Is Commuting a Drag? Effect of E-Bike Shell Design on Aerodynamic Drag

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One of the largest contributors to today's CO2 emissions is personal urban commuting, the daily driving from one place to another, mainly from a home to a place of work. It is one of the least efficient forms of transportation, and as such, makes up 59% of the largest emissions contributor in the USA, transportation. For my project I focused on the design of aerodynamic covers of a velomobile style electric vehicle as a more energy efficient form of transportation. To do this I implemented a three way verification process, utilizing computational fluid dynamics (CFD), experimental runs on a custom-made 3D printed wind tunnel, and a smoke rake created using dry ice fog and the wind tunnel. Once data was collected, it was fit to a weight-aerodynamics tradeoff model and the optimal design point was determined. The coefficient of drag was calculated and used to find the amount of power (watts) needed to propel the car at 25 mph (the average speed of urban commuting, set between the 15 mph of big city commuting and the 35 mph of suburban commuting). The end result was a power of approximately 116 watts for my experimentally verified optimum of a 2 ft tail and also calculated, using trend lines, as an optimum of 115 watts. This result is compared to the 400 watts for bikes and over 3000 watts for an average sedan, resulting in over 95% energy savings.

Awards Won:
Missouri University of Science and Technology: Summer Camp scholarships (camp tuition and travel expenses, valued at up to $1,500)