

**Thesis Project Portfolio**

**Liquor-Based Canned Cocktail Production: Fizzy with the Rizzy**

(Technical Report)

**Nuclear Fusion: Learning from Nuclear Fission's Mistakes to Reach Closure**

(STS Research Paper)

An Undergraduate Thesis

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## **Sociotechnical Synthesis**

Nuclear fusion and canned cocktails: One has the ability to drastically change the entire energy market by offering the potential to provide cheap, clean energy with very few downsides, while the other is a fun, portable, and refreshing drink that has become increasingly popular in recent years. Not much is shared between these two technologies other than my interest in the design and history behind both technologies. My technical topic revolves around the design and creation of a distillery for the production of canned cocktails while my STS research analyzes the issues, conflicts, and setbacks experienced by nuclear fission in policies and public perception to help guide nuclear fusion towards a more successful clean energy future. Other than interest, I chose to work on this technical topic not only because it was one of the only projects that had a realistic chance of being economically viable, but also because it was one of the only projects that had a clear definitive goal from the start – to make a profit. Economics seemed to matter much more on top of the design work we produced which made the project more engaging and meaningful to me. Similarly, I developed my STS research project due to my interest in energy and the environment. Nuclear fusion has been talked about for many years, but only recently has it had any possibility of being feasible. Being on the verge of an energy breakthrough that could seemingly solve the immense problem of cheap clean energy that meets heavy demand is astonishing. Even more so, this breakthrough has the potential to be held back by fears surrounding nuclear fusion's close relationship with nuclear fission and the drawbacks of it. I hope that my STS research paper will help resolve some of these fears and set apart nuclear fusion as an energy source.

For our capstone project, our team has designed a process to develop a liquor-based canned cocktail, called Fizzy with the Rizzy, that will be carbonated, clear in color, and flavored with

Stevia at 8% ABV in a 12 oz can and be sold in three different flavors: lemon-lime, cranberry, and strawberry. It will be sold in cases of 12 at a projected scale of approximately 500,000 gallons of canned cocktail product or 444,000 cases a year. In order to eliminate the unpleasant taste derived from malt-based alcoholic seltzers, the canned cocktail will have a distilled liquor base, allowing the better tasting cocktail to be sold at a premium wholesale price of \$15 per case. High-gravity fermentation of yeast, followed by fractional distillation, flavoring, carbonation, and canning will be the basis of the design. The final report details the fermentation, distillation, flavoring, carbonation, and canning design as well as evaluates the economic viability of this production design. From our economic analysis, our small scale distillery will earn a gross profit of approximately \$4 million per year and an internal rate of return of 28.3%, suggesting this design is viable for implementation.

For my STS research topic, I attempted to answer the question of: What ways can nuclear fusion learn from the issues, conflicts, fears, and setbacks experienced by nuclear fission in policies and public perception? Nuclear energy – despite its numerous benefits – has a large spectrum of opinions surrounding it due to a variety of reasons ranging from previous nuclear accidents, film depictions, government policies, and misconceptions, which all greatly hinder nuclear energy's ability to be a dominant and respected clean energy source. Even with these drawbacks, nuclear energy fills a gap that most clean energy cannot easily manage – demand; Nuclear power offers a promising source of high output low-emissions energy, but before it can meet a greater share of the energy demand in the U.S., the distrust and fears about nuclear fission energy must be better understood and mitigated. With the recent developments in nuclear fusion energy production methods, nuclear fusion has the potential to truly become the energy source that nuclear fission

energy dreamed of becoming. Although without proper care and communication, nuclear fusion could hit the same roadblocks and negative public opinion that nuclear fission was shackled by.

Despite these two projects not having much in common, working on both projects definitely made me notice important details in each project that I wouldn't have noticed had I not analyzed both projects at the same time. My STS research of nuclear fusion had a large focus on public perception and the users and groups behind the technology which allowed me to investigate the users and perception behind our capstone project's canned cocktail. This ultimately led to our project changing our hypothetical location as well as attempting to tackle some of the deficiencies that most canned cocktails have to better appeal to our ideal user/customer. My capstone project also helped guide my STS research project due to our focus on economics. One aspect of nuclear fusion that I had not initially considered was the economics behind building and operating a nuclear power plant, but as it turns out this was a major roadblock against the implementation of nuclear fission energy that nuclear fusion has the ability to overcome. Without my capstone project, I would not have considered this angle and might have missed a huge impediment of nuclear fission that works in nuclear fusion's favor. Ultimately the synthesis of working on both of these projects together – while stressful – certainly improved both my capstone project and STS research.