Name

Reflective Annotated Bibliography Unit 2 (assignment)

Eng 1101ML-D105 (section number)

Date

**Why Has The United States Fallen Behind In The Race To Electrify Transportation?**

My research question is: Why has the United States fallen behind in the race to electrify cars? This topic interests me because I am an electric vehicle (EV) enthusiast and have been following this topic for years. My prior experience working on real customer cars (though no full electric vehicles) as part of my program at Thomas A. Edison High School, and my personal interest in engineering-related subjects, allowed me to gain a good understanding of transportation from an engineering and design perspective. I am also considering vehicle design as a career and being EV-focused is a matter of forward planning with my potential career and with regards to being responsible for the environment.

Electrification of transportation is one of the most important steps towards a more sustainable future, as transportation is one of the major contributors to global greenhouse gas emissions, with about 14% share of the world’s emissions. The competition between China and the US is particularly relevant, as both nations are economic juggernauts on the world stage. At the moment, China has had a dramatic head start, with Chinese companies selling over 9 million EVs in 2023 compared to the US’s 1.1 million. Additionally, Norway is another pioneer of electrification, with 82% of its new car sales in 2023 being EVs. Some of the questions I am interested in exploring are: How are countries such as China and Norway so far ahead of the United States in the electric vehicle race? What makes America’s approach different? And what can the United States learn from successful EV adoption initiatives?

**Sources:**

**Source 1: Can the World Make an Electric Car Battery without China?**

1. **Citation:**

Chang, Agnes, and Keith Bradsher. “Can the World Make an Electric Car Battery without China?” *The New York Times*, 16 May 2023, [www.nytimes.com/interactive/2023/05/16/business/china-ev-battery.html.](http://www.nytimes.com/interactive/2023/05/16/business/china-ev-battery.html)

1. **Summary:**

 In “Can the World Make an Electric Car Battery without China?” Agnes Chang and Keith Bradsher state that China has an incredibly powerful hold over the world’s battery-making logistics and manufacturing capacity. The authors report that China controls a large percentage of the world’s cobalt, lithium, graphite, manganese, and nickel mining. All of these minerals are essential for nickel-manganese-cobalt (NMC) battery production, which is the most common battery cathode chemistry for electric vehicles (EVs) and consumer electronics. The authors also mention that the Democratic Republic of the Congo physically contains the majority of the world’s cobalt mines, but Chinese companies make up the majority of the operators of said cobalt mines. Additionally, Chang and Bradsher state that China also has a monopoly on the capacity to turn mined minerals into useful products. These include the majority of refining capacity of manganese, cobalt, graphite, lithium, and nickel. China also produces a majority of the world’s NMC cathodes, nearly all of the world's LFP (lithium-iron-phosphate) cathodes, and 66% of the entire world’s batteries. All of these give China a practically insurmountable advantage that allows it to produce half of the world's EVs alone. Finally, the authors describe how in 2015, the Chinese government made significant moves to encourage the development and sales of batteries and EVs, enacting legislation to block foreign competitors and subsidizing Chinese battery and EV companies. In contrast, the United States only began to work on a vaguely similar and smaller-scale strategy over seven years later in 2022 under the Biden administration. As a result, Chinese companies had years and resources to develop skills and technology, while most Western auto makers have only recently bothered to take vehicle electrification seriously.

1. **Rhetorical Analysis:**

This article was published relatively recently on May 16, 2023 in the *New York Times*, generally regarded as a reliable source of news and information. The *New York Times* is a larger media company and is known for fact-checking its articles. Being a feature piece, the article contains a high degree of information density and many statistics, but breaks down the topic of Chinese domination of the battery industry to be more digestible, with a notable use of infographics. Both authors Agnes Chang and Keith Bradsher have written a variety of articles regarding China and geopolitics. Bradsher also possesses experience with writing about the auto industry and published papers regarding the dangers of sports utility vehicles (SUVs). The purpose of this article is to inform readers, especially American readers, on how China has such a colossal advantage in electrification. Being a publication from a reputable source, it displays *ethos* through credibility. The use of the appeal of *logos* via statistics helps readers logically deduce that the power China exerts over the battery and electric vehicle industries is enormous. There is a potential *pathos* factor in this too, as some readers may be shocked when learning the seriousness of America’s situation while China pulls ahead.

1. **Quotes:**

“China owns most of the **cobalt** mines in Congo, which has the majority of the world’s supply of this scarce material needed for the most common type of battery. American companies failed to keep up and even [sold mines](https://www.nytimes.com/2021/11/21/world/us-china-energy.html) to their Chinese counterparts.” (Chang and Bradsher)

“Supported by the government with cheap land and energy, Chinese companies have been able to refine minerals at larger volume and lower cost than everyone else. This has caused refineries elsewhere to close. Refining also often causes pollution, and Chinese refineries benefit from less stringent environmental regulations. “ (Chang and Bradsher)

“China can build battery factories at nearly half the cost of countries in North America or Europe, according to Heiner Heimes, a professor at RWTH Aachen University in Germany. The main reasons: Labor costs are lower, and there are more equipment manufacturers in China.” (Chang and Bradsher)

“Experts say it is next to impossible for any other country to become self-reliant in the battery supply chain, no matter if it has cheaper labor or finds other global partners. Companies anywhere in the world will look to form partnerships with Chinese manufacturers to enter or expand in the industry.” (Chang and Bradsher)

**Source 2: China’s Electric Vehicles Are Going to Hit Detroit like a Wrecking Ball**

1. **Citation:**

Meyer, Robinson. “China’s Electric Vehicles Are Going to Hit Detroit like a Wrecking Ball.” *The New York Times*, 27 Feb. 2024, [www.nytimes.com/2024/02/27/opinion/gm-ford-electric-vehicles.html](http://www.nytimes.com/2024/02/27/opinion/gm-ford-electric-vehicles.html).

1. **Summary:**

In “China’s Electric Vehicles Are Going To Hit Detroit Like A Wrecking Ball” by Robinson Meyer, the author voices his thoughts on the dire state of Ford, GM, and Stellantis’ (the ‘Big Three’s) transition to electric vehicles. He remarks that despite the long United Auto Workers strike on the Big Three, they made billions of dollars in revenue in 2023. But even though they were the largest and most established American automakers, they fell short on their electrification goals. Citing another NYT article, Meyer states that BYD, the largest Chinese automaker and the largest electric vehicle manufacturer in the world, sold 3 million electric vehicles in 2023 alone. BYD is working to expand its annual production capacity by another million, and citing another article by Keith Bradsher, is currently building factories in Brazil, Hungary, Thailand, and Uzbekistan, countries who have not made significant strides to electrification. And not only is the volume of vehicles very high, the prices of the lower trim models are very low, with a hybrid model expected to sell at $11,000 USD equivalent. Meyer, referring to an earnings report from Ford, then points out how Ford lost an estimated $64,000 for each electric model it sold in 2023. The ‘Big Three’ are simply not competing at the same level as Hyundai and Tesla, let alone Chinese giants such as BYD. Robinson Meyer also points out a key difference between the American and Chinese markets: Americans are addicted to large vehicles. SUVs and pickup trucks, being bigger vehicles by definition, cost more in materials to build and money to simply run, and therefore there are less people able to afford them. Smaller vehicles such as sedans and microcars are the opposite, they are cheaper, and they require less energy to run. The author writes that the 2023 Inflation Reduction Act is helpful, as it subsidizes consumers and manufacturers for qualifying electric vehicles, but is still not enough to permit most American electric vehicles to compete with Chinese-made EVs, with the example of the Volvo EX30 targeting a price of $35,000 **after**a 25% import tariff (Volvo and Polestar are now subsidiaries of Geely, a Chinese company). Robinson Meyer warns that while import restrictions on Chinese EVs will be necessary to buy the Big Three time to compete, completely cutting off foreign competition will be equally destructive.

1. **Rhetorical Analysis:**

This opinion piece is very recent, being published on February 27, 2024. Robinson Meyer, the author of this opinion piece, specializes in writing opinion pieces for the *New York Times* and is the founding executive editor for *Heatmap*, a climate change media company. As another source from the *New York Times*, it obtains credibility through its status as a household name. Despite being an opinion editorial, Meyer primarily uses *logos* to express the dire situation of the Big Three’s future, bringing up sales and earnings reports, news articles from an assortment of sources, and referencing American and Chinese legislation. However there are still elements of *pathos* included in the text. Meyer paints a bleak picture of the American auto industry, using bold phrases and metaphors to describe the state of the industry. However, his tone shifts towards the end of the article, appealing to the American people to unite against the Chinese storm and invoking a sense of unity. The purpose of this opinion piece is to convince the American populace to vote for people and legislation that will help save the American legacy auto companies and our auto industry from potential extinction by Chinese companies.

1. **Quotes:**

“The Chinese automakers, especially BYD, represent something new in the world. They signal that China’s decades-long accretion of economic complexity is almost complete: Whereas the country once [made](https://oec.world/en/profile/country/chn?yearSelector1=1995) toys and clothes and then made electronics and batteries, now it makes cars and [airplanes](https://finance.yahoo.com/video/chinas-first-homegrown-airliner-makes-062308624.html).” (Meyer)

“After BYD announced its $11,000 plug-in hybrid, it [posted](https://www.scmp.com/business/china-business/article/3252472/chinas-byd-launches-cheaper-plug-hybrid-ev-lure-customers-away-petrol-powered-rivals-volkswagen) on the Chinese social media platform Weibo that “the price will make petrol car assemblers tremble.” The problem is many of those gasoline-car makers are American.”” (Meyer)

“But in the long term, Mr. Biden must be careful not to cordon off the American car market from the rest of the world, turning the United States into an automotive backwater of bloated, expensive, gas-guzzling vehicles. The Chinese carmakers are the first real competition that the global car industry has faced in decades, and American companies must be exposed to some of that threat, for their own good.That means they must feel the chill of death on their necks and be forced to rise and face this challenge.” (Meyer)

“That means that Republican lawmakers, in particular, must recognize that climate-friendly technologies are the future of global industry. Mr. Trump is threatening that, if elected, he would gut the Inflation Reduction Act, even though it’s full of policies meant to help America compete with Chinese E.V.s. There would be no faster way to destroy the U.S. car industry as a global force.” (Meyer)

“There’s no small amount of irony in the fact that all those involved here — Democrats, Republicans, major automakers — resent China for achieving what was once a goal of, well, hippies and environmentalists: making electric cars popular and cheap. But if they’ve done it, we can do it, too. It will take grit and good-faith effort. We should assume that Ford and General Motors will be competing with BYD and Geely for decades to come, and we should relish that fight.” (Meyer)

**Source 3: How Norway Built an EV Utopia While the U.S. Is Struggling to Go Electric**

1. **Citation:**

CNBC. “How Norway Built an EV Utopia While the U.S. Is Struggling to Go Electric” *www.youtube.com*, 17 Feb. 2024, [youtu.be/R5DbRyeZNRk?si=S0mc9NH8qG1sfEKt](http://youtu.be/R5DbRyeZNRk?si=S0mc9NH8qG1sfEKt). Accessed 7 Apr. 2024.

1. **Summary:**

The documentary “How Norway Built an EV Utopia While the U.S. Is Struggling to Go Electric” immediately introduces Norway’s relevance in the EV race: 82% of all new car sales in Norway were fully electric vehicles in 2023. The documentary compares that to America and China’s electric vehicle share in new vehicle sales: a measly 7.6% in that same year for America and 24% in China. Not only are civilian cars being rapidly electrified in Norway, but other vehicles such as buses, trucks, trams, trains, construction equipment, and ferries. At this point, one of the first factors a successful transition to EVs was brought up, that being a large amount of cheap, readily available, and clean hydropower in Norway. Following that is policy, through incentives and subsidies. These include no registration tax, free tolls, free parking, no value added tax, and access to bus lanes. In Norway, sales tax is 25% on almost every item, and the 0% tax rate on EVs gave them a significant point-of-sale cost edge over ICE vehicles. The Norwegian government is also planning to eliminate these benefits for hybrid-electric vehicles soon. According to Petter Haugneland, Assistant Secretary General of the Norwegian EV Association, the primary driver of EV sales appears to largely be a result of competitive pricing rather than environmental benefits, though the latter does come as a bonus for consumers. Additionally, the abundance of charging stations and the cheap and clean electricity they provide also allow for an easy and low cost of operating these EVs. Businesses, including former gas stations, have been installing chargers on their lots to ride the wave of the EV transition. The Norwegian government has also constructed charging stalls in apartment parking lots, garages, and on the sidewalks in order to ensure slow charging access for those who live in apartments instead of homes. Experiments have also been carried out with parking spots equipped with inductive chargers to wirelessly charge compatible EVs. In Oslo, 100% of its public transport is electrified, including its ferries, which are capable of charging in 5 minutes by drawing a whopping 3.5 megawatts. The grid infrastructure however, has become a potential limiting factor as transmission lines are slow to upgrade to carry larger amounts of energy to their destinations.

One weak point of the Norwegian charging experience though, is the lack of standardization. Like in North America, every charge provider has their own separate apps and method of payments that are required to use to charge the vehicle. However, Norwegian and EU regulations are on the way to rectify this issue. The documentary also addresses another concern: cold weather. Norway can, of course, be very cold in the winter, but the existence of preheating and preconditioning on modern EVs partially mitigate issues with cold weather, but not fully. However, the abundance of chargers in more populated areas of Norway make the issue less relevant. With the 100% EV adoption goal nearing completion, Norway is also rolling back some of its incentives and subsidies for EVs. These include changing EV access from bus lanes to car pools and changing parking, ferries, and tolls to be a discount instead of completely free. Due to the sheer pace and early start for EV adoption in Norway, there is a significant used market for EVs in Norway, with batteries holding a large percentage of their original capacity. Reflecting on this information, the documentary then lays out things the United States can learn from Norway in its transition to electric vehicles: Standardize and regulate things such as charging port architecture and payment systems; Subsidize the construction of charging stations; Provide incentives and subsidies for electric vehicles, as cost is a bigger driver for change; And greatest of all, try.

1. **Rhetorical Analysis:**

This video documentary was published on February 17, 2024, making it a very recent and relevant source. *Ethos* is a persuasive factor in this documentary, as *CNBC* is well established and one of the most watched news programs in America. *CNBC* is known for fact-checking and reliability. The primary audience of this documentary are voters and policy makers in America, as the primary goal of the documentary is to demonstrate what allows Norway to electrify most of its transportation so quickly and what the United States can learn from it. The documentary begins by immediately presenting statistics and infographics on Norway’s incredible EV adoption rate, and consistently uses *logos* throughout as a means of conveying numerical information. *Ethos* is also demonstrated through interviews with various credible individuals throughout the documentary, including Ragnhild Styrstad, State Secretary of the Norwegian Ministry of Climate and Environment, Cecilie Kroglund, the State Secretary of the Norwegian Ministry of Transport, as well as representatives from companies and non-profit organizations. One notable area where the documentary makes use of *pathos* was by demonstrating the direct and tangible impact of EVs in Norway: “There are chargers everywhere. The streets are quiet in Oslo. The air is pleasantly free of fumes. There’s been a noticeable improvement to the air quality in the city. ‘Yeah, it is so, around 20% reduction of local pollution.’ It was actually noticeable when a gas powered car sputtered by.” (3:03-3:24) A viewer can imagine the improvement in noise levels, smells, and health from this clip, and the sound of an engine being an abnormality also provides a stark contrast to life in the rest of the world. This and various other clips from Norway can very easily have a positive impression on a viewer, who may realize that the switch to electric vehicles en masse has very tangible benefits.

1. **Quotes:**

“More than 82% of new car sales [in Norway] were electric vehicles last year, and that number goes up to over 90% if you include plug-in hybrids.” (0:14-0:23)

“In the U.S., a measly 7.6% of new car sales were electric in 2023, up from 5.9% in 2022. In the world’s largest auto market, China, 24% of new car sales were EVs in 2023.” (0:30-0:44)

“[Charging] electric cars are maybe a third of the price of gasoline, because we have close to 100% hydropower.” (1:16-1:23)

“California has the highest EV adoption rate in the U.S. 21.5% of new car sales were electric in 2023, a figure that has doubled in the past two years. But Norway made California look like it was in the dark ages. There are chargers everywhere. The streets are quiet in Oslo. The air is pleasantly free of fumes. There’s been a noticeable improvement to the air quality in the city. "Yeah, it is so, around 20% reduction of local pollution.’ It was actually noticeable when a gas powered car sputtered by.” (2:50-3:24)

“Anything you miss about driving a gas powered car? ‘No, no, actually no, because it was so expensive. Like when I see gas prices, I’m like God damn, it’s so expensive these days. So no, actually, I’m not looking back.’” (4:10-4:23)

“And we set a goal for 2025 that all new passenger cars should be zero emission. And when you have set a goal like that, you have to put some incentives [in order] to make it work.” (5:05-5:20)

“Norway is a wealthy country, and much of that wealth has come from its robust oil and gas industry. Norway is western Europe's largest oil and gas exporter, and the industry is expected to make up 24% of the nation's GDP in 2024.” (8:50-9:05)

“It's the first city in Europe where all public transportation is zero emission. ‘So I love these ships. They are used by millions of passengers every year. It's charging as we speak and it takes around five minutes because it's charging on 3.5MW. And that is pretty fast, [3.5] million watt.’” (17:06-17:28)

**Reflection:**

These three sources here are very insightful, as they all agree the main limiting factor of the United State’s attempt to transition its transportation industries to electricity is the lack of significant policy moves to make electric vehicles an economically viable form of transport for the public. Norway and China are the main countries of interest, as those two are advancing their electric vehicle adoption at a breakneck pace while the United States lags behind. The policy choices of both Norway and China focus primarily on making the purchase and use of an electric vehicle as cheap as possible to the end consumer, whose primary motivation for making change is simply cost. These policy decisions include: Incentives and subsidies for mines, refineries, and manufacturers in order to reduce costs to the consumer; Subsidies and incentives for EV customers to make the purchase of the cars more appealing; Investment into infrastructure such as charging, power generation, and transmission lines; And regulating and standardizing the industry.

The incentives in the United States are relatively weak compared to those in Norway and China, and all three sources suggest or imply that the United States needs to do more in order to meet its goals. I was aware before this research that legislation is an important tool to accelerate the world’s transition to electric vehicles, and that the incentives in Norway and China are much stronger than those of America’s. However, I underestimated the sheer extent that the United States has fallen behind. This only reinforces the importance for America to take on a much more aggressive strategy to encourage American manufacturers and consumers to adopt EVs. Another thing that my research unveiled to me was the level of monopolization that China holds over large chunks of the industry of electric vehicles, its components and materials. The article “Can the World Make an Electric Car Battery without China?” emphasizes just how much control that China holds over mineral extraction, refining, and manufacturing of EVs and relevant components. Most of this advantage comes from geography, but the assumption that the U.S. would simply buy all of the required materials and components from China instead of producing its own also played a role in China’s outpacing of the United States in this area. This links back to the policy choices referenced in the CNBC documentary, which once again emphasizes the need for drastic policy moves in order to catch up.

The primary audience for all three of these sources are voters, potential car buyers, and government officials in the U.S. By focusing on these groups, these sources hope to make a positive change in not just America, but the rest of the world. However, the ability for the United States government to actually come together and agree to doing this is debatable, and rampant misinformation is also a primary factor at play. I feel it is necessary to investigate further the impact of misinformation on the electric vehicle transition, especially the United States. This does give me concern regarding the EV transition in the United States, given the divisiveness of almost every important issue in the country and the inability for the government to make changes fast enough (as seen with issues such as internet consumer protections). But as Robinson Meyer summed up, “What the United States is trying to do is really hard.” ... “But if they’ve [China] done it, we can do it, too. It will take grit and good-faith effort. We should assume that Ford and General Motors will be competing with BYD and Geely for decades to come, and we should relish that fight.”