Cost Effective Solar Powered Fan
(Technical Paper)

Volkswagen Emissions Scandal: A Case Study of Normalized Deviance
(STS Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

My technical thesis will focus on the development of a cost effective solar powered fan. Current solar fans on the market cost hundreds of dollars which can be unattainable for low income households. Further, these fans lack the ability to store the power collected from a solar panel for later use. Therefore, my team has proposed a fan that will cost about $150 and have a rechargeable battery that the fan can run off of in the absence of sunlight.

My STS thesis is a case study on the Volkswagen emissions scandal that was brought to light in 2014. Volkswagen sought to corner the market on clean automobiles in order to become the largest automobile manufacture in the world. However, when the company was unable to meet the required environmental standards they cheated. The purpose of this case study is to determine why the scandal occurred. Additionally, the study will determine whether the culture within the company caused the scandal.

These two topics can be related through sustainability. The issue of sustainability is a worldwide focus. As global warming continues sustainable options for transportation and cooling are extremely important. Volkswagen capitalized on this need, but failed to meet its goals of clean diesel. Therefore, this case can provide a cautionary tale for the future development of sustainable technology.

Cost Effective Solar Powered Fan

Abstract

The lack of adequate cooling systems has serious detrimental effects on health, especially on the elderly, women, and children. In addition, global warming exacerbates the cooling issue and compels for a sustainable cooling solution. However, the cost of consistently running an AC

in a metropolitan area such as Washington DC, can accrue an average electricity bill of over $200 per month making it financially strenuous on low income families. This project tackles this issue through the design of a solar powered cooling fan that is capable of running completely on renewable energy and without drawing any additional energy from the utility grid. The fan will be designed with a battery that charges during the daytime, and the power consumption of the fan will be optimized so that it is capable of running throughout most of the night. To make the fan as far reaching as possible, this project will focus on reducing the cost of construction of the fan to be lower than $100.

Description of Project

Our Solar Powered Fan is a machine solely powered through solar energy and is intended to create an air flow using a rotating arrangement of blades. The components will be housed within a circular casing to direct the airflow and include a plastic grid to prevent objects from inadvertently coming into contact with the rotating blades. In addition, the casing will protect the electrical components as well. The fan will also be adopting an axial-flow design where the blades will be attached so that it forces the air to move parallel to the rotating shaft. The fan will incorporate a three-blade fan design since lesser blades allow for less noise, and can go faster and move more air. This is because less blades create less drag on the motor, allowing the motor to move air more efficiently (2017). The blade shape will be designed to compromise an aerodynamic shape with structural integrity. The fan will be powered entirely using a solar panel which will be directed connected to the fan through a cable, but will be designed to be installed against a window. The fan will incorporate a 12V DC brush electric motor due to its low initial cost, reliability, and simple motor speed control. The motor will be configured with the solar

panels and battery and be driven by a motor controller. For the battery, the fan will integrate a DC 12V lithium ion rechargeable battery and integrate a charge controller.

The Volkswagen Emissions Scandal: A Case Study of Normalized Deviance

Introduction

Purchasing a car is one of the largest purchases of one's life. Hours of research on performance, cost, fuel efficiency, and carbon footprint are often taken into account when deciding which car to purchase. However, when automotive manufacturers falsely advertise and lie to consumers a misinformed purchase may be made. Such was the case for many who purchased Volkswagen's diesel models between the years of 2006 and 2015. The purpose of this thesis is to determine what decisions led to the Volkswagen emissions scandal. Additionally, this thesis will attempt to determine why these decisions were made and how they may be avoided in future situations. The analysis achieved in this thesis may give insight into how immoral decisions may be made and how they made be stopped.

Background

In 2006 Volkswagen (VW) was the third-largest automotive manufacturer in the world behind only General Motors and Toyota. In order to surpass these competitors, VW created a 10-year plan to triple US sales. This plan, born under CEO Bernd Pischetsrieder, relied on the sales on Clean Diesel (Parloff, 2018). The idea behind Clean Diesel relies on the fact that diesel limits the production of CO2 and other greenhouse gasses. However, diesel engines emit NOx which is one of the primary causes of smog (Forsgren, 2019). At this time, European emissions standards focused on reducing the effects of global warming by limiting greenhouse gasses. Meanwhile, in the US the emissions standards focused on clean air standards. Therefore, VW engineers were tasked with creating a diesel engine that could meet the high standards held by the US

Environmental Protection Agency (EPA) and the California Air Resource Board (CARB). If this task could be achieved VW could directly compete with Toyota Hybrid models such as the Prius. In 2008 the official 10-year plan was made public.

The plan set out by the executives and marketing team created a problem for VW engineers. As early as 2007, Wolfgang Hatz, a high-level VW supervisor was captured on video saying, “The CARB is not realistic. We can do quite a bit, and we will do quite a bit. But the impossible we cannot do” (Parloff, 2018). If VW were to reduce NOx, fuel economy would be lowered, engine performance would decrease, costs would increase, and more service would be needed. Therefore, software was created that would sense test scenarios by monitoring speed, engine operation, air pressure, and position of the steering wheel. When a test was detected, the car entered a safety mode with decreased power and performance thus decreasing NOx emissions (Hotten, 2015). This software was later given the name defeat device. In a meeting in 2008, news of this software reached senior Audi managers. Members of the engineering team sent news of the software to the head of the group Zaccheo Pamio warning that the software was illegal and highly problematic in the US. However, no actions were taken to rectify the situation (Forsgren, 2019).

The Downfall

The advertising of a Clean Diesel car achieved the original goal of tripling US sales. However, in 2014 West Virginia University published a study in which two models of diesel-powered VWs were studied in the lab and on the road. The results of this study displayed that on the road the vehicles emitted 35 times more NOx than in the lab (Forsgren, 2019). After this study was published, the EPA and CARB began pressuring VW. For more than a year VW denied any wrongdoing until the regulators barred the sales of VW's 2016 diesels from the US.

In order to address this crisis, CEO Winterkorn met with VW's main point of contact with US environmental regulators Oliver Schmidt. At this time, Schmidt worked as the General Manager in charge of the Environmental and Engineering Office and his main responsibility was communicating and coordinating with the EPA and CARB. During Winterkorn's meeting with Schmidt, Schmidt informed Winterkorn in unmistakable terms that VW had been cheating. Instead of reporting this, Winterkorn told Schmidt to meet with the EPA and lie. In August of 2015, Schmidt met with EPA officials and recited a script crafted by high-level VW officials detailing upgrades and hiding all cheating. However, on September 3rd another supervisor came forward and confessed to the EPA that a defeat device had been installed. On September 18th this confession was made public. Five days later, Winterkorn stepped down from CEO and continued to deny any knowledge of wrongdoing despite his continued involvement in using the defeat device. Additionally, VW insisted the software was created and distributed by a rouge group of engineers. However, as investigations were launched it was clear that many were involved in the coverup of the defeat device.

Consequences

After news of the defeat device reached the general public, stock fell 1.9% (La Times, 2019). Additionally, the EPA launched full investigation accusing 39 individuals of fraud and 13 others of fraud and false advertising. Within the US, both Pamio and Hatz were arrested. However, in Germany, no arrests were made (Forsgren, 2019).

On the corporate side, VW tried to appease the public by recalling the affected vehicles which totaled to about 11 million cars worldwide (Hotten, 2015). Within the US, consumers were given the option to trade in their car for cash to get another car. However, in Europe VW

insisted the affected cars could simply have the software tweaked to meet the less rigorous emissions standards (Phys.org, 2018).

In 2017, VW was charged by the US Department of Justice and plead guilty to 3 felony counts: Participating in a conspiracy to defraud US and VS's US customers and to violate the Clean Air Act, Obstruction of justice for destroying documents related to the scheme, and Importing these cars into the US by means of false statements about vehicles' compliance with emissions limits (Kennedy, 2017).

In the aftermath of the scandal, it has been reported that VW has paid more than 26 billion euros in fines and is still under investigation in UK, Italy, France, South Korea, Canada, and Germany (Phys.org, 2018).

Further, the scandal had larger impacts on the diesel industry as a whole. Although still popular in Europe due to a favorable tax regime, the sales of diesels have plummeted. Additionally, the product is now highly scrutinized (Kool 2015). Further, the discovery of VW's defeat device has encouraged further investigations into other makers' diesel vehicles. For example, France is now investigating Renault, Peugeot, and Fiat.

Company Culture

In 2015 after the initial scandal broke, VW launched an internal investigation. To encourage employees to come forward, an amnesty program was created. This program assured lower-level employees would not be punished for coming forward; however, this program did not apply to managers. It is reported that many employees came forward once this program was put into effect (Goodman, 2015). The actions of all those who came forward leads one to wonder why others did not step forward sooner. The answer to this question may lie in the culture prevalent within the corporation.

Former employees of VW have come forward and reported the culture of VW is extremely hierarchical. A former employee Walter Groth said the pressure put on an engineer in such an environment can be enormous. He also mentioned that if one fails the expectation is to either be reprimanded by a manager or fired. Further, it has been reported that VW had a code of conduct that requires employees to follow local and international laws and regulations. However, when VW engineers requested the addition of AdBlue tanks to lower NOx emissions their request was denied (Flender, 2019). Therefore, this top-down culture could have pushed engineers to make the defeat device in order to save their jobs and livelihood.

Conclusion

It is clear to see the VW emissions scandal was not created a single person or idea. Instead, it grew within the culture of the company reaching from the engineers to the CEO. Therefore, the question arises as to why no one spoke up when the device was used to deliberately cheat the emission regulations in the US. Further, one wonders whether one scandal created a culture in which cheating was acceptable or if the culture was established long before the 10-year plan to become the number one auto manufacturer in the world was introduced. These are the questions that the proposed thesis will seek to answer. From the preliminary research done, it seems these questions may be answered using the framework of normalized deviance as the scandal was created by a company culture rather than an immoral engineer. In my thesis, I plan to give a detailed background account of the company culture at VW and focus on the areas that forecasted a scandal such as the emissions scandal. Further, my thesis will try to answer why the scandal happened and how it may have been prevented.

My technical thesis will detail the completion of a low-cost solar fan. The goal of the final project to create a sustainable alternative to traditional HVAC systems.

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