SOCIOTECHNICAL SYNTHESIS

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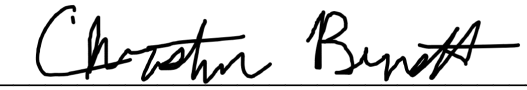
Signature  Date 07 May 2022
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Socio-Technical Synthesis

Over the past several decades, global dependence on fossil-fuels have resulted in disastrous environmental consequences. To prevent irreparable damage to both local ecosystems and the entire planet, immediate action needs to be taken to reduce fossil fuel usage. The increase in reliability and feasibility of renewable energy sources will be critical in adjusting global infrastructure to reflect these goals. One of the most promising sources of "green" energy currently being developed is bioethanol. Bioethanol blended gasoline significantly reduces tailpipe emissions from automobiles, severely limiting the amount of harmful greenhouse gases being released into the atmosphere. The current market for bioethanol is not sufficient to make the large-scale production economically feasible. Creating a bioethanol plant that is economically sustainable involves significant tradeoffs in terms of production and resource usage. It is important to be cognizant of the impact that design considerations will have on various externalities and stakeholders. Examining the process of designing an optimized production facility for bioethanol is critical in helping to combat the global climate challenge.

The technical report focuses on the design of an economically optimized bioethanol production facility. The goal of the plant is to transition farm-grown corn into two primary products: fuel-grade ethanol and Distiller Dried Grains and Solubles (DDGS). The plant is designed under the specifications of producing 150,000,000 gallons of ethanol annually. The DDGS is the recovered and dried corn mash that the ethanol is produced from; this side product is sold as an animal feedstock to minimize process waste and offset process costs. The technical report analyzes the creation and design of all equipment involved in the corn's journey from start to finish. Economic and energy analysis of each individual piece of equipment, as well as the

overall process, is performed. Based on the findings of the technical work, it has ultimately been concluded that construction of the given plant design should not occur. Although the plant achieves its goal of turning an economic profit, the design has it operating at a severe energy deficit. The energy going into utilities and heating for the process are not obtained from "clean" energy sources. Since the plant is consuming more energy than is produced by the ethanol product, it defeats the purpose of attempting to produce "green" energy.

The socio-technical discussion examines the environmental and ethical considerations that need to be considered in the domestic and global expansion of the bioethanol market. This involves examining the tradeoffs between profitability and environmental feasibility. The environmental strain associated with the production and harvesting of corn is detailed and considered alongside the increasing land requirements of a growing industry. By analyzing the current energy market and the state of renewable infrastructure, projections of the impact of expanding markets can be made. Further economic analysis can be done by considering the role of government subsidization and market volatility. It is ultimately concluded that a need to restructure the societal notion of "green" energy is important to battling climate change. The implementation of a successful plant requires a delicate balance and compromise between all stakeholders involved. Finding a middle ground between environmental impact and economic profitability is crucial to paving the pathway forward for bioethanol in global markets.

Overall, both projects harmonize to emphasize the importance of bioethanol, and renewables, in the battle against climate change. Further development and research in bioethanol production tactics could yield more energetically and monetarily favorable results. One area of exploration is the balance between high-gravity and low-gravity corn slurry mixtures and their

contributions to product yield and energy requirements. By working to create ethically sound, profitable bioethanol facilities, the world marches towards a more environmentally safe future.