

Thesis Project Portfolio

Optimization of a Formula SAE Intake Manifold

(Technical Report)

Analysis of the Development and Production of the 2011 Ford Focus Electric: Ford's Path to Electrification

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

This research aims to address the technical and social aspects to consider when transitioning from an Internal-Combustion Engine (ICE) vehicle to an Electric vehicle (EV). The findings from this paper are intended to serve as proving grounds for the Virginia Motorsports Formula SAE Team as they begin their transition from the ICE to EV competition. The technical project outlines an optimal design structure to follow when developing a new subsystem from scratch. It utilizes methods such as a design matrix, mathematical analysis, advanced simulation, and thoughtful choices backed by engineering science to define the steps to take to design, quantify, manufacture, and test a system from concept to production. The technical aspects are extremely important to consider when understanding how to build a brand-new system from the ground up; however, there are social aspects that are equally significant in ensuring a seamless transition from ICE to EV for the Formula SAE team. It is important to understand how certain social factors, such as competition and economy, inform and bias certain technical decisions, which could lead to the success or the demise of the transition. Actor-Network Theory (ANT) will be utilized to understand the development of certain technical and social actors, and how they interact with one another to stabilize and destabilize the network. Demonstrating an understanding of how the social actors can limit the technical aspects in the scope of the transition from ICE to EV is important to ensure a successful network. A case study of the development and eventual downfall of the 2011 Ford Focus Electric will be analyzed to understand how the associated actor-network was destabilized due to the failures in gaining a complete understanding of the social impacts on the vehicle. The goal of this case-study analysis is to gain a deeper understanding of what aspects were important to the company, in this case Ford, when they were taking their first step into the world of electric vehicles. The Ford Focus Electric had successful elements within the network that aided in generating and establishing it;

however, it was ultimately the lack of understanding in the interaction between the social and technical actors that caused the network to destabilize. The capstone research creates an optimized technical framework to follow when developing a new system, while the STS research aims to insight an overall understanding of the limitation of technical decisions because of social aspects. In concert, they both aim to provide sociotechnical findings that will aid the Virginia Motorsports Formula SAE Team to undertake a successful transition from ICE to EV.