

# Solar Powered Vehicles: Cornerstone of a Sustainable Transportation Infrastructure

(Note: This is an individual area of research as well as a project for other team members.)

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## Abstract

The goal of this research is to advance the viability of zero emissions vehicles within our transportation infrastructure by deploying new models of solar powered vehicle technology. Currently in the United States, society's primary mode of transportation is personal transportation, not public transportation found in many other industrialized countries around the world. The US ranks at the lowest level of mass transit adoption of the 18 industrialized nations surveyed and rated in the National Geographic's annual report *Greendex* [1]. Complicating the model of individual transport is a system where 96.9% of US transportation was fueled using petroleum products [2]. Additionally, the Department of Energy's *Monthly Energy Review* data shows that transportation sector produces the highest level of CO<sub>2</sub> emissions compared to any other sector in the US economy; roughly equal to industrial and residential sectors combined [3]. Finding alternatives is an imperative. Although solar technology is not the only solution, it is a growing industry with enough support and infrastructure to propel the advancement of solar vehicle technology into commercialization. Car manufacturers are increasing their fleet of low emitting vehicles, adding solar-electric and electric vehicles, such as the Ford's C-Max Solar and Focus Electric, and BMW's i5 and 360 Electric. Despite this progress, solar powered vehicles are still nascent and there is tremendous opportunity for research to accelerate their development and entry into the marketplace. Many of the perceived issues pertaining to solar powered vehicles, such as weight, safety, solar integration into the body, aerodynamics, and road-conditions testing, will all be tested for viability of implementation.

Appalachian State University students, with faculty and departmental support, have begun a Solar Vehicle Project. This interdisciplinary team represents diverse majors, from Sustainable Technology to Business to Computer Science, as well as a range in education level from sophomores to second year graduate students. The Solar Vehicle Project will be designing, building, and competing in an international collegiate race in July 2016. This solar vehicle will provide the basis for conducting applied research in solar transportation endeavors at Appalachian. The solar powered vehicle will facilitate our research of lightweight design, integrated solar arrays into body panels, overall vehicle optimization, and overall sizing of motor and battery equipment. Through in depth analysis of solar vehicle data, gathered in various climates, elevations, hill grades and road conditions, the team will be able to define the optimal applications for solar charged and solar electric vehicles in today's transportation sector. Not only will research be conducted on the ability to create and define a solar powered vehicle, but the affordability of such a vehicle in today's transportation market. There is limited information available to the general public for sizing motors, batteries, and solar arrays appropriately in personal transportation. Creating a decision matrix for public use will better educate and alleviate concerns of implementing solar charged and solar powered vehicles into the general population.

- [1] Sivagnanasundaram, L., & Whan, E. (Eds.). (2012). Greendex 2012. Retrieved from [http://images.nationalgeographic.com/wpf/media-content/file/NGS\\_2012\\_Final\\_Global\\_report\\_Jul20-cb1343059672.pdf](http://images.nationalgeographic.com/wpf/media-content/file/NGS_2012_Final_Global_report_Jul20-cb1343059672.pdf)
- [2] Department of Transportation. (2012). Table 4-2: U.S. Consumption of Energy from Primary Sources by Sector (Quadrillion Btu). Retrieved from [http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national\\_transportation\\_statistics/html/table\\_04\\_02.html](http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_02.html)
- [3] Department of Energy. (2015, January). Monthly Energy Review January 2015. Retrieved from <http://www.eia.gov/environment/emissions/carbon/>