

**Matthew DiBlanda**  
**Class of 2019**  
**Electrical Engineering**  
**Energy Storage Optimizations for Plug-In Electric Vehicle Charging Stations**  
**Mentor: Dr. Junhui Zhao**

A significant barrier to many who would like to own an electric vehicle is the high upfront cost of the vehicle itself. However, while the recurring battery charge costs are considerably less expensive than filling a traditional petrol-run car's gas tank, this expense is largely forgotten. If the recurring costs of charging electric vehicles can be made even less expensive, the high upfront cost of the electric vehicles becomes more justified. This in turn may open the possibility of owning a more environmentally friendly, technologically advanced vehicle to a wider percentage of society.

As a consumer, there is little that can be done to reduce the costs of gas prices. We are wholly at the whim of oil companies and their distributors, due to the low availability and complex acquisition process of fossil fuels. However, these barriers are not as prevalent with electricity. For example, electricity can be generated by any consumer with a solar panel or wind turbine. Additionally, electricity purchased from the local distribution grid often has time-of-use (TOU) rates, which affect the price of purchased electricity based on the time of day that it is purchased.

Current residential installations of charging stations do not have energy storage features to take advantage of these discounts. In developing such a solution, I also realized some added benefits of such a configuration, such as consistent energy transfer rates and potentially higher transfer rates than is available residentially. Because of these features, installation of electric vehicle charging stations can become easier, further reducing upfront cost, and the higher transfer rates makes the system appealing to owners with existing installations. If provided further time and funding, this project looks to have the capacity to evolve into a marketable product that could lay the groundwork for significant improvements to the area of electric vehicle charging stations.