Thesis Project Portfolio

Harnessing the Power of the Seas When Generating Sustainable, Floating Wind Power

(Technical Report)

Framing of Offshore Wind Energy in the United States

(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

Kelly Boenisch

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Department of Mechanical and Aerospace Engineering

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Sociotechnical Synthesis

Both my technical project and STS thesis focus on offshore wind energy. For our technical project, my group concentrated on exploring the design for floating offshore wind turbine substructures, or the structure on which wind turbines float. For my STS thesis, I explored offshore wind energy in the United States, including its framing, how and why certain projects have been implemented, and by comparing the country's progress in this field to that of Europe.

My capstone project team chose to focus on floating offshore wind energy specifically, because of the room for growth in this field. We started our project by coming up with substructure ideas, before settling on two final designs through concept screening. Our first design was modeled off of Principal Power's Wind Float design, which we used as a control. Our second design uses a base which floats by a naturally pressurized system of drainage holes. We then created computer models of both designs, and conducted preliminary analysis. After 3D-printing our parts, we tested our designs to determine their stability. During testing, we also added various weights to mimic ballasts, to offer more design options. With our results, we were able to analyze the effectiveness of our designs. We found the Principal Power model with weighted chains added to be the most effective.

In my STS research, the main question I aimed to answer was why the United States has been less successful in implementing offshore wind energy than other areas of the world, like Europe. I found that this is due to a multitude of reasons, including different government structures, and views on renewable energy. I also examined the existing offshore wind energy projects in the United States, and emphasized the need for support on all levels for offshore wind to be realized.

Overall, I am happy with the results of both my technical and STS projects. I came into these projects not having much knowledge of wind energy, so I am happy I have been able to learn so much this year. My team worked well together, and I am proud of what we were able to accomplish. Next year, our capstone advisor, Dr. Michael Momot, will be extending our project by adding automatic controls to further improve stability. I think this will be a great way to expand upon the research my team started this year.

I'd like to acknowledge the many people who have supported me during this project. First, I'd like to thank God for His innumerable blessings and peace which transcends understanding. Without His presence in my life, this would not have been possible. I'm extremely grateful for Emily Fedroff, Kyle Dana, Cydnie Golson, and Ahmed Abdelnabi, my capstone project team members, for working with me on this project. I would also like to thank Dr. Michael Momot and Dr. Sean Ferguson for advising me on my capstone and STS projects, respectively. Special thanks to my family, and friends, who have supported me in countless ways through my time at UVA.