

Unrealized Guilt Is Not Innocence

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“Earth is likely to cross a critical threshold for global warming within the next decade, and nations will need to make an immediate and drastic shift away from fossil fuels to prevent the planet from overheating dangerously beyond that level, according to a major new report released on Monday.” (Plumer) After over a century of advancements in the automotive industry, the court of popular opinion has dictated that we must move on from the old technology that is the internal combustion engine (ICE). Supposedly, gasoline and diesel-powered vehicles are killing the environment, and they will ultimately lead to our demise. Electric vehicles will inevitably swoop down like an angel from heaven and fix all of our problems with zero adverse side effects. The proof they provide for us gasoline-loving hill-billys is “a new report”. I certainly would not want to decide for you, but I will indulge in some obvious questions I feel should be answered. For instance “Do these people (so-called environmentalists) have even the faintest idea how those “lung-murdering” 6.2L Supercharged V8s work?” “How are Electric vehicles like the Tesla Model X or a Chevrolet Bolt manufactured?” How do Electric vehicles work?” “If these toxic fumes are a problem could you explain how a car’s exhaust system works?” I would pay no mind to any environmentalist who would tell me which cars are killing the environment and which ones aren't if he or she could not identify where the engine is on a vehicle! Unfortunately for any common personal transportation enjoyer, it is nigh impossible to find solid, unbiased data that could help someone decide for themselves whether to side with ICEs or EVs.

The Internal Combustion Engine (ICE) is a power source that converts explosion to linear movement to rotational power by use of air, fuel, compression, and sometimes spark. An explosion of compressed air and fuel will propel a piston which will rotate the crankshaft it is

attached to and that in turn will rotate the flywheel, or flexplate, which feeds into the transmission, driveshaft, and differential, to the axles which rotate the wheels.

The ICE has been around since the early 19th century when early engineers went searching for an efficient replacement for the steam engine. According to Encyclopedia Britannica the ICE “cannot be attributed to any single inventor”, but there is evidence of crude combustion engines used in 1823 and sold commercially as stationary power. (Cromer) The ICE was originally designed to replace the steam engine as the steam engine was heavy, inefficient, and fairly weak. The first use of the ICE in motion is attributed to a man by the name of Jean Joseph Étienne Lenoir. Lenoir fabricated an ICE, made out of a modified steam engine, into a three-wheeled vehicle he dubbed “The Hippomobile”. Lenoir’s Hippomobile utilized “coal gas”, a mixture of hydrogen, methane, and carbon monoxide, and air to run. This was later improved upon by Nicolaus Otto in the first 4-stroke engine. Nicolaus Otto’s 4-stroke had a cycle of 4 actions within two full rotations in the rotating assembly: intake, compression, power, and exhaust. The 4-stroke engine provided a cleaner exhaust and higher efficiency. Now, in the 21st century, you could pop the hood of any car and find a 4-stroke engine. Otto’s advancements led to the largest leap for the automobile until the sacred “Model-T” by Henry Ford, Carl Benz’s “Motorwagen” The Motorwagen boasted a 1-liter, single-cylinder engine that made a whopping 2 horsepower in its final production stage. As much as any mechanic would love to discuss the impact of the ICE on the automobile industry, it had an even greater impact on aviation. The ICE is lighter and more compact than a steam-powered or electric-powered engine and can potentially produce more power than either. Similarly, an aircraft must be light enough to fly and powerful enough to keep it in flight. The ICE’s impact on the 21st century is hardly easy to

exaggerate, with most forms of transportation dominated by gasoline and diesel-fueled engines.
(Holm)

There are two common types of Electric Vehicles (EVs), the true electric and the hybrid. The Hybrid models are designed with an ICE and Electric motor to work in tandem. Because the Hybrid has an ICE as well as an electric motor, I will be excluding this design from the thesis. The True Electric design is a vehicle that is powered off battery cells and gives energy to two motors attached directly to the front and rear axles. The batteries are composed of Lithium, cobalt, graphite, and manganese cells. Allegedly, Tesla and other prominent EV-producing companies like Chevy, Ford, and GM, have since switched to the Lithium Ion battery due to the cost and environmental damage of cobalt and nickel mining. Instead of gasoline or diesel, EVs use charging stations to “refill” the battery. So far, charging stations can be 120V AC wall outlets you’d find at home, 240V AC public charging stations, or ‘Rapid-Chargers’ which can recharge an EV to 80% within an hour. (Braga)

The History of the EV begins somewhere in around the 1830s when horse and carriage was the popular form of transportation. Inventors in Hungary, the Netherlands, and the United States started toying with the idea of the first electric vehicles. It took around 60 years for the EV to reach any practical form with the six-passenger, 14 mph, electric buggy made by William Morrison, a chemist from Iowa. The EV hit its golden age from 1900 to 1920 with EVs taking up a third of vehicles on the road. Around this time Thomas Edison began his research with Henry Ford to improve upon the electric car. Unfortunately for electric car enthusiasts of the early 20th century, it was Henry Ford’s own Model T that snuffed out any interest in the EV, and with the discovery of crude oil in Texas the EV was practically lost to history. That is until a sudden spike in gas prices and some federal and state regulations brought the EV and hybrid out of its grave to

fulfill the demands of fewer emissions and less money spent on gas. The Toyota Prius released in Japan and the Honda Insight released in the U.S. with an incredible response from the general populous proved that the Hybrid and EV were here to stay. (Matulka)

Everybody and their grandmother loves to throw around the taboo E-word, but how truthful are the claims of Tesla owners that have proudly paid for their “zero emissions” custom license plate? According to the EPA (United States Environmental Protection Agency), “In addition to carbon dioxide (CO₂), automobiles produce methane (CH₄) and nitrous oxide (N₂O) from the tailpipe and hydrofluorocarbon emissions from leaking air conditioners.” The EPA then points out that CO₂ is not the most impactful out of all the greenhouse gases (GHGs) but it still is the most relevant because the average ICE produces CO₂ the most. The EPA directly affirms this, saying, “The emissions of these gases are small in comparison to CO₂” (EPA). NASA defines CO₂ as “an important heat-trapping gas, or greenhouse gas, that comes from the extraction and burning of fossil fuels (such as coal, oil, and natural gas), from wildfires, and natural processes like volcanic eruptions”. (NASA)

The ICE has ‘tail-pipe emissions’. It is designed to use the combustion of oil-based fuel for rotational movement. The exhaust gases from such an explosion cannot stay in the cylinder bore and must exit out through pipes starting from the engine and exiting out the back of the vehicle. This is where we find our ‘tail-pipe emissions’; one, of which, is CO₂. The EPA claims that the average vehicle emits about 4.6 metric tons of carbon dioxide per year. This singular piece of information is the Holy Grail of trump cards in the agglomeration of points presented by EV enthusiasts. Supposedly, these EV owners live guilt-free in their zero-emission lifestyle. But is that the case?

It takes electricity to charge an EV. The electricity has to come from somewhere according to the Law of Conservation of Energy. From the United States Energy Information Administration itself, we can find incriminating data on where our electricity comes from. According to EIA, as of 2022, 60.2% of our electricity is produced by fossil fuels. 18.1% of electricity was generated using nuclear power. 21.5% of electricity was generated by renewable fuels with wind, solar, and hydropower taking up the majority of that percentage. (EIA) This means that the electricity we use to charge anything, including and especially EVs, is power converted directly from fossil fuels. Natural Gas, more commonly known as Methane, takes up the majority of the percentage in the fossil-fuel category. An article from the United Nations Environment Programme (UNEP) warns that methane “is the primary contributor to the formation of ground-level ozone, a hazardous air pollutant and greenhouse gas, exposure to which causes 1 million premature deaths every year. Methane is also a powerful greenhouse gas. Over a 20-year period, it is 80 times more potent at warming than carbon dioxide.”

The mining of materials for EV batteries is often avoided in the EV discussion. Lithium, cobalt, and nickel mining are a few of the three major processes required to make an EV battery. In an article about the consequences of cobalt mining from National Public Radio (NPR), the writer Terry Gross gives us insight from Siddharth Kara, a fellow at Harvard and Kennedy School, about ties between cobalt mining in the Democratic Republic of Congo to modern-day slavery. Kara has “been researching modern-day slavery, human trafficking, and child labor for two decades”, and says that, “smartphones, computers, and electric vehicles may be emblems of the modern world, but their rechargeable batteries are frequently powered by cobalt mined by workers laboring in slave-like conditions in the Democratic Republic of Congo.” Kara goes on to describe the conditions and environmental damage being done to the DRC for the production of

our rechargeable batteries. Kara explains that the mineral itself is dangerous: "Cobalt is toxic to touch and breathe — and there are hundreds of thousands of poor Congolese people touching and breathing it day in and day out. Young mothers with babies strapped to their backs, all breathing in this toxic cobalt dust." Understandably, Kara rebukes the self-righteous push for EVs because of the demoralizing, dehumanizing, and destructive nature that is in the production process. This issue is not a 'who's right and who's wrong' situation, there is clear bias and misunderstanding on both sides. Nevertheless, it is extremely important to understand what you are advocating for when trying to unconstitutionally force a product on people. EVs are not our 'be all end all'. It is certainly not the consequence-free perfect solution that many enthusiasts and environmentalists make it out to be. Gross finishes with a final quote from Kara saying "We shouldn't be transitioning to the use of electric vehicles at the cost of the people and environment of one of the most downtrodden and impoverished corners of the world, the bottom of the supply chain, where almost all the world's cobalt is coming from, is a horror show." (Gross)

Unfortunately, nickel mining, another process essential for most EV batteries, can also be destructive. Serious health concerns have arisen over the last decade over the mining of nickel specifically for battery production. Most often, the result of such inquiries has resulted in the closing of many Nickel mining facilities. An example of such from The Guardian is the Russian mining giant Norilsk Nickel. Norilsk Nickel's hometown of Norilsk is called, by The Guardian, "one of the most polluted cities in the world". The article speculates that Norilsk's title is fitting due to the alleged 350,000 metric tons of toxic sulfur dioxide "emitted annually by the city's nickel factory, which was decommissioned last year". (Opray) In addition, the article discloses that the same company, Norilsk Nickel, "made headlines when an overflow of oxidized nickel waste turned the city's Dal'dykan river red." Aside from this, The Guardian quotes a senior

scientist at Greenpeace Research Laboratories saying “The mining of nickel-rich ores themselves, combined with their crushing and transportation by conveyor belt, truck or train, can generate high loadings of dust in the air, dust that itself contains high concentrations of potentially toxic metals, including nickel itself, copper, cobalt and chromium.” (Opray)

The topic of environmental safety, EVs, and emissions is heavily guarded with a shroud of invalid claims, hearsay, and lies in news articles and supposed ‘new studies’. Aside from a clear lack of credible sources and proof, the links and sources they do provide are completely useless. For instance, an article from edfenergy.com, which fails to provide an author or editor for this specific article, provides a link to a tool made by the Luxembourg Institute of Science and Technology (LIST). This article is titled “The Benefits of Electric Cars on the Environment”. This article makes claims like “Research has shown that electric cars are better for the environment.” Halfway through the article it mentions that LIST have “put a fabulous tool together to help you compare the overall environmental impact of electric cars vs internal combustion engine (petrol) cars.” Interestingly enough, the link they provide brings you to the LIST website homepage instead of their alleged ‘fabulous tool’. This same article provides a link to research that proves “electric cars are better for the environment”. The article in question from ICCT (the International Council on Clean Transportation) first clearly states that “The wide range of values found in these studies indicates the degree of uncertainty in assessing life-cycle emissions and the variety of methods and materials used in manufacturing batteries.” and “The methodology used for a life-cycle assessment (LCA) can greatly influence its conclusions about the carbon intensity of batteries” and “The methodological and data input factors suggest that these early assessments have a high degree of uncertainty and may not accurately represent the dozens of electric vehicle battery production facilities in use around the world”. (Hall) After the

research briefing indicates that data collected about emissions is easily influenced, uncertain, and does not accurately represent all EV battery facilities around the world, ICCT concludes the briefing with a summary and projections for the future. The briefing claims that “the manufacturing of batteries does not outweigh the life-cycle environmental benefits of electric vehicles”. Although it does not provide evidence of these supposed environmental benefits, it goes on to clearly reiterate that “these emissions are nonetheless substantial. These emissions could become more substantial as longer-range electric vehicles with larger batteries become more common.” (edfenergy.com)

A couple of antagonizing and biased articles written by journalist Scooter Doll and published on Electrek.com provide some interestingly contradictory statements and statistics. For instance one of Doll’s articles “Government data show gasoline vehicles are up to 100x more prone to fires than EVs” provides no source for the alleged ‘government data’. This particular article on vehicular fire hazards tries to convince the reader that gasoline vehicles are more likely to catch fire due to malfunction than the average EV. Doll references a graph allegedly made by AutoInsuranceEZ that shows the controversial Chevrolet (Chevy) Bolt having fewer recalls for fire hazards than the gasoline-powered Hyundai Elantra. More than 11 months later, in a separate article, Doll bashes GM for an embarrassing recall of 140,000 Chevy Bolts for risk of fire. A statistic that is not consistent with his previous article and also not consistent with Recalls.gov, the source he cites in both articles. Moreover, Doll’s graph shows that 430,000 Hyundai Elantras were recalled for fire hazards in the year 2020. Unfortunately for Doll, his own source provides no information on fire hazard recalls for the 2020 Hyundai Elantra. According to another source, Kelley Blue Book, only 158,493 Hyundai Elantras were affected because of an engine design flaw that could potentially leak oil onto hot engine components which, in a crash, could possibly

lead to a fire. In addition to clear manipulation and lack of data, Doll frequently uses Ad-hominem fallacies to bolster his message. Doll describes anyone who still drives or favors gasoline vehicles as “coal rollers with a death grip on their gas cans, savoring their final sips of lame-duck, gasoline-based kool-aid”. (Doll) He also provides unfounded claims such as “a growing amount of consumers have stated their next vehicle purchase will be all electric” to which he provides no evidence or citations to back up these claims.

As of 2020, natural gas, which is predominantly methane, and coal account for 59% of America’s electricity generation. So, those ‘zero emissions’ plates aren’t statistically accurate. According to a graph provided by the EIA, in 2008, coal-burning power plants took a rapid decline and were subsequently replaced by natural gas power plants to reduce CO2 emissions. As of 2020, natural gas dominates the electricity generation leaderboard at 40% with coal, nuclear, and renewable energy trailing behind at half that amount and all three within a single percent of each other. (EIA) To the EPA’s credit, this rapid switch in 2008 from coal to natural gas did reduce CO2 emissions considerably. Unfortunately, by saving us from CO2 they introduced a much deadlier gas into the air: Methane. (EIA) A natural gas power plant works similarly to an ICE but uses methane gas instead. It has compression, combustion, and then the turbine. That’s right, the majority of electricity production is generated using a methane combustion motor. (USDE) According to the news outlet Scientific American, “A recent study by the Environmental Defense Fund found that 3.7% of natural gas produced in the Permian Basin leaked into the atmosphere. That’s enough to erase the greenhouse gas benefits of quitting coal for gas in the near term.” Unlike the majority of articles praising EVs, Scientific American cites the aforementioned research study which has over 15 authors with connections to Harvard, Cambridge, and other top schools and departments around the world. (Zhang) While talking

about the 3.7% statistic, researcher Daniel Raimi from Researchers for the Future said “It is a really high emission rate. It is yet another indicator that the U.S. oil and gas system emits more than current EPA estimates would suggest.” (Storrow) Allegedly, a “series of earlier studies coordinated by EDF and hundreds of other researchers indicated that the U.S. oil and gas system leaked on average 2.3% of all the gas it produced. That’s about 60% more than the leakage rate reported by EPA, at 1.4%”. (Storrow) Alejandra Borunda from National Geographic in an article about natural gas, surmises that although CO₂ emission reduction is a good thing, methane gas from power plants is a far worse evil. “On a 20-year timescale, a methane molecule is roughly 90 times more effective at trapping heat in the atmosphere than a molecule of carbon dioxide”. Borunda then cites statistics from the EIA which show that over 500 power plants that use coal burning have been replaced by natural gas, predominantly methane gas, since 2010. These new methane power plants produce 40 percent of the United States' electricity. (Borunda) If you bundle all of this information together, it is clear that the electricity used to power anything in the U.S., including EVs, until recently, came from coal burning which produced considerable amounts of CO₂ emissions. Now, the electricity predominantly comes from natural gas power plants that release methane; which is an alleged 90 times more destructive to the environment than CO₂. All of this data comes from sources such as but not limited to the EIA, EPA, the Department of Energy, and National Geographic. All of these sources and government agencies have reportedly supported the push for EVs.

If we assume that the true goal of the push for EVs and renewable energy is legitimately for a healthier and cleaner environment, then it would be more conducive, based on the information above, to find a replacement for the power plants that supply our electricity than to replace ICEs. One option could be investing in nuclear power as a replacement. Generally, the

logical replacement for fossil fuel-burning power plants would be renewable energy like hydroelectric power. Unlike wind power and solar power which are rendered useless at certain times by lack of wind or an abundance of cloud coverage, hydroelectric power is constant. Although hydroelectric power is sustainable and environmentally clean, according to data provided by NewScientist from the International Energy Agency (IEA), hydroelectric power has caused considerably more fatalities than fossil fuels or nuclear power and is only surpassed by the effects of coal burning. (Mckenna) The most prominent hydroelectric fatalities include the flooding caused by the failure of 30 central China hydropower dams in 1975. The most prominent nuclear power malfunction was the meltdown of Chernobyl in 1986. According to the International Atomic Energy Agency and the UN, the death toll from cancer following the 1986 meltdown at Chernobyl will reach around 9000. In contrast, the flooding from failed hydropower dams in China caused an estimated 230,000 deaths according to Phil Mckenna from NewScientist. A graph with data collated by the IEA indicates that nuclear power is nowhere near as deadly as other energy sources. According to the IEA, nuclear power is responsible for 0.2 to 1.2 deaths per 10 billion kWh whereas hydropower is responsible for 1.0 to 54.7 deaths per 10 billion kWh. (Mckenna) Up until around 2008, Coal-power was the dominant electricity generator and, according to the IEA, was responsible for 2.8 to 32.7 deaths per 10 billion kWh. This data puts nuclear power as the current least-deadly source of power despite the general fear revolving around radiation and reactor meltdowns.

There are other potential ways to lessen environmental impact besides replacing ICEs with EVs. The ICE has room to grow. If zero emissions are necessary to appease the masses, then it would be easier to improve upon a tried-and-true platform than eradicate one to replace with another. Engineers at Porsche are working on a synthetic fuel for the ICE called “efuel”.

The Team Leader of Porsche's research into eFuel, Karl Dums, says that "eFuels are synthetic fuels that have the potential to be nearly carbon neutral and that are made from CO2 and hydrogen using renewable energy sources." In an article from Porsche's newsroom, Dums says that we have to factor in that there are already at least 1.3 billion combustion engines on the road and electrification of the automobile industry is unlikely to happen anytime soon. (Steiner) So far we have very little information on the chemical makeup of Porsche's eFuel but the concept is significant in that there are different, more sustainable, more constitutional, and more rational solutions to the world's 'carbon crisis'.

Certain articles and reports are surfacing that express concerns about safety risks that are inherent to EVs. An article from StreetsBlogNYC (SBNYC) references a series of collision tests done by the insurance company, AXA Switzerland. SBNYC mentions that an EV like a Tesla has significantly faster acceleration times than the average ICE. For instance the mid-size SUV Model Y from Tesla, that's specifically marketed as a family vehicle, can accelerate from 0-60 within 3.5 seconds. An ICE counterpart for the Model Y in size, seating capacity, and price, like the 2022 Acura MDX, can accelerate from 0-60 within 6.4 seconds. This puts the Model Y at almost half as much time to get up to 60 mph to an equivalent ICE. SBNYC's point with all this is that placing mass amounts of incredibly quick cars into the hands of drivers who do not have any need for more power, like family vehicles or wallet-friendly sedans, is incredibly dangerous and leaves a higher likelihood of high-speed collisions. SBNYC also brings to light inherent risks to pedestrians. (SYNBC) The average EV gains around 1,000 pounds in weight over its ICE counterpart due to the battery pack and motors being significantly heavier than the average ICE engine. If EVs were to become commonplace in society, they would raise the average weight of a vehicle by around 1,000 pounds, thus a vehicle to pedestrian collision would

considerably increase the likelihood of severe injuries or fatality to the pedestrian involved. The risk of fire and spontaneous combustion are also mentioned in numerous news outlets, most notably in the case of Dr. Omar Awan. In this particular case, Dr. Awan was driving his Tesla S home from getting groceries when he lost control and crashed into a tree in the median of a highway. Although the officer on scene reported that Dr. Awan was speeding, according to the medical examiner, Awan was not killed by the impact of the car hitting the tree but instead was killed by burns and inhaling toxic fumes. After the Tesla S had crashed its emergency kill switch cut power from the battery to the car. Unfortunately for Dr. Awan, the battery failed and spontaneously burst into flames and, because the power was cut, Dr. Awan nor the first responders on the scene could not save his life without power to the doors to engage the handles. Life-saving devices like the Jaws of Life or merely smashing the window were useless due to the flames from the EV's battery being too large and volatile to go near. (Shepard) Another news source, CNBC, quotes Chas McGarvey, the Chief Fire Officer of Pennsylvania's Lower Merion Fire Department. In an interview with CNBC, Chas McGarvey said: "that one Tesla Model S Plaid fire his department handled in 2021 burned so hot that it melted the roadway beneath it." (Evers) TheHill.com quotes Austin Fire Department Division Chief Thayer Smith, who said, "Normally, a car fire you can put out with 500 to 1,000 gallons of water. But Teslas may take up to 30,000-40,000 gallons of water, maybe even more, to extinguish the battery pack once it starts burning". (Barnes)

For any unfortunate reader who seeks a clearer understanding of the topics discussed in this thesis, I apologize. Every article, quote, or reference is taken only to be used as a backboard to make conclusions off of. Thinking realistically, every statistic provided can and has been manipulated. My only goal was to show the hypocrisy of the prominent government departments

and news outlets. Based on the information I have compiled from leading sources that generally speak in aggressive favor of EV supremacy, it is clear that the EV's main pull is environmental innocence. Based on information provided by multiple sources that directly reference real current events, the environmental damage done indirectly by EVs rivals the impact of ICEs. If environmental safety is truly the pure intent of the radical push for EVs, then this movement's leaders are sorely misled. It is undeniable that EVs produce no emissions directly. If the conscience of an EV buyer is appeased by that fact then so be it. It is also undeniable that there is a significant indirect impact through electricity generation, mining, and assembly. Every buyer of an EV takes on unrealized metaphorical guilt of indirect environmental damage when purchasing and utilizing an EV. It is interesting that the draw of EVs being "zero-emissions" is such low-hanging fruit. It should make any curious mind question, why is our government pushing so hard for this?

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