also by social dynamics and stakeholder interactions. This approach provides a nuanced understanding of the sociotechnical barriers to solar energy adoption, such as socioeconomic disparities and the technical challenges of solar power intermittency. My research emphasizes the complexity of solar energy adoption as a sociotechnical phenomenon, shaped by a complex array of policy, technological, and social factors. The findings advocate for inclusive and equitable policies that promote a broader and more sustainable energy transition, beyond mere technological adoption.

Conclusion

Working on both my technical capstone project and STS research has been an invaluable experience that deepened my understanding of the complexities involved in solar energy adoption. Developing a decision-making model for the YMCA allowed me to apply technical knowledge and analytical skills in a real-world setting, giving me a practical perspective on the challenges and considerations specific to implementing solar technology. Meanwhile, my STS research provided a broader view of the sociopolitical and technological landscape, revealing how various forces like policy, community action, and technological progress intersect to shape solar energy adoption. The insights gained from both projects have underscored the value of integrating technical solutions with sociopolitical awareness. This has encouraged me to advocate for strategies that are not only technologically sound but also socially responsible, aiming to create energy solutions that are accessible and beneficial for all members of society.