

Thesis Project Portfolio

Educational Engine

(Technical Report)

**Analysis of the Recent Growth of the Electric Vehicle Market, and the Environmental
Costs of EV Battery Production vs. Carbon Emission Reduction**

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The automobile industry plays a critical role in shaping global economies, transportation systems, and technological innovation. Therefore advancements in vehicle technology and the evolution of the industry often reflect border technological and societal trends. Since the beginning of the 21st century, the electric vehicle (EV) market has grown significantly, despite their invention being in the 1800s. This rapid rise to popularity of the EV is an interesting topic, as the technology that is effectively being pushed out is the internal combustion engine (ICE), which is often considered the zenith of modern mechanical engineering. In times of consequential technological change, it is important for engineers to fully understand the past technology which is passing out of use, as well as recognize the various social and technical factors which influenced the transition to the new technology. This thesis addresses both of these points with the combination of a technical design project which provides interactive methods of learning about the ICE, and a research paper which investigates the rapid rise of the EV market from different perspectives and analyzes the true benefits and drawbacks of the technology.

The technical project of this thesis involved the design and development of two different interactive learning instruments for the four-stroke ICE. As a cornerstone of the mechanical engineering discipline, it is vital that all budding mechanical engineers understand the technology behind this piece of technology. The first design was an entirely 3D printable model of an ICE, which is available to anyone with access to a 3D printer. The model is easily assemblable and dynamic, displaying full functionality of a four-stroke ICE, including cam and crankshaft rotation, piston travel, and valve movement. The model also does not require the use of any glue or external hardware, or support material during printing. The second design was an interactive display, utilizing a cutaway model machined from a real four-stroke ICE. Mechanical,

electronic, and software components were synergistically utilized to create a dynamic and interactable model. Besides the model, the display also contains an informational display screen as well as a button panel for users to interact with the model and screen, and is intended for use by students or other passerby to learn about the operation of a four-stroke ICE.

The socio-technical research paper of this thesis studies the expansion of the electric vehicle market. Utilizing two different frameworks of analysis, Thomas Hughes's systems analysis and Actor-Network Theory, to gain a better understanding of the EV technological system through different perspectives. This paper thoroughly examines the social, economic, and technical factors which contributed to the meteoric rise of the new technology. This paper also investigates the true environmental effects of EVs. The general public opinion is that EVs are the saving grace of the climate change crisis. I argue that the upside of the technology is not as distinct as popular belief may say, through a more exhaustive analysis of the effects of EVs on the environment.