

Policies Changes of US Government on EVs Companies

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Abstract: With the increase of environmental awareness, reducing carbon emissions has become one of the top concerns. At the same time, the automotive industry, as a major focus of carbon emissions, has also received close attention, and more and more people are concerned about the environmental development potential of the industry. This trend has led to major shifts in public policy and consumer behavior. At the heart of this shift lies the development of electric vehicles (EVs). Governments around the world, including the United States, have enacted policies to support the industry. As one of the most powerful automobile production companies in the United States, Ford has also become an important company leading the production of electric vehicles. This article examines several different policies proposed by the US government and discusses in detail their impact on Ford Motor Company and the electric vehicle industry. The positive and negative impacts of policies are discussed by analyzing government initiatives, industry dynamics, consumer behavior, and social feedback. At the same time, the paper highlights the complexity and challenges companies face in moving from traditional internal combustion engines (ICE) to electric vehicles. The findings suggest that while government policy has played a key role in boosting electric vehicle infrastructure, it has also created other economic challenges and new opportunities for auto companies like Ford.

Keywords: US government policy, Cost deflation, Clean energy transition, Environmental sustainability.

1. Introduction

Owing to growing worries about the sustainability of petrochemical resources and the rapidly increasing of global pollution levels, there are increasing voices in society that are driving people's growing awareness of environmental protection, with the top priority being reducing carbon emissions and developing the new energy vehicle industry. When electric cars were born, not only they can severely reduce carbon dioxide emission, but also, they are able to exhibit greater efficiency, making them an eco-friendly and sustainable form of transportation. In this way, in order to protect the environment, consumers start to buy more electric cars instead of those conventional vehicles that consumes lots of fuels. From one article that tend to research why customers are moving more and more toward electric vehicles. According to the Mobility Consumer Index (MCI) 2022 study, 52% of respondents who plan to purchase a car say they will either purchase a fully electric vehicle or a

plug-in hybrid or hybrid [1]. Additionally, governments would also encourage residents to buy more EVs by releasing several policies that can benefit for both consumers, firms and society.

This essay uses case analysis to illustrate how US government policy changes effect on electric cars companies, like Ford Company. We first discuss several main government policy changes on EVs companies, and then state the consequences of those policies on three different perspective--consumers, firms and society, including both positive and negative effects. Eventually, we have discussed how can EVs companies do better or earn more money based on current policies that signed by presidents or some specific sectors and some data or research we searched from the internet as well.

2. US Government Policy on Ford's Electric Vehicles

The first policy that government release on electric cars is Inflation Reduction Act (IRA), which is a law that signed by US President Biden on August 16, 2022. It is aiming to make the manufacture equipment's that can help domestic supply chains, lower the total energy costs and pay more wages for employer's efforts [2]. The U.S. Department of the Treasury is responsible to implement tax incentives to stimulate investment in clean energy and manufacturing, so from this law, it created more than 20 tax credits for clean energy and manufacturing. To be specific, consumers can receive up to \$7500 tax credits after they buy electric cars, while people only buy Ford F-150 Lightning, Ford Mustang Mach-E or Ford E-Transit can receive those specific tax credits (all are powered by pure electricity) [3]. In this way, by giving this subsidy to the consumers, the government promotes their adoption and increase customers' demand. Thus, with the increased demand, it can also increase the price, according to the demand and supply curve, and finally can help manufacturers to reach a higher revenue as well. This policy can directly help EVs companies by helping consumers spend at a lower price on those electric cars.

The government's second policy is "Budget2024 electric vehicle Rebates and Tax Credits". Firstly Ford Motor has begun cutting orders from battery suppliers in an effort to mitigate mounting losses in its electric vehicle business The executives stated that the introduction of more aerodynamic vehicle designs along with the reduction of pack sizes and introduction of more efficient battery chemistries will yield the advantages. (the increased quantity and decreased cost of raw materials in addition to5. He The shift to zero-emission transportation and electricity generation is receiving billions of dollars in funding from the liberal government's 2024 budget. The \$480.5 billion agreement includes spending pledges of \$607 million for zero-emission car purchase subsidies, 10% tax credit to encourage investment in the electric vehicle supply chain, and 15% tax credit to increase investment in low-emitting energy generation systems.

The government outlines six major themes of sustainability and decarbonization in Budget 2024. Significant tax credits for economic investment will be given to certain locations. These are: Carbon capture, utilization and storage; Clean technology adoption; Clean hydrogen; Clean power, clean hydrogen, clean technology production, and EV supply networks. Certain tax credits are extensions of current programs (production of clean technologies). However, brand-new streams exist as well, such as the 10% EV Supply Chain Investment Tax Credit. Buildings used for EV assembly, battery production, and cathode active material production are eligible for the EV supply chain tax credit [4].

In the US, transportation contributes 28% of total energy use and 26% of carbon emissions. Plug-in hybrid electric and battery electric vehicles are viable ways to reduce transportation's carbon footprint. Electric utility companies, state and federal governments, and several other organizations have offered financial and nonfinancial incentives to encourage the adoption of electric vehicles. We assess how these incentives affect the uptake of electric vehicles in this article. According to the research, the average sales of electric vehicles increase by 2.6% for every \$1000 granted as a tax credit or rebate. In addition, we discover that access to HOV lanes significantly increases adoption;

this effect is equivalent to a 4.7% increase for every 100 vehicles per hour in HOV lanes. Furthermore, we find that increasing consumer awareness is essential to the success of EV incentive programs and incorporate a novel variable to capture consumer knowledge of EVs and associated incentives in our model to help explain the variation at the state level in reaction to incentives [5]. The government or operators provide subsidy funds to reduce the cost of the merchant, and then the merchant is willing to lower the price to get more sales. For consumers, they can buy cheaper goods, and for merchants, more sales also increase profits

It is true that the environmental effects of conventional internal combustion engine vehicles (ICEVs) can be reduced by the development of electric vehicles (EVs). However, when the tram industry emerged as a viable solution, it could not be accepted by the public to replace the traditional gasoline car as the dominant. When the U.S. government recognized that the development of new energy vehicles could play an important role in environmental protection, they began to implement a series of policies aimed at promoting EV development and adoption. One of these policies is investment in charging infrastructure, which is central to eliminating and overcoming the oft-cited problem of "range anxiety" that impeding EV development. The following explores the impact of these policies on Ford Motor Company and other EV industry players, focusing on the economic issues and operational challenges they face.

As a major player in the automotive industry, Ford is directly affected by the transition to electric vehicles. Like many other companies, in response to market demand and government directives, they have adjusted their strategy. Now, they focus on producing electric vehicles. However, the shift to electric vehicles faces several challenges. One of the biggest is the energy demands of these vehicles.

One of the main concerns for consumers is "range anxiety" [6]. This is the fear that electric vehicles will run out of power and break down on the road before reaching their destination. This concern is growing because current battery technology still has limitations. Also, charging stations are unevenly distributed in most regions, more of these devices are located in affluent areas, making it difficult to popularize electric vehicles outside large cities [7]. While part of the problem can be addressed by enhancing and improving battery performance, a widespread, reliable infrastructure for charging is essential. This is needed to ease consumer anxiety and promote EV adoption.

Building charging infrastructure could be a lucrative opportunity for Ford and other automakers. But, it's also a huge financial burden. The construction and maintenance of charging stations require a large capital investment. This pressure can cause financial problems for car companies [8]. In addition, as an indispensable supporting product of electric vehicles, charging stations themselves will not bring considerable profits. So in fact, this economic situation presents a challenge. Ford and other such companies must balance the need to invest in infrastructure with maintaining financial sustainability.

It goes without saying that the price at which electric vehicles are sold is impacted by the expense of constructing and maintaining charging stations. As a for-profit company, to avoid operating losses, the company must ensure that the price of electric vehicles at least covers their marginal cost of production. When these costs also include the high costs associated with infrastructure development, this means that the current cost structure may cause vehicle prices to continue to rise. Also, consumer demand may fall when consumer purchasing power cannot keep up with the rising prices. Rising prices could slow the widespread adoption of electric vehicles in society. This is a negative development that poses a major obstacle to the goal of promoting a green economy.

To address these challenges, the U.S. government has implemented several measures. These measures are aimed at reducing the financial burden on electric vehicle manufacturers and stimulating market demand. One such measure is the previously mentioned investment in production and setting up charging infrastructure, according to the policy issued by the Biden administration the, US government has invested 7.5 billion dollars in the construction of these charging devices, which has

greatly eased the economic pressure on businesses [9]. By lowering the cost of these facilities, the government's role actually shifts the supply curve to the right. This increases the availability of charging stations and makes it more likely that companies will develop and deploy electric vehicle plans.

In addition, government policies include subsidies and incentives for consumers and manufacturers. According to the Inflation Reduction Act [10]. Manufacturers that produce EV charging equipment in the United States can enjoy tax incentives, while consumers can also enjoy tax incentives for installing home EV chargers, helping to reduce upfront costs. Because of these advantages, electric vehicles are more affordable and therefore more appealing to buyers. This helps to stimulate demand. In turn, increased demand for EVs has driven investment in charging infrastructure. This creates a positive feedback loop that benefits the entire industry.

Furthermore, switching to electric cars is not without its difficulties. There are many technological and administrative challenges in integrating charging infrastructure into the current electricity systems. In addition to ensuring the placement of charging equipment, it is also necessary to ensure that the grid can cope with the increased demand for electric vehicles. This is especially important in the planned concentration of electric vehicles. It will require a massive upgrade of the country's energy infrastructure.

Finally, ensuring interoperability between different brands of electric vehicles and charging stations is crucial for consumers. This requires standardizing charging technology. While this standardization process is necessary, it also adds complexity to the development of charging infrastructure. It requires coordination between government agencies, car manufacturers, and technology suppliers.

Despite these challenges, the continued expansion of charging networks also presents significant opportunities for Ford and other car companies. With the increasing availability and reliability of charging infrastructure, consumer concerns about range and charging availability are likely to diminish. Consumer anxiety is eliminated. This is an outcome that will effectively drive the adoption rate of EVs. As a result, there will be a greater demand for electric cars, which will boost industry profits and investments.

3. The Impact of Legislative Incentives on the Uptake of Electric Vehicles

3.1. Background Overview

A number of nations offer packages of legislative incentives to make electric vehicles (EVs) more desirable. Nevertheless, the efficacy of various policy incentives remains unclear. Furthermore, it is debatable if they affect various groups of people in the same way. Using constructs from the Transtheoretical Model of Change (TTM) and Protection Motivation Theory (PMT), this study, which is based on a stated-choice experiment, examines the impact of socio-psychological determinants and various potential policy incentives on Adoption. Because the generalized cost of EV use is predicted to drop, policy incentives in the choice experiment improve the probability of declared EV adoption. Free parking and bus lane access are highly valued, which makes them effective substitutes for pricey subsidies. The likelihood of an electric vehicle adoption rises with the degree of behavioral modification. Those in more advanced stages of transition, however, become less susceptible to subsidies. Individuals who hold beliefs. People whose travel habits can accommodate the usage of EVs are also more likely to choose an EV. EVs are successful in reducing the negative externalities of the current transportation system.

3.2. For Consumers

when the price of commodities decreases, consumers can get these commodities for less money, which is beneficial to consumers. The change of tram makes it easier to use, which will make it more convenient for consumers to use tram. At the same time, consumers will also enjoy the convenience brought by economic benefits, especially the progress of science and technology brought by economic development has brought more convenience to consumers' lives. The reduction in trams' carbon emissions will improve air quality and enable consumers to live in a healthier environment. A healthy environment is also conducive to improving productivity and enhancing human immunity, and the abundance of human resources is conducive to promoting economic development.

3.3. For Producers

government subsidies reduce the production cost of manufacturers, and then manufacturers will be willing to reduce the price of trams, in order to achieve the purpose of increasing sales. The profit of the manufacturer will increase as sales increase

With the increase of profits, there will be more budget for increasing human resources and new scientific and technological equipment, and the innovation of enterprises will be improved. It is also easier to attract outside investment

3.4. Social

3.4.1. Creation of Jobs and Economic Growth

Since the United States spends a great deal of money, time, and effort on climate change and clean energy, the country's wind, solar, battery, and storage projects are strengthening along with the electric vehicle industry. This has led to the creation of over 270000 (271,713) new clean energy jobs in the US, including those for technicians, electricians, mechanics, construction workers, and support staff. According to THE STATE OF THE CLEAN ENERGY BOOM, between August 16, 2022, and February 28, 2024, there will be "523 new clean energy projects totaling 271,713 new jobs and over \$352 billion in investments across 47 states and Puerto Rico." Republicans hold the majority of congressional districts in where new clean energy projects are located. In 133 Republican-controlled districts, 274 renewable energy projects have combined to provide [11]. Here is the data about how new jobs are created throughout many different sates and how much do those jobs bring to these several states (Table 1).

Table 1: Ten States with Majority Of New Jobs

STATE	#OF PROJECTS	NEW JOBS	NEW INVESTMENTS
GEORGIA	40	29472	\$ 23.12 BILLION
NEW YORK	20	26082	\$ 115.04 BILLION
TEXAS	38	23315	\$ 16.05 BILLION
KANSAS	4	20892	\$ 4.13 BILLION
MICHIGAN	45	20107	\$ 21.53 BILLION
SOUTH CAROLINA	29	16584	\$ 13.67 BILLION
NEVADA	15	15938	\$ 12.2 BILLION
ARIZONA	22	14100	\$ 10.57 BILLION
NORTH CAROLINA	24	9886	\$ 18.75 BILLION
OHIO	21	8612	\$ 8.8 BILLION

According to Brookings Institution research, obtaining a position in sustainable energy can boost income by eight to 19 percent because clean energy jobs can be paid in a higher wages, which can promote consumer spending with a high income and thus the economics of the states would grow as the aggregate demand would shift to the right (based on aggregate demand and supply curve) to raise GDP(exclude other factors that can affect GDP)

Furthermore, the clean energy initiative has helped unions outside of the car industry. Based on the Laborers International Union of North America and the International Union of Operating Engineers, the International Brotherhood of Electrical Workers (IBEW) signed a project labor agreement in December 2023 to build the SunZia transmission line across Arizona and New Mexico. This agreement facilitates the process of bringing more solar power online for developers, contractors, and unions (Table 2) [11].

Table 2: The Clean Energy Economic Boom by Sector

SECTOR	#OF PROJECTS	NEW JOBS	NEW INVESTMENTS
BATTERIES	163 PROJECTS	117,975 JOBS	\$ 109.92 BILLION
ELECTRIC VEHICLES	117 PROJECTS	54,385 JOBS	\$ 51.02 BILLION
GRID & TRANSMISSION	23 PROJECTS	10,086 JOBS	\$ 9.03 BILLION
HYDROGEN	20 PROJECTS	8,315 JOBS	\$ 12.72 BILLION
SEMICONDUCTORS 8OTHER CLEAN TECH	44 PROJECTS	25,899 JOBS	\$ 124.66 BILLION
SOLAR	114 PROJECTS	39,714 JOBS	\$ 31.01 BILLION

3.4.2. Reduced Noise

Nowadays, many city citizens suffer from noise pollution, especially who lived or settled near city center or along the highways. Lots of fossil fuels cars pass through uptown-- usually the way people go to work and go back home at night-- and severely affect residents' sleeping condition as well as stress, hearing damage and even heart disease. Since traffic noise is made up of engine noise, tire noise, road noise, and whistling noise, fossil fuels cars with engine can generate lots of traffic noise, unlike EVs, that only generate small tire noise when they are derived in a rough road and only has a motor system powered by a battery instead of engine. The EU requires EVs to emit at least 56 decibels at low speeds, which is similar to the noise of a dishwasher, office computer, or nearly empty restaurant. Furthermore, one study did an experiment that they test the noise between Tesla and Porsche for three times, and the result showed that in average, Tesla can emit 3 dB (SPL) than Porsche [12].

Noise pollution as a negative externality ($MSB < MPB$) cause deadweight loss in the society, but with the increased use of electric cars, it can cause the marginal social benefit curve shift to right and move close to the social optimal point, reducing the deadweight loss created by the consumers' negative externality.

3.4.3. Environmental Benefits

With the increased greenhouse gas emission, climate change has been a serious public topic in modern society, especially in the rural areas which occur increased frequency and severity of wildfires in order to maintain their existence by burring or hunting animals, and the increased heat and droughts, which all can generate lots of air pollution. More specifically, "more than any other U.S. sector, the

transportation sector is responsible for 29% of all U.S. GHG emissions, and approximately 60% of these emissions come from passenger vehicles." In terms of greenhouse gas emissions, electric vehicles (EVs) can be less than conventional cars, particularly if the electricity is produced using renewable energy sources like hydroelectricity, solar power, or wind power [3]. Furthermore, in the fully electrified (fuller) scenario, the reduction in PM2.5 peaked between 0.34 and 2.29 μg in place of utilizing traditional vehicles. m^{-3} [13]. According to a study by the European Energy Agency, electric automobiles release between 17–30% less carbon than gasoline or diesel cars, even when the source of energy generation is taken into consideration. The following data can clearly show how electric cars can reduce air pollution, comparing the conventional car on RFG. Thus, it can be seen that employing more electric cars contribute to a healthier environment with less air pollution. By 2050, the American Lung Association estimates that a nationwide electric transportation system will prevent 93,000 asthma attacks, save 6,300 lives annually, and eliminate 416,000 working days (Table 3) [3].

Table 3: Lifecycle Emissions* and Fuel Use per Mile for Gasoline and EV Passenger Cars

	Conventional Car on RFG	Electric Car	Percent Reduction (increase)
	Grams/Mile	Grams/Mile	
Carbon Monoxide (CO) Total	2.906	0.113	96%
CO: Urban	2.767	0.005	100%
Volatile Organic Compounds (VoC) Total	0.209	0.036	83%
VOC: Urban	0.148	0.000	100%
NOx: Urban	0.048	0.015	69%
PM10: Urban	0.032	0.022	31%
SOx: Urban	0.008	0.002	75%
Carbon Dioxide	449	371	17%
Greenhouse Gases (GHG)	473	384	19%
	BTU/Mile	BTU/Mile	
Fossil Fuels	5827	4201	28%
Petroleum	4573	89	98%

4. Drawbacks and Solutions

4.1. Inflation

People may think that with the increased government spending and investments, it may also cause inflation to the overall economic. Then government would try to do somethings to mitigate inflation that was caused by the large amount of government spending or investments on electric cars we mentioned before. Government can impose income taxes to stimulate private investment, which can increase loanable fund demand in the whole economic. In this way, the real interest rate would increase and then the consumption or investment would decrease. Moreover, government can increase discount rate or reserve ratio to cause money supply decrease, which can reduce the amount of money circulating in the market.

4.2. More Air Pollution

Ashley Nunes, Ph.D., a fellow at Harvard Law School's Labor and Work life Program rebuts that those subsidies given by the governments may actually increase greenhouse gas emissions. His study claims that one of the reasons is that the major consumers of EVs are rich families, but they won't use EVs very often and just regard as a secondary vehicle. They won't keep EVs very long, so the air pollution can still not be improved [14]. However, according to one publication, "only couples with incomes of \$300,000 or less or single people with incomes of \$150,000 or less would be eligible for these specific tax credits [15]." In this way, it means that low income-families would more prefer to buy EVs. Also, now in US, low-income families make up a large part. The U.S. Census Bureau announced today that real median household income in 2022 fell in comparison to 2021 and to be specific, their income fell by 2.3% from \$76,330 in 2021 to \$74,580 in 2022 [16]. Another research, called Pew Research Center, maintains that the proportion of adults in the upper income group rose from 14% to 20% between 1971 and 2019. Concurrently, the proportion of people in the lower income bracket rose from 25% to 29%. Overall, there was a greater amount of movement up the income ladder than down. In addition, because of war between Russia and Ukraine, and Russia is not willing to export oil to other countries, especially to the US, the oil price rapid increase. The price of West Texas Intermediate (WTI) crude oil will climb by \$52.33% to \$37.14, while the price of Brent crude oil will rise by 56.33% to \$41.49 [17]. And, according to Trading Economics, "as of August 23, 2024, crude oil prices have increased 4.62% since the beginning of the year". In this way, more low-income families would not choose conventional cars that consumes lots of oil and turn their preference to EVs. It follows from this that EVs are probably aimed at large masses of low-income people instead of rich families. Exactly, an article indicates that their research results show that in the US, there is a substantial negative correlation between having more personal income and the EV market share in the Central US, while there is a positive correlation between owning charging stations [18].

5. Conclusion

In summary, the new policies promoting electric vehicles (EVs) represent a strong push towards reducing carbon emissions and fostering sustainability. The Inflation Reduction Act (IRA) and Budget 2024 incentives offer crucial tax credits and funding to boost EV adoption as well as support charging infrastructure development.

Since the official US government source for fuel economy information claims that only the EVs produced in the US can receive the tax credits for their consumers. Also, as we mention before, tax credits would available only to couples with incomes of \$300,000 or less or single people with income of \$150,000 or less, and then with the more low-income family's preference, in the future, the company can convert the high-end models to the foreign production and move the low-end models to the domestic production lines. In this way, the electric vehicles companies can receive higher revenue with a higher demand of EVs.

These measures make EVs more affordable and accessible while creating clean energy jobs. However, challenges like potential revenue loss and market distortions need careful management. Effective policy design and strategic adjustments will be key to maximizing the benefits of these initiatives and achieving long-term environmental and economic goals.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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