

“HYBRID CARS”: NOT SO ENVIRONMENTALLY FRIENDLY

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INTRODUCTION: HYBRIDS CREATE POLLUTION

Hybrid cars may be solving several problems dealing with the harmful emissions of gas-powered vehicles into the environment, but they are also creating some pollution issues of their own. They may emit a little less greenhouse gases into the environment while you are driving them, but they are also a more complex car and therefore require a substantially larger amount of energy to produce. This increased output of energy increases the amount of pollution emitted into the air, thereby nullifying the advantages gained through reduced emissions during the operation of a hybrid vehicle. Also, since hybrids have batteries, the materials used to produce them still have to be gathered and disposed of – doing these things can be harmful to the environment as well. Many proponents of hybrid vehicles will claim that battery-powered vehicles don't give off bad emissions, but where is that energy to charge the battery coming from? If it is not from a clean energy source, it is still polluting the air. I feel that our environment deserves better, and that the auto industry should stop leading people to believe that they are having a positive impact on the environment by buying and driving hybrids. I have always been curious about how hybrids supposedly “help” us protect our planet, and researching them gave me enough insight regarding the topic to form a solid opinion on it. Also included in this paper will be a discussion on the ethics involved in creating hybrids as well as engineering in general, along with a weighing of the value of doing research on a topic such as this as a freshman college student.

THE BENEFITS OF HYBRIDS

Over two million people have chosen hybrids because of the benefits they are supposed to have [1]. For instance, they give off less CO₂ during operation [2]. They produce less noise, and since hybrid cars run partially off of a battery, they require less gasoline [2]. They also have a braking system that partially recharges the battery [3]. However, hybrid cars are only slightly more efficient than a diesel powered vehicle [2]. The auto industry claims many great things to be true about hybrids, but many of these claims aren't as true as they want you to believe.

PRODUCTION LEADS TO POLLUTION

When you drive a hybrid car, it has less of an impact on the environment than when you drive a car that is fueled by

gas. Most likely, no one will deny this. However, hybrid cars are much more complex than regular cars, and the factories producing them emit more pollution than a normal car factory [4]. Since hybrids have a gasoline engine and an electric engine, they would also have to carry extra weight, which means they should require more energy to run [5]. In order to counteract this, most hybrid car companies try to make their car frames significantly lighter in order to make them more efficient. They achieve this weight reduction by making the frames out of aluminum instead of steel. However, there is an enormous downside to this – aluminum production takes ten times the amount of energy than that of steel. [5]. Essentially, that means ten times the amount of pollution emitted into the environment before the consumer ever drives the car. After these hybrid cars are manufactured using large amounts of energy, they still need a battery to actually produce the results that the auto industry promises.

BATTERY PRODUCTION HARMS THE ENVIRONMENT

The batteries that are found in hybrids are made primarily of nickel. It requires much more energy to produce nickel batteries than it does to produce lead batteries, which are found in gasoline-powered cars [5]. Those in favor of hybrids claim that the nickel batteries may be slightly better for the environment in the long run. However, I do not believe they could be environmentally friendly if Toyota offers two hundred dollars for people to return their used nickel batteries so that Toyota can dispose of them properly [6]. My concern is summarized well by this quote: “They worry that a hybrid utopia might turn into a toxic nightmare when the nickel metal hydride batteries in today's hybrids end up in landfills” [6]. Another major concern is the methods used to obtain all these materials for complex hybrid cars [7].

MINING FOR MATERIALS DESTROYS THE EARTH

Hybrid batteries contain nickel, and their wiring is primarily copper. These metals used to create hybrid cars are acquired through the process of strip mining. In strip mining, miners clear the surface of all life and collect materials close to the surface, rather than digging down into the earth to find them [7]. This form of mining gives off a considerable amount of air pollution and also destroys plants and streams. A group of scientists from the University of Maryland, Duke University and others found that strip mining does

Colten Fortenbaugh

irreparable damage to the earth and can cause health issues for humans [8]. Each hybrid car requires approximately seventy pounds of these metals, which are acquired through strip mining [9]. After reporting that fifteen hundred streams have been destroyed, Duke professor Emily Bernhard said: "It obliterates stream ecosystems [...] they've been wiped from the landscape." These scientists also report that the damage could last hundreds of years [8]. Strip miners also level mountains to get to the coal beneath them, and that damage is most certainly irreversible [8]. However, the biggest factor is the electricity that charges the batteries of hybrid cars. If the power plant that produces the electricity uses coal, then that produces an even greater amount of pollution. Also, the coal that is used to produce that energy is acquired through mining. At the Powder River Basin, located in parts of Wyoming and Montana, thirty-one thousand acres have been mined. Federal law states that the land that is mined must be reclaimed, but so far only eighty-six of those acres have been reclaimed. They are mining the land at an extremely faster rate than they can reclaim it [10].



POWDER RIVER BASIN

This is where the coal is mined that powers the hybrids [10].

Tearing up that much of the earth's surface doesn't seem very beneficial to the environment. Maybe gasoline-fueled cars are better for the environment than hybrids cars.

HYBRIDS VS. GAS-POWERED VEHICLES

Both the hybrid and the gas-powered car have a normal engine. That means even though the hybrid has the low maintenance electric engine, it also has the engine of a normal car. One still has to change the oil and take care of it just as they would in a normal car [3]. Their brake systems are slightly different. A gas-powered vehicle has simple brake pads. A hybrid car also has these, but they also have a system called regenerative braking [3]. This causes the engine to run in reverse, and while doing so the engine acts

as an electric generator and slightly recharges the battery [11]. The performances of the cars are where the hybrid is supposed to make its mark. Since the production of hybrids puts so much pollution into the air, a "break-even" point is the method by which they are typically measured. The break-even point is the amount of miles at which the emissions given off during production and driving of the hybrid are equal to the amount that would have been emitted from a gasoline-powered car. A study done by students at the Worcester Polytechnic Institute in 2010 found the break-even points of several vehicles. The Ford Fusion Hybrid would need to be driven for 150,000 miles exclusively in the city before it breaks even. However, if most of the driving were done on the highway, one would need to drive it approximately two million miles [5]. The Ford Escape Hybrid would need to be driven for 200,000 city miles before breaking even and one million highway miles [5]. For the Toyota Highlander Hybrid, one would need to drive 250,000 miles in the city to reach the break-even point. However, if one were driving exclusively on the highway, one would never break even. This is because the fuel efficiency in the hybrid model is worse than in the standard version when driving on the highway [5]. Essentially, until one drives a hybrid to its break-even point, they are doing more harm to the environment than good.

ETHICAL DECISION MAKING

Does Creating Hybrid Cars Follow Engineering Codes of Ethics?

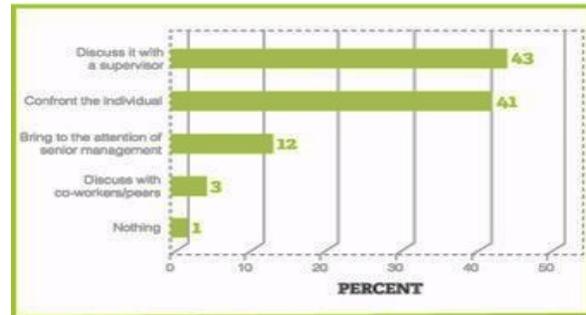
After learning about the creation process of hybrids, I believe that the auto industry is not being entirely honest in the way they market hybrids. The cars are "green" once they are created and they do not give off pollution while running. However, they can only be as environmentally friendly as the energy used to recharge their batteries [12]. At this point, most of this energy comes from burning fossil fuels, which pollute the environment considerably. This causes an ethical dilemma. According to the National Society of Professional Engineers Code of Ethics, engineers may not act in ways that deceive the public [13]. Taking that into account, it does not make sense that the general public should think that hybrid cars are "green" when they are harmful to the environment. However, the engineers are involved in the design and creation of the cars. There are other professionals that market the products and therefore the engineers never do anything against the code that could be considered deceiving to the public. However, in the American Society of Mechanical Engineers Code of Ethics of Engineers, it states, "Engineers shall consider environmental impact and sustainable development in the performance of their professional duties" [14]. Now it seems as if my research was wrong, because if the engineers have to take into account the environmental impact, then clearly hybrid cars would not be polluting the earth, but they are. Examining

that part of the code closer, we see it also mentions that mechanical engineers must also consider sustainable development. This means that they must also take into account where they believe their development will take the product in the future. While hybrids might not be environmentally friendly now, they are making progress toward becoming the green vehicle they were initially intended to be. They have increased in efficiency over the past few years. Jack Lucero Fleck test-drove a new, all-electric car called the RAV4 from Toyota. It has a battery that held a charge three times the amount of his current car, a 2010 Volt, which is also a hybrid vehicle. He also noted the increase in miles per kilowatt from 3.1 to 3.3 [15]. That is a measurable improvement over a short period of time. I think that if hybrids continue to improve in this way, then it is worth continuing to pursue advancements in hybrid technology. They may eventually become a viable replacement for gas-powered vehicles. In all fields of engineering, there are choices such as this that must be made that involve difficult decision-making.

The Effects of Codes of Ethics On Engineers

What happens when a product doesn't turn out the way it was supposed to? Maybe it doesn't perform up to par, or maybe it stops working completely. That means somewhere along the line that someone did not perform their job correctly. According to the NSPE Code of Ethics, "Engineers shall undertake assignments only when qualified by education or experience in the specific technical fields involved" [13]. It also states, "Engineers shall acknowledge their errors and shall not distort or alter the facts. [...] Engineers shall advise their clients or employers when they believe a project will not be successful" [13]. If every engineer involved in a project follows these guidelines, then the product will be successful. However, all it takes is one person to decide to sign off on something that they know isn't correct, and the whole project could fail. This reflects poorly on the whole team, not just that individual [16].

These are the results of a poll done by the American Society of Mechanical Engineers:



POLL DONE BY ASME TO SEE WHAT EMPLOYEES WOULD DO IF THEY SAW A COWORKER FALSIFYING DATA

As you can see, there are a few who would not take the appropriate action [16].

This one oversight could cause the whole project to fail and have negative effects on everyone involved. In recent years, many engineering programs added ethics courses to their curriculum, and in turn, ABET decided to add "understanding of professional responsibility and ethics" as a requirement for students in accredited programs [16].

VALUE OF THIS RESEARCH

During the time I have spent researching hybrid cars and ethics in engineering, I have learned a number of different things. I became more knowledgeable about the benefits and drawbacks of hybrid cars. Even after I had taken my position on them, researching the ethics behind their design and creation provided new insight into why engineers continue to pursue the advancement of hybrid car technology. I believe that doing this research was very beneficial for me because it allowed me to begin to see what types of challenges I will be facing in the field, as well as opened my eyes to some of the tough decisions I may be faced with. I think that freshmen next year will also benefit from doing research similar to this because writing this paper gave me the opportunity to see what professional engineering involves. When I initially considered engineering, I thought it would be a lot of math and science classes. While that is true, I am finding that being a solid math student is not going to allow me to become an engineer. This quote really shows the value of a quality engineering education: "The underlying idea in the best engineering schools is to teach the habit of concentration and to encourage clear and logical thinking, the actual knowledge gained during the years of study being considered a valuable incidental but not the main object of the work" [17]. This allowed me to realize that I am not here to learn something specific. I am here to become a problem solver and logical thinker, so that when I

become a professional, I do not need to follow a formula to success, I can figure it out myself.

THE VERDICT: HYBRIDS ARE NOT YET THE ANSWER

I believe that, after seeing the information I have gathered, one will realize hybrids do not live up to the claims that the auto industry makes about them, and in my opinion do not solve the vehicle emissions issue. They may solve a few problems, but they create many more of their own. Simply creating hybrid cars gives off a large amount of pollution, and they are only slightly more efficient than a regular car. Also, the gathering of materials to make hybrid cars is destroying large parts of the environment. If the hybrid is being recharged by electricity created by using coal, then it is having an even worse impact on the environment. Many hybrids have to be driven at least a couple hundred thousand miles before they become more efficient than a gasoline-fueled car. I do not believe that the benefits of hybrid cars outweigh their environmental cost. However, they are improving and becoming more efficient every year. Eventually, they may be able to replace gas-powered vehicles and be properly labeled as a green alternative. Right now, engineers designing hybrid cars are aware that they are not environmentally friendly, but they are also aware that they are making strides in the right direction, and may one day solve the problem. Researching these things has allowed me to become more knowledgeable about hybrids and what they can potentially do for our environment. It was a very worthwhile experience and I believe that next years freshmen will think the same. This research has allowed me to see what being a professional engineer is—it isn't all about equations and formulas, it is about being a logical thinker and problem solver.

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Colten Fortenbaugh

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