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The Race to Electric Vehicles:

National Policy in China and the United States

By

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# The Race to Electric Vehicles:
# National Policy in China and the United States

Jerome Y. Saliba

## ABSTRACT

Over the past decade, electric vehicles have been growing in popularity. The number of electric vehicles on the roads increased from a few thousand in 2010 to more than 10 million in 2020.[1] Electric vehicles have already become a major element of modern transportation and may even replace traditional internal combustion engine vehicles before we know it.[2] As a rising industry, electric vehicles manufacturing has been subject to national policy in many countries around the world. China and the United States are among those countries, where state involvement has had significant implications on the EVs industry.[3] The aim of this thesis is to comparatively analyze the impacts of national policy in the United States and China on the respective performances of the electric vehicles industry. This thesis looks closely at the national policy shift that occurred in the United States when President Donald. J Trump was elected. This focus on the policy transition after the election of Trump is relevant, given his drastic diversion from his predecessor's approach on energy matters, including electric vehicles. At a time when China was heavily supporting its electric vehicles sector,[4] the Trump administration was rolling back key national policy without providing any alternatives.[5]

**Keywords:** Electric Vehicles, EV, Car Industry, United States, China, National Policy, International Competition, Xi Jinping, Barack Obama, Donald J. Trump.

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[1] "Global EV Outlook 2021" (International Energy Agency, 2021), 07.
[2] Andreas Cornet et al., "Why the Future Involves E-Mobility?" (McKinsey & Company, September 7, 2021), https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/why-the-automotive-future-is-electric; Peter Campbell and Joe Miller, "Electric Vehicles: The Revolution Is Finally Here," *Financial Times*, October 4, 2021, https://www ft.com/content/fb4d1d64-5d90-4e27-b77f-6e221bc02696.
[3] "Comparing U.S. and Chinese Electric Vehicle Policies," Environmental and Energy Study Institute, February 28, 2018, https://www.eesi.org/articles/view/comparing-u.s.-and-chinese-electric-vehicle-policies.
[4] He Hui and Jin Lingzhi, "How China Put Nearly 5 Million New Energy Vehicles on the Road in One Decade," *The International Council on Clean Transportation* (blog), January 28, 2021, https://theicct.org/how-china-put-nearly-5-million-new-energy-vehicles-on-the-road-in-one-decade/.
[5] David Shepardson, "Trump Finalizes Rollback of Obama-Era Vehicle Fuel Efficiency Standards," Reuters, March 31, 2020, https://www.reuters.com/article/us-usa-autos-emissions-idUSKBN21I25S.

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| | |
|---|---|
| CAFC | Corporate Average Fuel Consumption |
| CAFE | Corporate Average Fuel Economy |
| DOE | The United States Department of Energy |
| DOT | The United States Department of Transportation |
| EPA | The Environmental Protection Agency |
| FCEV | Fuel Cell Electric Vehicle |
| FYP | Five-Year Plan |
| GHG | Greenhouse Gas |
| GM | General Motors |
| HEV | Hybrid Electric Vehicle |
| ICE | Internal Combustion Engine |
| ICEV | Internal Combustion Engine Vehicle |
| IR | International Relations |
| MPG | Miles Per Gallon |
| MST | The Chinese Ministry of Science and Technology |
| MY | Model Year |
| NEV | New Energy Vehicle |
| NPC | The Chinese National People's Congress |
| PEV | Plug-In Electric Vehicle |
| PHEV | Plug-In Hybrid Electric Vehicle |
| PNGV | Partnership for a New Generation of Vehicles |
| PRC | People's Republic of China |
| R&D | Research and Development |
| SAFE | Safer Affordable Fuel-Efficient |
| SEI | Strategic Emerging Industries |
| US | United States |
| ZEV | Zero Emission Vehicles |

# Chapter One

# Introduction

This study investigates the difference in national electric vehicles policy between the People's Republic of China and the United States to understand its impacts on the industry. More specifically, it examines the implications of the policy shift that happened in the US when President Donald J. Trump assumed office. In broad terms, an EV is a vehicle that is powered by an electric engine.[6] While it may be difficult to identify the exact time and place of the invention of the first electric vehicle, EVs are the result of a series of breakthroughs that began in the 1800s.[7] While most EVs at the time were produced for experimental purposes, many of them were put into practical use. For instance, between 1897 and 1898, the London Electrical Cab company introduced 75 EVs to its fleet and kept using them until 1900.[8] Since then, EVs-related technology has drastically advanced.[9]

In 1996, General Motors produced its EV1 model, the first mass produced modern EV by a major company.[10] By 1999, around 1,100 EV1 had already been produced, none of which was sold out.[11] Instead, GM leased out those vehicles, which allowed it to

[6] "Electric Vehicles," Australian Renewable Energy Agency, Australian Renewable Energy Agency, accessed March 30, 2022, https://arena.gov.au/renewable-energy/electric-vehicles/.
[7] "The History of the Electric Car," The United States Department of Energy, accessed March 26, 2022, https://www.energy.gov/articles/history-electric-car.
[8] Masayuki Morimoto, "Which Is the First Electric Vehicle?," *Electrical Engineering in Japan* 192, no. 2 (2015): 34, https://doi.org/10.1002/eej.22550.
[9] Bryce Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," *ReNew: Technology for a Sustainable Future*, no. 145 (2018): 80–83.
[10] "25 Years of Drive: The World's First Electric Vehicle Goes on Sale," Drive, January 29, 2022, https://www.drive.com.au/caradvice/25-years-of-drive-the-worlds-first-electric-vehicle-goes-on-sale/.
[11] "25 Years of Drive."

repossess and crush them due to what it described as a liability risk after deciding to abandon its electric research program.[12] In 2008, Tesla released the first generation of the Roadster model, "the first mass-produced highway-legal electric vehicle powered by a lithium-ion battery".[13] Shortly after, major car companies all over the world started introducing EVs of their own,[14] which initiated tremendous growth in the industry. It was around 2010 when the number of EVs on the roads surpassed few thousand cars.[15]

For this study, we look specifically at those commercially produced EVs as we are primarily interested in understanding the impacts of national policy in the US and China on the growth of EVs as a popular transportation option. In that regard, it is important to further explain what types of vehicles is included in the scope of our research, given that the term EVs may be used to describe a wide range of modern vehicles.

The term EVs has evolved to include several types of vehicles. Battery electric vehicles are vehicles that are powered entirely by an electric battery and do not rely on any type of fuel combustion.[16] They are recharged through regular electricity outlets or dedicated charging points that tend to charge faster.[17]

Hybrid electric vehicles generally have an electric engine, a relatively small battery, and an internal combustion engine.[18] HEVs are refueled solely with fossil fuels and cannot be plugged for recharging.[19] The battery on a HEV is recharged through

[12] "25 Years of Drive."
[13] "The Race for The Electric Vehicle," CB Insights Research, September 15, 2021, https://www.cbinsights.com/research/report/electric-car-race/.
[14] "Global EV Outlook 2021," 07.
[15] "Global EV Outlook 2021," 07.
[16] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 80.
[17] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 80.
[18] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 80.
[19] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 80.

regenerative breaking, which allows for the vehicle's kinetic energy to be converted to electrical energy that can be stored in the battery.[20] Regenerative breaking can save around 10% to 20% of fuel consumption.[21] The first generations of EVs that appeared in the market in the 1990s were HEVs.[22]

Plug-in hybrid electric vehicles are another type of EVs. PHEVs generally have both an internal combustion engine and a battery.[23] What distinguishes a PHEV from a HEV is that it can be plugged to an external power point for recharging, which enables it to drive on pure electric power without any fuel combustion.[24] In addition to plug-in charging, many PHEVs can recharge from the ICE directly that acts like a generator and/or through regenerative breaking.[25] When it comes to battery range, some models have a 15 km battery range while others like the BMW i3 REx can go as far as 180 km on a full charge.[26] Both BEVs and PHEVs are also called plug-in electric vehicles, which refers to all EVs that can recharge partially or totally through external charging points.[27]

The last category of modern EVs is known as Fuel Cell Electric Vehicles. FCEVs are like BEVs in the sense that both do not have any form of ICE on board.[28] However, unlike BEVs and PHEVs, FCEVs are not typically capable of recharging through external

[20] "Regenerative Braking - an Overview | ScienceDirect Topics," accessed July 2, 2022, https://www.sciencedirect.com/topics/engineering/regenerative-braking.
[21] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 80.
[22] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 80.
[23] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 82.
[24] "Hybrids vs. Plug-in Hybrids: Pros and Cons," accessed July 2, 2022, https://www.caranddriver.com/features/a27127697/plug-in-hybrid-2019/.
[25] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 81.
[26] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 81.
[27] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 80–82.
[28] "Alternative Fuels Data Center: How Do Fuel Cell Electric Vehicles Work Using Hydrogen?," The United States Department of Energy, accessed July 2, 2022, https://afdc.energy.gov/vehicles/how-do-fuel-cell-electric-cars-work.

electric charging points.[29] FCEVs are equipped with fuel cells powered by hydrogen, which produces the electricity that powers the engine.[30] Although FCEVs, have several advantages such as producing no tail pipe emissions besides water vapor, they are still not as popular as the other types of electric vehicles as they require special and expensive refueling stations.[31] For instance, in 2020, out of the 10 million plus[32] EVs stock in the world, only 35,000 were FCEVs.[33]

For our research, the term EVs refers to all the above-mentioned categories except HEVs. This distinction is because HEVs are vehicles that are purposed to be more efficient while still relying on ICEs. Furthermore, recent EVs policy in both the US and China tend to make that distinction.[34] As a result, in this study, EVs as an umbrella term includes BEVs, PHEVs, and FCEVs, keeping in mind that the first two types are more common due to the relatively small popularity of FCEVs.[35] Lastly, it is important to note that in Chinese policy, BEVs, PHEVs, and FCEVs are typically referred to as New Energy Vehicles,[36] which in our research is used interchangeably with the term EVs as they both include the same three subcategories.

[29] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 81.
[30] "Alternative Fuels Data Center: How Do Fuel Cell Electric Vehicles Work Using Hydrogen?"
[31] Gaton, "BEV, PHEV, HEV or FCEV: Choose Your EV Acronym!," 81.
[32] "Global EV Outlook 2021," 17.
[33] "The Future of Hydrogen: Seizing Today's Opportunities" (International Energy Agency, June 2019), https://www.iea.org/reports/hydrogen.
[34] Hui and Lingzhi, "How China Put Nearly 5 Million New Energy Vehicles on the Road in One Decade"; "Alternative Fuels Data Center: Electric Vehicles," The United States Department of Energy, accessed July 4, 2022, https://afdc.energy.gov/vehicles/electric.html.
[35] "Global EV Outlook 2021," 36.
[36] Hui and Lingzhi, "How China Put Nearly 5 Million New Energy Vehicles on the Road in One Decade."

Since 2010, the world's EVs stock has increased from a few thousand vehicles to more than 10 million in 2020[37]. In financial terms, the EVs industry has been growing quickly and steadily. In 2020 alone, consumers all around the world spent more than 120 billion USD on EVs.[38] In addition to traditional car brands, the world also witnessed the rise of carmakers that solely produce electric cars. Tesla for example hit one trillion USD in market valuation in 2021.[39]

Today, more than 10 of the major car manufacturers in the world have already set significant electrification targets. Both Jaguar and Volvo announced their intentions to sell only electric cars from 2025[40] and 2030[41] respectively. Similarly, GM is aiming to offer only electric light duty vehicles as of 2035.[42] All around the world, governments have been investing large amounts into the development of EVs and their required infrastructure.[43] It is undeniable that EVs have already become a major element of modern transportation and may even replace traditional internal combustion engine vehicles before we know it.[44]

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[37] "Global EV Outlook 2021," 07.
[38] "Global EV Outlook 2021," 21.
[39] "Tesla Is Now Worth More than $1 Trillion - CNN," accessed March 13, 2022, https://edition.cnn.com/2021/10/25/investing/tesla-stock-trillion-dollar-market-cap/index html.
[40] "JLR to Make Jaguar Brand Electric-Only by 2025," The Guardian, accessed March 13, 2022, https://www.theguardian.com/business/2021/feb/15/jlr-to-make-jaguar-brand-electric-only-by-2025.
[41] Jack Ewing, "Volvo Plans to Sell Only Electric Cars by 2030," *The New York Times*, October 22, 2021, https://www nytimes.com/2021/03/02/business/volvo-electric-cars html.
[42] Michael Wayland, "General Motors Plans to Exclusively Offer Electric Vehicles by 2035," Consumer News and Business Channel, January 28, 2021, https://www.cnbc.com/2021/01/28/general-motors-plans-to-exclusively-offer-electric-vehicles-by-2035.html.
[43] "Infrastructure for Charging Electric Vehicles: More Charging Stations but Uneven Deployment Makes Travel Across the EU Complicated" (Luxembourg, Luxembourg: Eurpean Court of Auditors, 2021), 7; Michael Schuman, "The Electric-Car Lesson That China Is Serving up for America," *The Atlantic*, May 21, 2021, https://www.theatlantic.com/international/archive/2021/05/joe-biden-china-infrastructure/618921/.
[44] Cornet et al., "Why the Future Involves E-Mobility?"; Campbell and Miller, "Electric Vehicles."

As is the case with most global topics, we often hear questions concerning the US-China competition in the context of EVs.[45] Some have even discussed this topic as part of the "Battery Wars" between the US and China.[46] As an emerging sector, the EVs industry brings tremendous opportunity in terms of innovation, power, and economic growth. In that sense, discussions about competition are mainly concerned with the extent to which the EVs industry in either China or the US outperforms the other. As the world is still at an early stage of electrifying transportation, national success stories are discussed in relative terms to other countries.[47] As a result, China and the United States being two of the main EVs markets in the world, are in a "de facto" competition as is the case for them in every other topic of economic relevance.

Since 2010, the Chinese government has been approaching the EVs sector with a "whole of nation approach".[48] It has been dedicating significant efforts to push the transportation sector towards electrification.[49] Over the past decade, it has become a favorable environment for EVs through generous government subsidies and supportive regulations.[50] It has also been developing its EVs-related infrastructure, including

[45] Anjani Trivedi, "The U.S. Is Losing the EV Battery Race to China," Bloomberg, accessed July 11, 2022, https://www.bloomberg.com/opinion/articles/2022-04-05/the-u-s-is-losing-the-ev-battery-race-to-china#xj4y7vzkg.
[46] Pete Pattisson and Febriana Firdaus, "'Battery Arms Race': How China Has Monopolised the Electric Vehicle Industry," *The Guardian*, November 25, 2021, sec. Global development, https://www.theguardian.com/global-development/2021/nov/25/battery-arms-race-how-china-has-monopolised-the-electric-vehicle-industry.
[47] "Global EV Outlook 2021."
[48] Dennis Blair and Robbie Diamond, "The US Is Falling Behind China in the Race for Electric Vehicles," *The Diplomat*, March 15, 2021, https://thediplomat.com/2021/03/the-us-is-falling-behind-china-in-the-race-for-electric-vehicles/.
[49] Gregor Sebastian, "In the Driver's Seat: China's Electric Vehicle Makers Target Europe" (Mercator Institute for China Studies, September 1, 2021), https://merics.org/en/report/drivers-seat-chinas-electric-vehicle-makers-target-europe.
[50] Han Hao et al., "China's Electric Vehicle Subsidy Scheme: Rationale and Impacts," *Energy Policy* 73 (October 1, 2014): 731, https://doi.org/10.1016/j.enpol.2014.05.022.

charging stations, repair stations, adequate parking facilities among many others.[51] Today, there are more EVs on Chinese roads than there are in the United States and the entire European continent.[52]

On the US side, EVs have undergone a different course. While initially the industry received some public support, it also faced several challenges, especially after the election of President Donald Trump in November of 2016.[53] Over the course of four years (2017-2021), the Trump administration adopted several national policies that may have negatively impacted the growth of the EVs industry in the US[54] and consequently gave China an edge. Since his early days in office, Trump took several steps to rollback fuel efficiency and weaken greenhouse gas emissions standards. He formally withdrew from the Paris accord and limited public support to green initiatives.[55] Trump's support to the EVs industry or the lack thereof may have negatively impacted its prospects in the US at a time when China had been taking steady and large steps towards mainstreaming electric cars.

The main purpose behind this thesis is to explore the true nature of the US-China competition when it comes to the EVs industry and to provide a comparative analysis of national EVs policy and its implications in both countries. More specifically, we look at Trump's term (2017-2021) and analyse the change in the US national EVs approach.

[51] Sebastian, "In the Driver's Seat: China's Electric Vehicle Makers Target Europe."
[52] "Global EV Outlook 2021," 07.
[53] Noah Smith, "Trump's Plan to Kill Subsidies for Electric Cars Is a Mistake," Bloomberg, December 6, 2018, https://www.bloomberg.com/opinion/articles/2018-12-06/trump-s-plan-to-kill-subsidies-for-electric-cars-is-a-mistake.
[54] Paul A. Eisenstein, "Biden Ditches Trump Mileage Cuts, Targets EVs as Half of U.S. Car Sales by 2030," Forbes, October 4, 2021, https://www.forbes.com/wheels/news/biden-half-ev-sales-2030/.
[55] Matt McGrath, "Climate Change: US Formally Withdraws from Paris Agreement," British Broadcasting Corporation, November 4, 2020, https://www.bbc.com/news/science-environment-54797743.

Furthermore, we aim to better understand the existing belief that China, especially in the past few years has in fact been "winning" the "EVs Race" against the US.[56]

Although foreign policy, such as installing trade barriers have been an important policy measure that states have employed to protect their critical and newly rising industries, this study focuses on national policy in the US and China and excludes the trade war. While the implications of protectionism are surely relevant, expanding the scope of this research to include international policy, such as tariff instalment is likely to cause counterproductive effects as it may distort our comparative chapter. For this reason, the scope of this paper is focused solely on comparing national EVs policy in both the US and China, while acknowledging the relevance of other factors, such as international trade barriers.[57]

While Europe ranks second when it comes to the size of the EVs market,[58] this study focuses solely on the US and China. While national policy has been a major element in EVs promotion in Europe, it significantly varies between one country and another, which makes it counterproductive to include it in this study. Furthermore, as the thesis aims to reach a better understanding of the US-China competition in the EVs realm, leaving Europe out of our analysis can further limit the variables that could come into play, and consequently provide us with more accurate findings.

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[56] Pattisson and Firdaus, "'Battery Arms Race'"; Keith Bradsher, "As Cars Go Electric, China Builds a Big Lead in Factories," *The New York Times*, May 4, 2021, https://www nytimes.com/2021/05/04/business/china-electric-cars.html; "How Will China's Tech Giants Shake up the World's Biggest Auto Market?," South China Morning Post, accessed April 3, 2022, https://www.scmp.com/business/companies/article/3117793/chinas-ev-war-heres-how-tech-giants-will-shake-worlds-biggest; Sebastian, "In the Driver's Seat: China's Electric Vehicle Makers Target Europe."
[57] "How Electric Vehicles Will Redefine Geopolitics," World Economic Forum, July 10, 2019, https://www.weforum.org/agenda/2019/07/how-electric-vehicles-will-redefine-geopolitics/.
[58] "Global EV Outlook 2021," 38.

This thesis is of relevance for several reasons. From an International Relations perspective, it can contribute towards the existing literature on the US-China competition on the global stage. While it fits well within a pre-established discussion in the field of IR, it can also provide relevant insights by locating issues of the latter within the realm of electric vehicles, technology, and sustainability. Furthermore, this study can make both theoretical and practical contributions to the field of International Political Economy. From an academic standpoint, this paper intends to highlight the relevance of multi-field research within IR as it interacts with a variety of fields, including, politics, energy, economics, and technology just to name a few.

## Research Question

The main research question is: how national policy in the US and China has impacted the respective prospects of EVs, specifically during the presidency of Donald Trump between 2017 and 2021? This study also considers other relevant questions including the following: how does the EVs sector in the US compare to that of China? Which among the two global powers dominates the sector and is consequently winning the "Battery Arms Race"? Asking those questions is important because of how well they fit within pre-existing discussions on the competition between the US and China. While similar ones may have already been asked, the significance of those questions is that they aim to find the links between the performance of EVs industry and national policy.

## Literature Review and Gaps

Having presented the topic and listed the research questions, this section analyses pre-existing literature to understand what has already been said about the topic and identify some of the gaps that need to be filled.

### Research on National Electric Vehicles Policy in China

In 2010, the Chinese State Council issued a decision to support what they defined as Strategic Emerging Industries, which refers to fields that are in a relatively early stage of development but hold significant value especially on the technological level.[59] Naturally, the production of electric vehicles became a prime example of a SEI that China took active measures to support.[60] Since then, literature has already discussed the concept of SEI and Chinese energy policy in relation to the field of EVs.

The first type of those studies tends to focus on policy that provides financial incentives to encourage consumers to buy electric vehicles.[61] The second type looks at taxing carbon emissions to render the purchase of ICEVs less attractive.[62] The third type discusses government initiatives to mainstream EVs by investing in the needed infrastructure such as plug-in stations, motorway planning, and parking designing just to

[59] Ling Chen and Barry Naughton, "An Institutionalized Policy-Making Mechanism: China's Return to Techno-Industrial Policy," *Research Policy* 45, no. 10 (2016): 2139.
[60] Yang Andrew Wu et al., "A Review of Evolutionary Policy Incentives for Sustainable Development of Electric Vehicles in China: Strategic Implications," *Energy Policy* 148 (January 1, 2021): 01, https://doi.org/10.1016/j.enpol.2020.111983.
[61] Shanyong Wang, Jun Li, and Dingtao Zhao, "The Impact of Policy Measures on Consumer Intention to Adopt Electric Vehicles: Evidence from China," *Transportation Research Part A: Policy and Practice* 105 (November 1, 2017): 15, https://doi.org/10.1016/j.tra.2017.08.013.
[62] Wang, Li, and Zhao, "The Impact of Policy Measures on Consumer Intention to Adopt Electric Vehicles: Evidence from China," 15.

name a few.[63] In addition to the studies that analyse such policies, a significant amount of empirical research on the EVs sector in China also exists. Such studies have answered questions on the size of the EVs market, its share of Chinese exports to Europe and the United States, and the quantitative aspects of its popularity or the lack thereof.[64]

### Research on National Electric Vehicles Policy in the US

Many studies have reflected on EVs-related policy within the United States over the past decade. Like in China, those studies discuss the different types of policy and their respective implications ranging from financial incentives[65] to the state's involvement in establishing the adequate infrastructure and its commitment to transform its fleets into electric ones.[66] While we can find research into national EVs policy in the US, it appears that the research on Chinese policy is more developed, which may indicate that national EVs policy has been more common in China.

The existing research on the US case seems to be broader. For instance, while we might not find an abundance of literature on nation-wide EVs policy specifically, we can still look at a wide range of studies on energy topics where we can find relevant

[63] Wang, Li, and Zhao, "The Impact of Policy Measures on Consumer Intention to Adopt Electric Vehicles: Evidence from China," 15.
[64] Shuxia Yang et al., "Market Cultivation of Electric Vehicles in China: A Survey Based on Consumer Behavior," *Sustainability* 10, no. 11 (2018): 01–23; Qingyou Yan et al., "Research on Real Purchasing Behavior Analysis of Electric Cars in Beijing Based on Structural Equation Modeling and Multinomial Logit Model," *Sustainability* 11, no. 20 (2019): 5870; Yong Zhang, Yifeng Yu, and Bai Zou, "Analyzing Public Awareness and Acceptance of Alternative Fuel Vehicles in China: The Case of EV," *Energy Policy* 39, no. 11 (2011): 7015–24.
[65] Sanya Carley et al., "Overcoming the Shortcomings of US Plug-in Electric Vehicle Policies," *Renewable and Sustainable Energy Reviews* 113 (2019): 109–291.
[66] Matjaz Knez, Gašper Kozelj Zevnik, and Matevz Obrecht, "A Review of Available Chargers for Electric Vehicles: United States of America, European Union, and Asia," *Renewable and Sustainable Energy Reviews* 109 (2019): 284–93.

information on EVs policy.[67] Furthermore, we can find copious amounts of studies on Trump's policy towards climate change and his seeming favoritism of fossil fuels as an energy source instead of greener options like electric.[68] In that regard, an important source of information is *Elsevier's Energy Policy* Journal, which presents numerous articles on the various impacts of energy-related policy. For instance, one of those articles has discussed how Trump's "America First" approach may have influenced his national energy policy and reconfigured the global energy order.[69]

Another factor that sets the China case apart from the US one concerns the policy mediums in question. Given China's political structure that is largely centralized, policy studies are typically centered around decisions enacted by the central government or under its directives. On the US side, state and national policy intertwine and may not always align.[70]

### Research on the US-China Electric Vehicles Competition

While discussions around US-China competition in the field of EVs are by no means new, it appears that much of the discussion is found through news sources and media reports. Much of the existing literature on the topic often concerns broader clean energy matters where electric cars are studied among many other elements.[71] Even when

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[67] Meghan Claiborne, "The SAFE Vehicles Rule: How the Trump Administration's Course Change on Vehicle Emissions Reflects a Larger Policy Shift Away from Environmentally Friendly Regulations," *Emory Corporate Governance and Accountability Review* 6, no. 1 (2019): 10–15.
[68] Claiborne, "The SAFE Vehicles Rule: How the Trump Administration's Course Change on Vehicle Emissions Reflects a Larger Policy Shift Away from Environmentally Friendly Regulations."
[69] Farid Guliyev, "Trump's 'America First' Energy Policy, Contingency and the Reconfiguration of the Global Energy Order," *Energy Policy* 140 (May 2020): 8, https://doi.org/10.1016/j.enpol.2020.111435.
[70] Barry G. Rabe and Sarah B. Mills, "State Energy Policy in the Trump Era: Insights from Public Opinion," *Journal of Environmental Studies and Sciences* 7, no. 4 (2017): 535–39.
[71] Brian Murray et al., "The United States, China, and the Competition for Clean Energy," *Nicholas Institute for Environmental Policy Solutions, Duke University* 12, no. 26 (July 2011): 9.

we may find comparative studies on EVs in the US and China, they typically focus on comparing quantitative elements such as the size of the market or its valuation, without necessarily considering policy-related factors.[72]

In that regard, one gap that we identify is the lack of precise literature that considers the US-China competition in the EVs realm, which our research can contribute to. One example of this competition falls under the areas of intellectual property where the US and China have been ruthlessly competing in their quest to develop the most advanced EVs.[73]

## Working Arguments, Variables, Hypotheses, and Concepts

Having discussed the pertinent literature on the topic and having identified the main gaps, this part discusses the main arguments and presents our hypothesis and variables. Our working arguments revolve around the idea that state policy is critical to supporting emerging industries and therefore among the two countries, the one with more "aggressive" EVs approaches is more likely to dominate the market. In that regard, the main hypothesis is that China's "whole of nation" approach when it comes to EVs allowed it to surpass the US and arguably dominate the industry. In other words, the increased commitment towards policy that supports EVs significantly contributes to the size of the industry.

[72] Peter Slowik and Nic Lutsey, "The Continued Transition to Electric Vehicles in US Cities" (The International Council on Clean Transportation, July 24, 2018); Xu Hao et al., "Plug-in Electric Vehicles in China and the USA: A Technology and Market Comparison," *Mitigation and Adaptation Strategies for Global Change* 25, no. 3 (January 17, 2020): 329–53.
[73] Jonas Meckling and Jonas Nahm, "The Politics of Technology Bans: Industrial Policy Competition and Green Goals for the Auto Industry," *Energy Policy* 126 (2019): 470–79.

## Appropriate Methods, Justification, and Sources of Data

Overall, this study heavily relies on qualitative analysis while also reflecting on quantitative figures of relevance to national EVs policy and markets. It discusses national EVs policy in both countries before proceeding to comparing the two. The sources of data include both primary and secondary sources, such as laws, regulations, policy briefs, books, news articles, and statistical reports, just to name a few.

## Chapters' Outline

This chapter introduces the topic and highlights the main objective. It is also employed as a space to address relevant concepts and notions. For instance, in this chapter we detail our rationale behind focusing on the US-China EVs competition and leaving Europe out, even though it is a major entity in the EVs realm. Chapter Two focuses on the nature of state involvement in that sector thus far. Chapter Three discusses China's policy approach towards EVs and how it has affected the prospects of the industry. Chapter Four considers national EVs policy in the US and its impacts on the advancement of the industry or the lack thereof, looking specifically at the four years of the Trump presidency. Chapter Five provides a comparative take on the two preceding chapters and presents our inferences on the competition between the US and China when it comes to EVs. It also reflects on what it means to "win" the "EVs Race". Chapter Six serves as a conclusion that reiterates the main questions and the main findings. It also presents potential ways to build on those findings and strengthen them further.

# Chapter Two

# National Electric Vehicles Policy: An Overview

Having presented the main aim of this study, which is to compare the US and Chinese national EVs policy, this chapter discusses the notion of state involvement in the EVs industry by means of national policy. First, it highlights some of the main challenges that the EVs industry has been facing thus far. Second, it discusses the role of states to counter those challenges and the rationale behind their interventions. Lastly, it lists the main forms of EVs policy mechanisms that states around the world have employed thus far. This chapter sets the premise for the following chapters by providing the reader with a clear conceptual understanding of EVs policy before discussing its application in both China and the US.

While EVs have been rising in popularity all around the world, especially in recent times,[74] they are still far behind in the race with ICEVs. For instance, in 2020, although EVs sales saw an impressive 43% increase from the previous year, they only accounted for about 1% of the global car market share.[75] While for many EVs are the future of transportation,[76] it is evident that they have been and are still facing significant barriers to their adoption as a mainstream transportation alternative.[77] Among those numerous

[74] Johnny Wood, "More Electric Cars Are Now Sold Every Week than in the Whole of 2012," World Economic Forum, February 18, 2022, https://www.weforum.org/agenda/2022/02/electric-cars-sales-evs/.
[75] "Policies to Promote Electric Vehicle Deployment," International Energy Agency, 10, accessed April 13, 2022, https://www.iea.org/reports/global-ev-outlook-2021/policies-to-promote-electric-vehicle-deployment.
[76] Cornet et al., "Why the Future Involves E-Mobility?"
[77] G. Krishna, "Understanding and Identifying Barriers to Electric Vehicle Adoption through Thematic Analysis," *Transportation Research Interdisciplinary Perspectives* 10 (June 2021): 01–09, https://doi.org/10.1016/j.trip.2021.100364.

limitations, we recognize the following categories: technological and infrastructural issues; social acceptance; high prices;[78] and concerns about the extent to which EVs are cleaner than ICEVs.[79]

Technological problems create major barriers ahead of a full-scale adoption of EVs. First and foremost, the main concerns in that regard revolve around batteries. More specifically, the "limited" range of EVs has so far been reported as a major barrier for many potential consumers.[80] Although, many EVs can easily travel a larger distance on a full charge in comparison to ICEVs on a full fuel tank, range is still a major hurdle as charging stations are not as widespread as gas stations.[81] Furthermore, the often "long" charging period for EVs, especially when we compare it to that of fuel refilling also contributes to "range anxiety"[82] as an EV full charge may require few hours.[83]

In addition to the technology issues discussed above, EVs encounter similar barriers on the level of infrastructure. A major deterrent to potential EVs consumers is due to the insufficiency of charging stations and to the mainstream perception of current transportation infrastructure as being unfriendly towards EVs. A survey conducted in the

[78] Fuad Un-Noor et al., "A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development," *Energies* 10, no. 8 (2017): 58–60; Krishna, "Understanding and Identifying Barriers to Electric Vehicle Adoption through Thematic Analysis," 02–06.
[79] Krishna, "Understanding and Identifying Barriers to Electric Vehicle Adoption through Thematic Analysis."
[80] Un-Noor et al., "A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development," 58.
[81] Un-Noor et al., "A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development," 58.
[82] Madeleine Stone, "Will Charging Electric Cars Ever Be as Fast as Pumping Gas?," National Geographic Society, June 9, 2021, https://www nationalgeographic.com/environment/article/will-charging-electric-cars-ever-be-as-fast-as-pumping-gas.
[83] Chanel Lee, "How Long Does It Take to Charge an Electric Car?," Kelley Blue Book, April 1, 2022, https://www kbb.com/car-advice/how-long-does-take-charge-electric-car/.

US listed the lack of public charging stations (48%), purchase price (43%), and insufficient driving range (42%) as the three main deterrents to owning EVs.[84]

Although many EVs are plug-in electric vehicles that can be charged directly from the electric grid, the lack of public stations is still a major concern for several reasons. Charging a PEV at home can be costly, which could defy the purpose of getting it to cut fuel cost. It can also be a timely process. Similarly, for those who purchase EVs for environmental purposes, having to plug their cars to the grid may be a discouraging factor when it is supplied through non-green means like fossil fuels. While the lack of charging stations may embody the biggest infrastructure-related concern, one should acknowledge that more barriers can also be identified under this category. Other concerns include inadequate motorway and parking planning, and the lack of repair facilities.

Social acceptance has also impacted peoples' willingness to own an EV. When people encounter new technologies, they may have some reservations especially when it is an alternative to something that they have long been used to.[85] For some, conventional vehicles are preferred for primarily subjective attributes.[86] For instance, some of the most popular "supercars" on the market are distinguished by their loud engine noise, an element that EVs typically lack. Here it is important to recognize that although issues of desirability are by no means objective and easily quantifiable, they still pose relevant challenges to EVs by "alienating" certain types of prospective consumers.

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[84] "Barriers to US EV Adoption," MSX International, accessed April 22, 2022, https://www msxi.com/en/barriers-to-us-ev-adoption/.
[85] Un-Noor et al., "A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development," 59.
[86] Krishna, "Understanding and Identifying Barriers to Electric Vehicle Adoption through Thematic Analysis," 05.

Lastly, one of the biggest hindering factors to the sale of EVs is its hefty price tag, which discourages many potential shoppers.[87] This factor impacts both manufacturers and buyers alike. On the carmakers' level, the surging prices of battery materials causes significant complications.[88] On the consumer level, a *Kelley Blue Book* report has shown that the average price of a new EV in the US in 2021 was close to 60,000 USD which is roughly 10,000 USD higher than the average transaction that includes both ICEVs and EVs. That study also found that 51% of car shoppers considered EVs to be "too expensive to seriously consider", which was nearly the same percentage from their 2019 study.[89]

Having outlined the major barriers ahead of EVs, we recognize state involvement on the national level as one way to counter the limitations mentioned above. In brief, state involvement, refers to the policy measures that a state adopts to encourage the growth of the EVs industry. Overall, this type of state behaviour is rooted in two main prerogatives, one is environmental and the other is economic.

From an environmental standpoint, many governments consider EVs as a more sustainable form of transportation in comparison to ICEVs,[90] which makes supporting them a matter of public interest. More specifically, EVs have become a major underlying theme of climate change policy. While EVs still come with significant environmental repercussions, current research shows that they are still much cleaner in comparison to

[87] Sean Tucker, "EV Sales Growing, but Price, Range Hold Some Shoppers Back," *Kelley Blue Book* (blog), November 16, 2021, https://www kbb.com/car-news/ev-sales-growing-but-price-range-hold-some-shoppers-back/.
[88] Peter Campbell, Joe Miller, and Song Jung-a, "Surging Price of Battery Materials Complicates Carmakers' Electric Plans," *Financial Times*, April 4, 2022, https://www ft.com/content/17d2d027-22c1-4ecc-8f92-d70268c8a4ac.
[89] Tucker, "EV Sales Growing, but Price, Range Hold Some Shoppers Back."
[90] Hiroko Tabuchi and Brad Plumer, "How Green Are Electric Vehicles?," *The New York Times*, November 9, 2021, https://www nytimes.com/2021/03/02/climate/electric-vehicles-environment.html.

ICEVs over their lifetime even after factoring the emissions induced as part of both production and operation.[91] This commitment towards EVs policy on the national level is also reflected by the Paris Accord, where all the signatory parties acknowledge the need for electrifying transportation.[92] Such environmental tendencies to adopt EVs-related policy are particularly prominent in countries where environmental issues influence political attitudes, such as Germany, Denmark, and Norway.[93] In addition, countries have also been promoting EVs for economic reasons. For industrial states like China, EVs markets are viewed as an economy of scale that can yield tremendous revenue when granted adequate support.[94]

The use of national policy to promote electric transportation is not a particularly new phenomenon. In many countries it was put to action long before the EVs boom in the late 2000s. For instance, Norway has been adopting such policies since the 1990s when import taxes on electric cars were removed.[95] Since then, nations all over the world have been pursuing such measures, to provide solutions to the barriers that were discussed above and push for the mainstreaming of EVs. Overall, national EVs policy targets two main groups: consumers and producers. Such efforts can be listed under the following

[91] Dale Hall and Nic Lutsey, "Effects of Battery Manufacturing on Electric Vehicle Life-Cycle Greenhouse Gas Emissions" (The International Council on Clean Transportation, February 9, 2018), https://theicct.org/publication/effects-of-battery-manufacturing-on-electric-vehicle-life-cycle-greenhouse-gas-emissions/.
[92] Daniel Sperling, "Electric Vehicles: Approaching the Tipping Point," in *Three Revolutions* (Springer, 2018), 40.
[93] Benjamin K. Sovacool et al., "Income, Political Affiliation, Urbanism and Geography in Stated Preferences for Electric Vehicles (EVs) And Vehicle-To-Grid (V2g) Technologies in Northern Europe," *Journal of Transport Geography* 78 (2019): 221, https://doi.org/10.1016/j.jtrangeo.2019.06.006.
[94] Hui and Lingzhi, "How China Put Nearly 5 Million New Energy Vehicles on the Road in One Decade."
[95] "Norwegian EV Policy: Norway Is Leading the Way for a Transition to Zero Emission in Transport," Norsk elbilforening, accessed April 13, 2022, https://elbil no/english/norwegian-ev-policy/.

categories: financial policy; electric fleet procurement; EVs charging infrastructure investments; traffic regulations; "demonstration"; and research and development.[96]

Financial policy includes two main categories. The first is to provide incentives to adopt EVs and the second is to install disincentives such as taxes on ICEVs. To counter the impacts of the high EVs price tag, many policies that promote EVs rely on providing some form of financial incentive for both consumers and producers. At the consumer's level, such policies may include tax credits, tax reduction, tax exemption or subsidies.[97] They may also offer toll exemptions, cheaper electricity prices, and free parking with the use of EVs just to name a few.[98] At the carmakers' level, tax exemptions and direct subsidies tend to be the most common measures.[99] In many cases, financial EVs policy is paired with certain production quotas and/or emissions requirements that reward the production of more EVs. So far, research has shown positive causal correlation between financial incentives such as sale tax waivers and the purchasing of EVs in the US, Europe, and numerous other countries. [100]

While this type of EVs policy is rather common, some still have concerns about its cost effectiveness. For instance, a 2012 study from the early days of the EVs federal tax credit in the US argued that the 7,500 USD tax is rather "excessive" when factoring in

[96] "Policies to Promote Electric Vehicle Deployment"; "Comparing U.S. and Chinese Electric Vehicle Policies."
[97] Xingping Zhang et al., "Policy Incentives for the Adoption of Electric Vehicles Across Countries," *Sustainability* 6, no. 11 (2014): 8060–61.
[98] Zhang et al., "Policy Incentives for the Adoption of Electric Vehicles Across Countries," 8061.
[99] "How Tax Credits and Government Subsidies Have Aided the Electric-Vehicle Market - WSJ," accessed April 15, 2022, https://www.wsj.com/articles/how-tax-credits-and-government-subsidies-have-aided-the-electric-vehicle-market-11637583826.
[100] Wang, Li, and Zhao, "The Impact of Policy Measures on Consumer Intention to Adopt Electric Vehicles: Evidence from China," 23.

the fiscal benefits of decreased CO2 emissions.[101] Another study about EVs subsidies in Canada reached a similar conclusion finding that the 5,000 CAD subsidy significantly outweighs the cost of alternative emissions reductions methods that can be used instead.[102] While that type of policy tends to be relatively costly, it is still effective in promoting EVs, especially when it comes to establishing demand in the early stages of industry growth.[103]

Disincentives with respect to ICEVs refer to different policy measures that states have used to discourage the sale of conventional fossil fuel vehicles. First and foremost, such disincentives take the form of carbon taxes either by directly taxing fossil fuels at high rates or by taxing car purchases in ways that often correlate with the extent of their CO2 emissions.[104] For instance, in many countries, ICEVs taxes are relative to the size of the engine, weight of the car, and its fuel efficiency.[105] Some policies also consider "luxury" as a relevant factor and install significantly higher carbon taxes on more expensive cars.[106]

That type of EVs mainstreaming effort can target both consumers and car makers. Like financial incentives, disincentives have also received their share of criticism. Typically, opponents of carbon taxes question their "fairness" arguing that they may lead to an "unfair distribution of burdens" as they link between one's affluence and their ability

[101] William R. Fuqua, "Cost Benefit Analysis of the Federal Tax Credit for Purchasing an Electric Vehicle" (Rochester, NY, Rochester Institute of Technology, 2012), 72.
[102] Zachary Thorne and Larry Hughes, "Evaluating the Effectiveness of Electric Vehicle Subsidies in Canada," *Procedia Computer Science* 155 (2019): 526, https://doi.org/10.1016/j.procs.2019.08.072.
[103] Thorne and Hughes, "Evaluating the Effectiveness of Electric Vehicle Subsidies in Canada," 525–26.
[104] Lasse Fridstrøm, "The Norwegian Vehicle Electrification Policy and Its Implicit Price of Carbon," *Sustainability* 13, no. 3 (2021): 11.
[105] Fridstrøm, "The Norwegian Vehicle Electrification Policy and Its Implicit Price of Carbon," 11.
[106] Terry Martin, "Industry Slams 'Luxury Fossil Fuel Car Tax' Plan," GoAuto, March 29, 2019, https://www.goauto.com.au/news/industry-news/industry-slams-lsquo-luxury-fossil-fuel-car-tax-rsquo-plan/2019-03-29/78194 html.

to choose an emissions intensive lifestyle and consequently exclude those who cannot afford it.[107] This arguably becomes even more problematic when we realize that EVs to a large degree are still much more expensive than conventional vehicles.[108] In that regard, a carbon tax may not be only limiting one's choices to EVs but may also be altering it to one between access to transportation or the lack thereof.

Research and development are another major area of EVs promotion. As mentioned above, EVs have been facing numerous hurdles on the technology level. As a result, supporting research and development efforts has been crucial for the growth of the EVs sector over the past few years. Unlike other types of EVs policy, R&D is an area where both public and private entities have had active roles to play. Between 2019 and 2020, it is estimated that the top 20 carmakers in the world spent more than 71 billion USD on R&D.[109]

As mentioned above, the lack of charging stations is a major EVs ownership deterrent. For this reason, governments have been pursuing numerous policy initiatives on the level of infrastructure. In addition to installing chargers and building repair facilities, this type of policy focuses on making cities friendly towards EVs in every possible way. Arguably, this form of state involvement in the realm of EVs is one of the most critical, mainly due to the structural nature of the problems that it aims to solve.[110] This type of

[107] Marina Povitkina et al., "Why Are Carbon Taxes Unfair? Disentangling Public Perceptions of Fairness," *Global Environmental Change* 70 (September 2021): 01–14, https://doi.org/10.1016/j.gloenvcha.2021.102356.
[108] "EV Sales Growing, but Price, Range Hold Some Shoppers Back," *Kelley Blue Book* (blog), November 16, 2021, https://www kbb.com/car-news/ev-sales-growing-but-price-range-hold-some-shoppers-back/.
[109] "Top 20 Global Carmakers Spend Another £71.7bn on R&D as Electric Vehicle Rollout Gathers Pace" (BDO United Kingdom, July 26, 2021), https://www.bdo.co.uk/en-gb/news/2021/top-20-global-carmakers-spend-another-71-7bn-on-r-and-d-as-electric-vehicle-rollout-gathers-pace.
[110] "Comparing U.S. and Chinese Electric Vehicle Policies."

policy also faces "free rider" problems especially when such facilities are accessible to the public for free or for fees that fall below the operational cost in hopes of making EVs more attractive.

In addition to individuals and private entities, governments all around the world have been moving towards electric transportation by introducing more and more EVs to their fleets. As mentioned above, state entities tend to view EVs as a more sustainable form of transportation and therefore see inherent environmental value in electrifying their fleets. Similarly, some of them see economic value in making that transition, especially when it comes to cutting fuel cost. They also might adopt it to promote EVs by stepping into the market as a consumer with significant purchasing power. In China, this type of policy has been playing a significant role. In 2014, China set its public fleet electrification goal at 30%[111] which has been raised since.[112] Since 2020, around 500,000 electric buses have been roaming Chinese streets amounting to 98% of all E-buses in the world.[113]

Another important type of policy refers to EVs traffic regulations that governments put forth to support the EV sector. Such mandates include the enactment of laws and regulations with the purpose of mainstreaming EVs. For instance, many governments have implemented special license plates and registration schemes for EVs exclusively to

[111] Antony Ingram, "China Wants 30 Percent of Government Cars to Be Electric Cars," *Christian Science Monitor*, July 21, 2014, https://www.csmonitor.com/Business/In-Gear/2014/0721/China-wants-30-percent-of-government-cars-to-be-electric-cars.
[112] "Guide to Chinese Climate Policy: Electric Vehicles" (New York, NY: Columbia University, 2019), https://chineseclimatepolicy.energypolicy.columbia.edu/en/electric-vehicles#/_ftn6.
[113] Katharina Buchholz, "What's Really Driving the Trend in E-Vehicles?," World Economic Forum, March 25, 2021, https://www.weforum.org/agenda/2021/03/municipal-buses-lead-electrification-effort/.

increase sales.[114] Overall, the importance of such mandates and regulations is that they can have significant impacts with a relatively small cost.[115]

"Demonstrations" are another form of public policy that governments have been employing to promote new concepts and innovations such as EVs. They can play an important role in countering the EVs barriers when it comes to personal preference.[116] In the policy realm, "demonstration" programs serve to expose people to new technologies at an early stage where natural demand may not exist.[117] In the case of EVs, "demonstration" programs consist of the ways that governments use to highlight the benefits of EVs to the community and incentivise them to transition to E-transportation.[118] They also play a role in testing new technologies and collecting data.[119] While some distinguish "demonstration" as a distinct form of EVs policy,[120] it is important to recognize that "demonstration" is typically paired with one or many of the policies that we mention above, especially subsidization. While it may be nuanced, it is important to make that distinction between "demonstration" and other forms of EVs policy to ensure that upcoming discussions are clear.

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[114] Tim Dixon, "China Green Licence Plate Scheme Going National," CleanTechnica, December 10, 2017, https://cleantechnica.com/2017/12/10/china-green-licence-plate-scheme-going-national/; Hugo Griffiths, "Green Number Plates for Electric Cars Arrive," Auto Express, December 8, 2020, https://www.autoexpress.co.uk/news/104561/new-70-plate-marks-arrival-of-green-number-plates.
[115] Thorne and Hughes, "Evaluating the Effectiveness of Electric Vehicle Subsidies in Canada," 02.
[116] Un-Noor et al., "A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development," 59.
[117] "One Million Electric Vehicles by 2015" (Washington, DC: United Sates Department of Energy, February 2011).
[118] Jie Zheng et al., "Strategic Policies and Demonstration Program of Electric Vehicle in China," *Transport Policy* 19, no. 1 (January 1, 2012): 17–25, https://doi.org/10.1016/j.tranpol.2011.07.006.
[119] "AVTA - Plug-in Electric Vehicle on-Road Demonstration Data," The United States Department of Energy, accessed June 22, 2022, https://www.energy.gov/eere/vehicles/avta-plug-electric-vehicle-road-demonstration-data.
[120] Zheng et al., "Strategic Policies and Demonstration Program of Electric Vehicle in China."

While it is important to categorize different EVs policy to understand them and their implications more accurately, it is equally important to recognize that such initiatives interconnect on many levels. For instance, subsidization policies are sometimes employed to incentivize public procurement of EVs on the local level.[121] Similarly, taxation policy, especially when targeting car manufacturers can lead to direct implications on the extent of R&D.[122] Therefore, the following chapters analyse different EVs policy based on the categories mentioned above in this chapter, while also highlighting the different ways in which they intertwine.

[121] Shiqi Ou et al., "A Study of China's Explosive Growth in the Plug-in Electric Vehicle Market" (Oak Ridge, TN: Oak Ridge National Laboratory, 2017), 38.
[122] Shiqi Ou et al., "The Dual-Credit Policy: Quantifying the Policy Impact on Plug-in Electric Vehicle Sales and Industry Profits in China," *Energy Policy* 121 (October 1, 2018): 597–610, https://doi.org/10.1016/j.enpol.2018.06.017.

# Chapter Three

# National Electric Vehicles Policy in China

To understand EVs policy in the context of China, it is important to first understand the system of government and some of the most important dynamics that come into play in the People's Republic of China. The Chinese Communist Party is the founding and ruling political party of China since the Revolution of 1949. Since then, the party has expanded its control over Chinese institutions.[123] While it is considered as a one-party regime, the PRC includes representative institutions like the National People's Congress, and its government holds relatively high approval according to several reputable research entities. For instance, in 2013, a study by the *Pew Research Center* found that around 85% of Chinese were satisfied with the nation's path.[124] Similarly, a *Harvard* survey, found 95.5% of the Chinese population to be relatively or highly satisfied with the Chinese government.[125]

According to the Chinese constitution, the NPC is considered as the "highest organ of state power".[126] It holds the legislative power of the state and is elected for a term of five years. One of its main duties is to elect the president of the PRC based on single candidate voting.[127] The NPC also has the constitutional power to remove the president

[123] Eleanor Albert, Lindsay Maizland, and Beina Xu, "The Chinese Communist Party," *Council on Foreign Relations* (blog), June 23, 2021, https://www.cfr.org/backgrounder/chinese-communist-party.
[124] "Chapter 1. National and Economic Conditions" (Washington, DC: Pew Research Center, May 12, 2014), https://www.pewresearch.org/global/2013/05/23/chapter-1-national-and-economic-conditions/.
[125] Dan Harsha, "Taking China's Pulse," Harvard University, July 9, 2020, https://news harvard.edu/gazette/story/2020/07/long-term-survey-reveals-chinese-government-satisfaction/.
[126] "The National People's Congress of the People's Republic of China," The National People's Congress, accessed July 3, 2022, http://www npc.gov.cn/englishnpc/c2846/column2.shtml.
[127] "The National People's Congress of the People's Republic of China."

from office. The current NPC was elected in 2018 and has 2980 members.[128] NPC deputies are elected from 35 different electoral units that include "provinces, autonomous regions, municipalities directly under the central government, the servicemen congress of the People's Liberation Army, the deputy election council of the Hong Kong Special Administrative Region, the deputy election council of the Macao Special Administrative Region and the Taiwan compatriots' consultation election council".[129]

While PRC presidents are formally elected in the NPC, it has been argued that much of the real power is concentrated in the CCP.[130] Every five years, the CCP National Party Congress meets to decide on major policy issues in the country. During that session, the Central Committee is chosen, which includes around 370 members of the political elites, such as military officers, ministers, provincial leaders, and senior administrators.[131] This committee proceeds according to its mandate to choose a Politburo of 25 members.[132] In turn, the Politburo elects a standing committee to lead the party and consequently the state. Typically, this committee has anywhere from five to nine members.[133] Since 2012, Xi Jinping has been presiding over a committee of seven as a general secretary of the Party and the president of the state. President Xi has been standing at the epicentre of Chinese politics both domestic and foreign and has since experienced a rise in political influence

[128] "The National People's Congress of the People's Republic of China."
[129] "The National People's Congress of the People's Republic of China."
[130] Albert, Maizland, and Xu, "The Chinese Communist Party."
[131] Albert, Maizland, and Xu, "The Chinese Communist Party."
[132] Albert, Maizland, and Xu, "The Chinese Communist Party."
[133] Albert, Maizland, and Xu, "The Chinese Communist Party."

and strength.[134] Alongside Xi, Premier Li Keqiang who is considered as China's number two man has presided over the state council, which is the equivalent of a Cabinet.[135]

On the economic front, the PRC is also known for its state-led capitalism model, where the state is directly involved in the workings of private businesses. It is estimated that close to 60% of Chinese enterprises are owned by the state.[136] While the remaining 40% are considered as private entities, the Chinese state still has significant influence over their strategies and operations. For instance, since 1993, companies based in China have been required to allow for CCP units to be established.[137] Under Xi Jinping, party presence within private entities was brought back to the front.[138] A survey by the All-China Federation of Industry and Commerce showed that around 48.3% of all private entities had a party unit in 2018. More importantly, party presence at China's top 500 enterprises was around 92-93% in that year.[139] In accordance with that political context, Chinese EVs policy is highly sensitive to the above-mentioned division of power and authority.[140]

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[134] John Ruwitch, "Timeline: The Rise of Chinese Leader Xi Jinping," *Reuters*, March 16, 2018, sec. Emerging Markets, https://www reuters.com/article/us-china-parliament-xi-timeline-idUSKCN1GS0ZA.
[135] Albert, Maizland, and Xu, "The Chinese Communist Party."
[136] Amir Guluzade, "How Reform Has Made China's State-Owned Enterprises Stronger," World Economic Forum, May 21, 2020, https://www.weforum.org/agenda/2020/05/how-reform-has-made-chinas-state-owned-enterprises-stronger/.
[137] Guluzade, "How Reform Has Made China's State-Owned Enterprises Stronger."
[138] Jérôme Doyon, "Influence without Ownership: The Chinese Communist Party Targets the Private Sector," Institut Montaigne, January 26, 2021, https://www.institutmontaigne.org/en/blog/influence-without-ownership-chinese-communist-party-targets-private-sector.
[139] Neil Thomas, "Party Committees See Rising Prevalence in Private Sector," MacroPolo, December 16, 2020, https://macropolo.org/party-committees-private-sector-china/.
[140] Albert, Maizland, and Xu, "The Chinese Communist Party."

China's support for hybrid and greener vehicles is by no means a new phenomenon. As early as the year 2000, the government led various initiatives to support the introduction of such technologies to the transportation sector.[141] Since then, China's interest in moving towards cleaner forms of energy has also been reflected in its Five-Year Plans. In 1953, under the leadership of Chairman Mao, China enacted its first Five-Year Plan as a guideline for its development strategies and economic goals.[142] Since then, this plan has become one of China's most important policy documents that evolve over the years in accordance with the nation's economic and social conditions.[143]

In 2005 and 2009, China became the biggest emitter of energy-related CO2 and the world's largest energy consumer respectively.[144] This set the stage for the 12th FYP that was enacted in 2011 to focus primarily on issues related to energy and sustainability, which made it a turning point for EVs related policy on the national level.[145] As a result, the Chinese government introduced EVs production as a Strategic and Emerging Industry that requires significant public support on the policy level. That FYP categorized the industrialization of EVs over three phases. Phase I (2009-2012); Phase II (2013-2015); Phase III (2016-2020).[146] While this thesis focuses on Phase III in its comparative analysis

[141] Lingzhi Jin et al., "Driving a Green Future a Retrospective Review of China's Electric Vehicle Developement and Outlook for the Future" (The International Council on Clean Transportation, January 2021), 02.
[142] "What Is China's Five-Year Plan?," *The Economist*, March 4, 2021, https://www.economist.com/the-economist-explains/2021/03/04/what-is-chinas-five-year-plan.
[143] Xueliang Yuan and Jian Zuo, "Transition to Low Carbon Energy Policies in China from the Five-Year Plan Perspective," *Energy Policy* 39, no. 6 (June 1, 2011): 249, https://doi.org/10.1016/j.enpol.2011.04.017.
[144] "An Energy Sector Roadmap to Carbon Neutrality in China" (International Energy Agency, September 2021), 22.
[145] Wu et al., "A Review of Evolutionary Policy Incentives for Sustainable Development of Electric Vehicles in China: Strategic Implications," 02.
[146] Wu et al., "A Review of Evolutionary Policy Incentives for Sustainable Development of Electric Vehicles in China: Strategic Implications," 02.

chapter, it first investigates each phase as the development of EVs is part of a series of interrelated events that should not be ignored.

In brief, Phase I began on the urban level in key cities and primarily consisted of offering forms of purchase subsidies. Phase II largely expanded those subsidies increasing both the amount and the outreach of such policy to cover both private and public entities.[147] Following the successful establishment of EVs industrial chains and incentivizing initial demand over the course of the first two phases, Phase III saw a relative decrease in EVs policy that rely on providing financial incentives and witnessed an increase in public support for EVs manufacturers especially when it comes to R&D to promote innovation and counter the effects of technical entry barriers.[148] Having presented the broad context of EVs policy in China, this study discusses the different forms of national EVs policy and their respective implications based on the categorization that was highlighted in the previous chapter.

As mentioned above, some of the earliest forms of EVs policy in China consisted of providing financial incentives such as subsidies and tax rebates. Here, it is important to clarify that the term subsidy refers to financial incentives that are provided by the central government to local authorities and private citizens to purchase EVs. In 2009, as part of Phase I, the federal Chinese government launched "Ten Cities, Thousand Cars", a pilot project with the aim of demonstrating EVs in several provinces.[149] Initially, the program

[147] Wu et al., "A Review of Evolutionary Policy Incentives for Sustainable Development of Electric Vehicles in China: Strategic Implications," 03.
[148] Wu et al., "A Review of Evolutionary Policy Incentives for Sustainable Development of Electric Vehicles in China: Strategic Implications," 04.
[149] Shanjun Li et al., "The Role of Government in the Market for Electric Vehicles: Evidence from China," *Journal of Policy Analysis and Management* 41, no. 2 (2022): 09.

targeted local authorities by offering them monetary incentives to add hybrid and electric vehicles to their public transportation networks.[150] At that stage, both electric and hybrid buses qualified for a subsidy that ranged between 200,000 CNY and 600,000 CNY depending on many factors, especially fuel-saving. For instance, subsidies for FCEV buses were set at 600,000 CNY.[151]

In Phase II, the subsidies program was expanded to benefit private entities alongside city governments.[152] For private purchase, the value of the subsidy depended on the vehicle's battery capacity with a maximum amount set at 60,000 CNY.[153] By 2012, seven of the pilot cities had reached their electrification targets and 15 new ones were added to the plan. While such subsidies did initiate relevant demand on EVs,[154] China still fell short in terms of meeting its intended electrification goals of 500,000 EVs by 2011 and had to push it for four more years.[155] The "Ten Cities, Thousand Vehicles" project was expanded to include more than 88 cities by 2013.[156] Since 2015, the central government has been putting in place stricter standards for subsidies to encourage more efficient and advanced EVs production.[157]

[150] Hao et al., "China's Electric Vehicle Subsidy Scheme: Rationale and Impacts," 724.
[151] Hao et al., "China's Electric Vehicle Subsidy Scheme: Rationale and Impacts," 724.
[152] Li et al., "The Role of Government in the Market for Electric Vehicles: Evidence from China," 09.
[153] Hao et al., "China's Electric Vehicle Subsidy Scheme: Rationale and Impacts," 724.
[154] Tamara L. Sheldon and Rubal Dua, "Effectiveness of China's Plug-in Electric Vehicle Subsidy," *Energy Economics* 88 (May 2020): 01–08; Wang, Li, and Zhao, "The Impact of Policy Measures on Consumer Intention to Adopt Electric Vehicles: Evidence from China," 23.
[155] ST Howell, H Lee, and A Heal, "Leapfrogging or Stalling Out? Electric Vehicles in China (No. RWP14-035)," 2014, 9.
[156] "An Energy Sector Roadmap to Carbon Neutrality in China," 242.
[157] "An Energy Sector Roadmap to Carbon Neutrality in China," 242.

One major issue that accompanied EVs subsidization programs in China concerned public uncertainty about their scope and duration. Most of those initiatives had to be updated every three to four years and were sometimes discontinued for several months between the end and the renewal dates. This uncertainty may have discouraged customers and carmakers alike.[158]

While China may have been facing certain difficulties to mainstream EVs at that phase and had been falling short of its announced goals, it is important to acknowledge that it was not the only one. In fact, many of the difficulties that it faced at the time were equally visible in other countries, including the US mainly due to EVs being relatively new to the market as a mass-produced transportation option, competing with ICEVs that had always dominated the transportation sector. In fact, China in 2014, underwent, what could be described as explosive growth, which intensified even more in the following years.[159] The number of PEVs sold went from 17,456 in 2013 to 61,660 in 2014 and to 343,675 in 2015.[160] Similarly, demand on BEVs drastically increased with more than 140,000 units being sold between 2013 and 2015.[161]

The implications of Chinese subsidy schemes on the EVs market have been subject to numerous studies that tackled its role to mainstream EVs on the roads, its cost-effectiveness, and the implication of its phase out. Using the propensity score matching difference in differences method, which attempts to estimate a treatment effect while accounting for covariates to limit biases, one study has analysed the impact of subsidies

[158] Howell, Lee, and Heal, "Leapfrogging or Stalling Out? Electric Vehicles in China (No. RWP14-035)," 10.
[159] Ou et al., "A Study of China's Explosive Growth in the Plug-in Electric Vehicle Market," 05.
[160] Ou et al., "A Study of China's Explosive Growth in the Plug-in Electric Vehicle Market," 05.
[161] Ou et al., "A Study of China's Explosive Growth in the Plug-in Electric Vehicle Market," 08.

on EVs adoption in the Chinese public domain.[162] It compared the policy implications on the number of electric buses sold in 12 pilot cities that were covered by the national subsidy policy and 36 cities. It found that the sales of electric buses were significantly sensitive to the provision of subsidies. Similarly, after controlling the influences of population density, road conditions, air pollution, the presence of local EVs manufacturers, and fuel prices, it estimated the coefficient of purchase subsidy to be at 95% confidence level, which indicates that financial incentives played a vital role in promoting EVs.[163]

Other studies have also found causal relationships that connect different types of subsidies with the uptake in EVs sales.[164] One study that analysed data from 150 Chinese cities in the period of 2015-2018 found that subsidies explained more than 55% of EVs sales during the analysis period,[165] which is consistent with other research that analysed the impact of financial incentives on the EVs market in other countries around the world. For instance, it was estimated that the US federal tax credit of 2,500 USD to 7,500 contributed to 40% of EVs sale in 2011-2013.[166] In accordance with studies about the role of purchase subsidies in increasing the sales of EVs, studies have also simulated the potential negative implications of those subsidies being phased out. A stated preference

[162] Xiaoling Liu et al., "Do Policy Incentives Drive Electric Vehicle Adoption? Evidence from China," *Transportation Research Part A: Policy and Practice* 150 (August 1, 2021): 56, https://doi.org/10.1016/j.tra.2021.05.013.
[163] Liu et al., "Do Policy Incentives Drive Electric Vehicle Adoption? Evidence from China," 58.
[164] Yanqiu Song et al., "Scenario Analysis on Subsidy Policies for the Uptake of Electric Vehicles Industry in China," *Resources, Conservation and Recycling* 161 (October 1, 2020): 09, https://doi.org/10.1016/j resconrec.2020.104927.
[165] Li et al., "The Role of Government in the Market for Electric Vehicles: Evidence from China," 27.
[166] Jing Li, "Compatibility and Investment in the US Electric Vehicle Market" (Cambridge, MA, Massachusetts Institute of Technology, 2019).

survey in Beijing showed that EV choice rate in Beijing is diminished from 47.52% to 12.43% when purchase subsidies are set at zero.[167]

In 2019, when purchase subsidies were cut approximately in half, the sales of EVs also decreased, nonetheless, this decrease was not proportional as the purchase cost of EVs had been shrinking over the past years.[168] Similarly, other non-financial policies had also been further mainstreamed, which likely contributed to limiting the negative implications of the purchase subsidy reduction. While China had been planning to stop its EVs purchase subsidy program by 2020, it ended up decreasing the values but postponing it until 2022 due to the COVID-19 pandemic.[169]

Besides subsidies, China's measures also included tax exemption targeting both vehicle and vehicle purchase taxations. The central government also heavily invested in public charging infrastructure and introduced several convenience measures to promote the use of EVs such as giving EVs access to specified lanes and exempting them from parking fees among many other privileges.[170] In addition, China initiated several regulatory policies to mainstream EVs by setting certain EVs production quotas for factories and creating EVs-friendly vehicle registration schemes.[171]

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[167] Tianwei Lu et al., "Analysis of Incentive Policies for Electric Vehicle Adoptions after the Abolishment of Purchase Subsidy Policy," *Energy* 239 (January 15, 2022): 11, https://doi.org/10.1016/j.energy.2021.122136.
[168] Harris Ng et al., "How Governments Can Encourage Adoption of Battery Electric Vehicles," Kearney, accessed June 18, 2022, https://www.kearney.com/automotive/article/-/insights/how-governments-can-encourage-adoption-of-battery-electric-vehicles.
[169] Chris Randall, "China to Extend EV Subsidies," electrive, April 2020, https://www.electrive.com/2020/04/01/china-considers-extending-ev-subsidies/.
[170] Liu et al., "Do Policy Incentives Drive Electric Vehicle Adoption? Evidence from China," 52.
[171] Dixon, "China Green Licence Plate Scheme Going National."

As mentioned above, Phase III saw a significant expansion of EVs policy on the national level and a gradual phase-out of subsidies that were replaced with an increase of government support for R&D and infrastructure development.[172] The funding for R&D in China is focused on a special plan called the "863" that was initiated in the 1980s to bring together several key companies, universities, and research institutions.[173] The Chinese Ministry of Science and Technology initiated the first batch of project application guide for NEV pilot special project in 2016.[174]

One study that assessed the impacts of subsidies on EVs R&D considered data from 88 automobile manufacturers from 2001 to 2015.[175] Here, the term subsidy refers to the government providing financial incentives to carmakers to encourage them to produce more EVs, which is different from purchase subsidies that are discussed at the beginning of the chapter.

The study found that R&D subsidies have significant impacts on the behaviour of car manufacturers. In fact, they found that the impacts of R&D subsidies tend to be substantially higher in comparison to production subsidies.[176] Other papers that analysed the impact of R&D public investment have all concluded that it can seriously stimulate

[172] Wu et al., "A Review of Evolutionary Policy Incentives for Sustainable Development of Electric Vehicles in China: Strategic Implications," 04.
[173] Wu et al., "A Review of Evolutionary Policy Incentives for Sustainable Development of Electric Vehicles in China: Strategic Implications," 703.
[174] Xingping Zhang et al., "Review of Electric Vehicle Policies in China: Content Summary and Effect Analysis," *Renewable and Sustainable Energy Reviews* 70 (April 1, 2017): 703, https://doi.org/10.1016/j rser.2016.11.250.
[175] Wei Shao, Ke Yang, and Xiao Bai, "Impact of Financial Subsidies on the R&D Intensity of New Energy Vehicles: A Case Study of 88 Listed Enterprises in China," *Energy Strategy Reviews* 33 (2021): 01.
[176] Shao, Yang, and Bai, "Impact of Financial Subsidies on the R&D Intensity of New Energy Vehicles: A Case Study of 88 Listed Enterprises in China," 06.

the production of EVs, especially in the early stages when markets are being established.[177]

In terms of EVs infrastructure, The MST launched several initiatives to promote EVs. It selected 20 pilot cities for EVs infrastructure development and planned to construct 400,000 charging poles and 2,000 charging and swapping power stations between 2010 and 2015.[178] At the same time, China's National Development and Reform Commission, the entity in charge of nationwide macroeconomic planning, authorized cheaper electricity prices for EVs infrastructure. While EVs policy on the level of infrastructure was introduced relatively early, it was not until 2015 that the first specialized development guideline for EVs infrastructure was issued.[179] That guidance document included an elaborate plan to construct 800 intercity fast charging stations between 2015 and 2020.[180] It also identified three strategic regions in the western parts of China with major charging infrastructure goals, including building 7,400 new centralized charging stations and distributing 2.5 million new individual chargers.[181] The goals for the remaining northern, central, and eastern provinces were set at 4700 charging stations and 2.3 million charging points.[182]

[177] Liu et al., "Do Policy Incentives Drive Electric Vehicle Adoption? Evidence from China," 49.
[178] Zhang et al., "Review of Electric Vehicle Policies in China: Content Summary and Effect Analysis," 701.
[179] Zhang et al., "Review of Electric Vehicle Policies in China: Content Summary and Effect Analysis," 701.
[180] Hui He et al., "Assessment of Electric Car Promotion Policies in Chinese Cities" (The International Council on Clean Transportation, October 18, 2018), 14.
[181] He et al., "Assessment of Electric Car Promotion Policies in Chinese Cities," 15.
[182] He et al., "Assessment of Electric Car Promotion Policies in Chinese Cities," 14–15.

While China fell short off its plans in that area it still made significant strides by building more than 750,000 public charging points by 2020 and 1.1 million public charging points by 2021, which put it ahead of all its competitors combined, including the United States.[183] When adding the number of private charging piles, the number of EVs chargers dramatically increases to more than 2.6 million EVs charging piles installed by 2021.[184]

When it comes to weighing the impacts of China's policy on the level of infrastructure, many studies have highlighted its positive role thus far. A study to quantitatively assess the impact of charging infrastructure in China, found that increase in publicly available charging units can evidently motivate consumer acceptance of EVs, specifically in emerging markets.[185]

One study that analysed the efficiency of the Chinese government's support for deployment of charging stations found that although purchase subsidies play a significant role in increasing the size of the EVs market, the deployment of public chargers can be as much as four times more cost effective than purchase subsidies. It found that the cost on the Chinese government to induce the buying of one extra EV is 97,825 CYN and 27,331 CYN for providing a purchase subsidy and installing public chargers respectively. [186]

[183] "Electric Vehicle Outlook 2022," BloombergNEF (Bloomberg), accessed June 5, 2022, https://about.bnef.com/electric-vehicle-outlook/.
[184] "China Has 2.617 Million EV Charging Piles by End of 2021," January 12, 2022, https://autonews.gasgoo.com/m/70019543 html.
[185] Shiqi Ou et al., "Modeling Charging Infrastructure Impact on the Electric Vehicle Market in China," *Transportation Research Part D: Transport and Environment* 81 (April 1, 2020): 15, https://doi.org/10.1016/j.trd.2020.102248.
[186] Li et al., "The Role of Government in the Market for Electric Vehicles: Evidence from China," 30.

In addition to highlighting the evident positive correlations between the instalment of chargers and the number of EVs, some research has also answered the "chicken and egg problem" when it comes to showing whether chargers incentivise the growth of EVs markets or whether their numbers increase because of EVs becoming more and more common.[187] In that regard, studies have found that private entities are typically not willing to install chargers in ways that exceed existing demand, making it the responsibility of governments to build public chargers to stimulate initial consumer interest.[188]

Production quotas have also been a major part of Chinese EVs policy. In 2017, China passed a requirement for all its car manufacturers to meet certain electrification percentages. This decision went into effect in 2018 and required 10% and 12% of newly produced cars to be electric in 2019 and 2020 respectively.[189] This mandate was accompanied with the dual-credit policy to give carmakers further incentives to produce EVs.

The dual-credit policy in China, which is in part modelled after California's Zero Emission Vehicles Program refers to a set of regulations that connect carmakers' ICE performance with their EVs credit performance. As mentioned above, carmakers have credit requirements to make fuel-efficient cars. At the same time, they have credit requirements to produce electric vehicles. The dual-credit system grants a certain level of

[187] Jack Perkowski, "The Electric Car Market Has A 'Chicken Or Egg' Problem and China Is Solving It," Forbes, September 26, 2016, https://www.forbes.com/sites/jackperkowski/2016/09/26/china-electric-car-charging-station/.
[188] Ou et al., "Modeling Charging Infrastructure Impact on the Electric Vehicle Market in China"; "China Has 2.617 Million EV Charging Piles by End of 2021"; Michael Nicholas, Dale Hall, and Nic Lutsey, "Quantifying the Electric Vehicle Charging Infrastructure Gap Across US Markets," *International Council on Clean Transportation,* 2019, 1–39.
[189] He et al., "Assessment of Electric Car Promotion Policies in Chinese Cities," 13.

flexibility by managing the relationship between both credit systems that already exist. What makes it even more relevant for the mainstreaming of EVs is that it exhibits a one-way street when it comes to compliance. While EV credits can be used to offset corporate average fuel consumption deficit, the latter cannot be used to offset EV credit. In other words, companies have incentives to increase the production of EVs more than to increase the production of fuel-efficient ICEVs.[190]

In terms of the implications of the dual-credit policy, research has so far identified several of its positive implications on the EVs markets in China. One study studied those implications by assessing this policy over two periods: the brewing period (2014-2016) and the implementation period (2017-2019). This phased analysis allows for more accurate inferences, given that the impacts of this type of central policy are seldom limited to the implementation period and are often observed before those measures even go into effect, as private entities start altering their behaviour prospectively. In brief, this study employed the difference in difference statistical technique, which allows for studying the differential effect by comparing a "control" group and a "treatment" group in a social sciences-related context.[191] The groups for that study are commercial car companies and passenger car companies. By looking at quantitative indicators about R&D scales and capitalization ratio, this study assessed the growth of R&D investment prior to the dual-credit policy, during its brewing period, and after its implementation.[192]

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[190] Zhinan Chen and Hui He, "How Will the Dual-Credit Policy Help China Boost New Energy Vehicle Growth?," *The International Council on Clean Transportation* (blog), February 10, 2022, https://theicct.org/china-dual-credit-policy-feb22/.
[191] "Difference-in-Difference Estimation," Columbia University Mailman School of Public Health, June 7, 2022, https://www.publichealth.columbia.edu/research/population-health-methods/difference-difference-estimation.
[192] Xu Li and Qing Y. Xiong, "Phased Impacts of China's Dual-Credit Policy on R&D," *Frontiers in Energy Research* 9 (2021): 02, https://doi.org/10.3389/fenrg.2021.694338.

The study found that during the brewing period, the dual-credit policy had a significant impact on the R&D scale of Chinese car companies. On the other hand, that phase did not particularly see a significant rise in the capitalization ratio and the R&D staffing of those companies. At that time, the growth of the R&D scale was 15.87 and the capitalization ratio was at 0.17%. During the implementation period, both R&D scale and the capitalization ratio increased with the first witnessing an increase by 8.14 and capitalization seeing a 2.67% increase.[193] Furthermore, when comparing the growth of the R&D scale and the capitalization ratio between 2018 and 2019, they saw an increase by 24.2 for the first and a 7.37% for the latter, which indicates the positive role that this policy has played towards expanding the EVs industry in China.[194]

Due to high levels of traffic, big cities in China have been establishing quotas for car registration. This traffic-related regulation has played an important role in increasing the number of EVs as in many cases policy measures are adopted to give certain privileges to EV buyers such as exemption from the lottery or auction systems that ICEV buyers must undergo to register their vehicles.[195] China has also been implementing certain restrictions on the number of issued license plates for ICEVs. Under that policy, the government controls the number of issued plates for conventional cars. As a result, new car buyers in certain areas must resort to lotteries or auctions to register an ICEV.[196] In accordance with the results above about green license plates, it is evident that restrictions

[193] Li and Xiong, "Phased Impacts of China's Dual-Credit Policy on R&D," 08.
[194] Li and Xiong, "Phased Impacts of China's Dual-Credit Policy on R&D," 09.
[195] Amanda Ge, "Electric Vehicle Regulation and Law in China," CMS Legal, accessed June 18, 2022, https://cms.law/en/int/expert-guides/cms-expert-guide-to-electric-vehicles/china.
[196] Jingjing Li, Victor Nian, and Jianling Jiao, "Diffusion and Benefits Evaluation of Electric Vehicles Under Policy Interventions Based on a Multiagent System Dynamics Model," *Applied Energy* 309 (March 1, 2022): 4.

on ICEV license plates can increase the numbers of EVs on the roads with a relatively small cost to the central government.[197]

Furthermore, China introduced green-coloured license plates for EVs. This policy allows for EVs to be easily distinguished on the roads which facilitates access to many preferential services that EVs receive such as the access to special driving lanes, parking, and toll-free roads just to name a few. Similarly, the fees on such plates are often reduced or even removed entirely depending on the region. While this policy was first launched in key provinces, it was rolled out nationally as of November 2017, over three stages.[198] A study on the role of Government in stimulating consumer demand on EVs, found that the creation of a green license plate, increased EVs sales by more than 30%.[199]

In brief, it is evident that the Chinese government has been supporting the national EVs sector in a consistent manner. This commitment towards the industry has gradually increased since the industry began booming in the late 2000s. While China has clearly exhibited its interest in developing its EVs sector, its approach has evolved over time. As a result, China has combined different types of national EVs policy at different stages of its EVs market growth.

[197] Thorne and Hughes, "Evaluating the Effectiveness of Electric Vehicle Subsidies in Canada," 2.
[198] Dixon, "China Green Licence Plate Scheme Going National."
[199] Li et al., "The Role of Government in the Market for Electric Vehicles: Evidence from China," 19.

# Chapter Four

# National Electric Vehicles Policy in the United States

Having presented EVs policy in China, this chapter discusses EVs policy in the US to set the stage for the following comparative chapter. In brief, federal policy in the US is shaped by the three branches of government: the executive, the legislative and the judicial.[200] Executive functions are fulfilled by the President, the Vice President, and the cabinet.[201] Legislative powers are granted to Congress, which is divided into two institutions, the House of Representatives, and the Senate.[202] Judicial power is granted to the Supreme Court and District Courts. While both the President and members of Congress are elected by the people, members of the judiciary are appointed by the first and confirmed by the latter. [203]

In terms of the political makeup of the country, the US is known for its two-party system, where the Democratic and the Republican Parties often compete to take hold of the federal government's branches above and their affiliated entities.[204] As a result, the productivity of those institutions is sensitive to political representation. For instance, both the Presidency and Congress can significantly impact each other's policy efforts, with the

[200] "Our Government," The White House, accessed June 27, 2022, https://www.whitehouse.gov/about-the-white-house/our-government/.
[201] "The Executive Branch," The White House, accessed June 27, 2022, https://www.whitehouse.gov/about-the-white-house/our-government/the-executive-branch/.
[202] "Our Government: The Legislative Branch," The White House, accessed June 27, 2022, https://www.whitehouse.gov/about-the-white-house/our-government/the-legislative-branch/.
[203] "The Judicial Branch," The White House, accessed June 27, 2022, https://www.whitehouse.gov/about-the-white-house/our-government/the-judicial-branch/.
[204] Aaron Blake, "Why Are There Only Two Parties in American Politics?," *The Washington Post*, April 27, 2016, https://www.washingtonpost.com/news/the-fix/wp/2016/04/27/why-are-there-only-two-parties-in-american-politics/.

President having the constitutional authority to veto decision passed by congress and vice versa.[205] As representative institutions, both chambers of Congress can also go through political gridlocks that impede legislative productivity, especially in times of political polarization.[206]

Just like any other issue, EVs policy is subject to the political context. As a result, it has been part of an evolving dynamic that knows both partisanship and bipartisanship. While democrats are often considered to be more supportive of climate change policy, including clean energy and EVs,[207] the history of EVs policy in the US is more nuanced and includes multiple examples of collaboration along party lines.[208]

At the Presidential level, the involvement of the federal government in the EVs industry in the US is by no means a new phenomenon. As early as the 1990s, the US government had already began supporting R&D in that realm. In 1993, President Bill Clinton launched the "Partnership for a New Generation of Vehicles" with the aim of extending collaboration between the federal government and the big three car manufacturers in the country, GM, Ford, and Chrysler to produce more efficient cars including EVs.[209]

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[205] "Presidential Vetoes," United States House of Representatives, accessed June 27, 2022, https://history.house.gov/Institution/Presidential-Vetoes/Presidential-Vetoes/.
[206] Sarah A. Binder, "Going Nowhere: A Gridlocked Congress," *Brookings* (blog), December 1, 2000, https://www.brookings.edu/articles/going-nowhere-a-gridlocked-congress/.
[207] Nicole D. Sintov, Victoria Abou-Ghalioum, and Lee V. White, "The Partisan Politics of Low-Carbon Transport: Why Democrats Are More Likely to Adopt Electric Vehicles than Republicans in the United States," *Energy Research & Social Science* 68 (October 1, 2020): 6, https://doi.org/10.1016/j.erss.2020.101576.
[208] Leah C. Stokes and Hanna L. Breetz, "Politics in the U.S. Energy Transition: Case Studies of Solar, Wind, Biofuels and Electric Vehicles Policy," *Energy Policy* 113 (February 1, 2018): 83, https://doi.org/10.1016/j.enpol.2017.10.057.
[209] Robert M. Chapman, *The Machine That Could: PNGV, a Government-Industry Partnership* (Santa Monica, Calif: RAND Critical Technologies Institute, 1998), 01.

One pertinent example in that regard is GM's EV1, the first mass produced modern EV by a major company, which benefited from considerable PNGV technology.[210] While EV1, was eventually recalled as we explain in the introduction chapter, its production was a major milestone for the EVs industry on a global level. On the other hand, some have criticized the PNGV arguing that it fell short of achieving its technical goals in the hybrid and electric vehicles area as none of the participating companies managed to commercially sell their prototypes, while Toyota, a non-participant still dominated this section of the car making industry.[211]

Congress has also enacted multiple Acts and national plans on energy-related topics, including EVs, such as tax breaks, fleet acquisition incentives and R&D grants, just to name a few.[212] In 1992, it enacted the "Energy Policy Act" to reduce fuel imports, which included multiple clauses related to EVs. It allocated 40 million USD for R&D and another 50 million USD for EVs "demonstrations". It also allowed for a 4,000 USD income tax credit for purchasing an EV and another 2,000 USD for purchasing a clean-fuel vehicle. Those tax deductions were to undergo incremental reductions until they are totally phased out after 2004. This act was enacted due to bipartisan efforts as well as a coalition of clean-fuel interest groups and environmental advocates. In the following years, the "Job Creation and Worker Assistance Act" extended the phase out period for the previous tax deductions by two more years.[213]

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[210] Chapman, *The Machine That Could*, 20.
[211] David Trinkle, "A Vehicle for Change: PNGV, An Experiment in Government-Industry Cooperation" (Santa Monica, CA, Pardee RAND Graduate School, 2009), 322.
[212] "Plug-In Electric Vehicle Policy: Evaluating the Effectiveness of State Policies for Increasing Deployment" (The Center for American Progress Action Fund, June 7, 2018), https://www.americanprogress.org/article/plug-electric-vehicle-policy/.
[213] Stokes and Breetz, "Politics in the U.S. Energy Transition: Case Studies of Solar, Wind, Biofuels and Electric Vehicles Policy," 83.

Shortly after, congress enacted the "Energy Policy Act" of 2005, which put more emphasis on hybrid vehicles as opposed to clean-fuel vehicles. It allowed for a tax credit up to 2,400 USD for owners of light-duty hybrid vehicles, which could be increased for heavier vehicles. It also capped the number of eligible purchases at 60,000 vehicles per manufacturer.[214] It offered a tax credit up to 30% of the cost of installing alternative-fuel vehicle refuelling infrastructure, including chargers for EVs. The value of that credit was capped at 1,000 USD for individuals and 30,000 USD for businesses.[215] While EVs had been included in many legislation and acts at this point, they were not always presented as a priority issue.

In 2008, the "Energy Improvement and Extension Act" was enacted as part of the "Emergency Economic Stabilization Act". It came into effect around the same time as commercial EV models from major manufacturers began hitting the roads in significant numbers. It created a tax credit for electric vehicles up to 7,500 USD.[216] The number of vehicles that could benefit from this financial incentive was capped at 250,000 vehicles nationwide. This was a major turning point as it targeted plug-in electric vehicles instead of hybrid cars. [217] It also covered charging stations by a 30% tax credit until 2010. Since then, the act has been amended and extended.[218]

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[214] "Alternative Fuels Data Center: Energy Policy Act of 2005," The United States Department of Energy, accessed June 28, 2022, https://afdc.energy.gov/laws/epact_2005.
[215] "Issue Brief: Electric Vehicles," American Public Power Association, June 2022, https://www.publicpower.org/policy/electric-vehicles.
[216] Jonas Meckling and Jonas Nahm, "When Do States Disrupt Industries? Electric Cars and the Politics of Innovation," *Review of International Political Economy* 25, no. 4 (2018): 519.
[217] Stokes and Breetz, "Politics in the U.S. Energy Transition: Case Studies of Solar, Wind, Biofuels and Electric Vehicles Policy," 83.
[218] Charles B. Rangel, "Energy Improvement and Extension Act of 2008," Pub. L. No. H.R.6049 (2008), http://www.congress.gov/.

In 2009, the "American Recovery and Reinvestment Act" was enacted and signed into law by President Barrack Obama who considered clean energy as a major pillar of his agenda.[219] The ARRA provided a sizeable stimulus package in response to the Great Recession of 2008.[220] It invested more than 31 billion USD on supporting clean energy projects,[221] including 2.4 billion USD to advanced battery and electric drive projects at the world's first EVs factories in California, Delaware, and Tennessee.[222] It also allocated another two billion USD to 30 factories that produce batteries, engines, and other EVs components. It expanded the plug-in electric drive tax cap of the "Energy Improvement and Extension Act" of 2008 from 200,000 nationwide to 250,000 per carmaker until 2014 when it was extended again through the "American Taxpayer Relief Act".[223] This tax credit would become one of the most significant EVs promotion efforts. It was estimated that the US spent around two billion USD between 2010 and 2019 solely on the EVs tax credit.[224]

[219] "2009 American Recovery and Reinvestment Act," The United States Department of Energy, accessed June 20, 2022, https://www.energy.gov/oe/information-center/recovery-act.
[220] Shoshana Lew and John D. Porcari, "Eight Years Later: What the Recovery Act Taught Us about Investing in Transportation," Brookings, February 22, 2017, https://www.brookings.edu/blog/the-avenue/2017/02/22/eight-years-later-what-the-recovery-act-taught-us/.
[221] "Recovery Act," Energy.gov, accessed June 20, 2022, https://www.energy.gov/recovery-act.
[222] "President Obama Announces $2.4 Billion in Grants to Accelerate the Manufacturing and Deployment of the Next Generation of U.S. Batteries and Electric Vehicles," Energy.gov, accessed June 20, 2022, https://www.energy.gov/articles/president-obama-announces-24-billion-grants-accelerate-manufacturing-and-deployment-next; "One Million Electric Vehicles by 2015," 5.
[223] Stokes and Breetz, "Politics in the U.S. Energy Transition: Case Studies of Solar, Wind, Biofuels and Electric Vehicles Policy," 83.
[224] Karla Walter et al., "Electric Vehicles Should Be a Win for American Workers" (Center for American Progress Action Fund, September 23, 2020), https://www.americanprogress.org/article/electric-vehicles-win-american-workers/.

In his 2011 State of the Union address, President Obama announced his goal to put one million EVs on US roads by 2015 to limit dependency on fossil fuels and decrease pollution.[225] In brief, the policy initiatives that Obama took alongside his cabinet consisted of the following 5 categories: manufacturing investments; deployment, "demonstration", and outreach; financial incentives; and R&D support.[226] To a large degree, the ARRA remained the bedrock for all the mentioned policy, especially when it came to budget allocation.

Federal manufacturing investments consisted of allocating parts of the ARRA grants to help manufacturers improve their EVs technologies and output. They also included an agreement with EVs producers to match dollar for dollar the two billion USD grant that was designated for supporting the production of EVs parts at 30 factories,[227] which meant that more than 6 billion USD had been dedicated for EVs production.

In terms of R&D, improving batteries has been a major goal to decrease the limitations of "range anxiety" that new buyers experience. In that regard, close to three billion USD of the ARRA funds were allocated to improve the quality of batteries. This included increasing battery-life, decreasing recharging time, improving their efficiency, and reducing their cost just to name a few.[228] Furthermore, The Department of Energy's Vehicles Technologies Office, which is tasked with supporting R&D, and the deployment of more efficient and sustainable transportation systems to increase fuel efficiency and decrease the United States' dependence on non-renewable fuels has also played a major

[225] "One Million Electric Vehicles by 2015," 02.
[226] "One Million Electric Vehicles by 2015," 05–06.
[227] "One Million Electric Vehicles by 2015," 05.
[228] "One Million Electric Vehicles by 2015," 06–07.

role in that area.[229] In 2015, the Vehicles Technologies Office's investments totalled around 80 million USD[230] covering R&D subprograms with five separate components. It has also coordinated efforts with more than 10 national and international entities on battery R&D.[231]

When it comes to deployment, "demonstration", and outreach, 400 million USD of ARRA funds were designated for the Transportation Electrification Initiative, a largescale "demonstration" project to introduce around 13,000 EVs and install more than 22,000 chargers in more than 20 cities all over the US.[232] Similar to manufacturing investments, private entities committed to matching the 400 million USD dollar for dollar.[233] Furthermore, Obama's Department of Energy initiated the Clean Cities Initiative with the purpose of advancing collaboration between the private sector, local governments, and communities, which in 2012 included around 85 active coalitions all over the country.[234]

In terms of emissions regulations, the Environmental Protection Agency, and the Department of Transportation under Obama's administration in 2012, released new fuel efficiency standards, increasing them to the equivalent of 54.5 mpg for cars and light duty trucks for model year 2017-2025 following the relative success of the 35.5 mpg standards

[229] "AVTA - Plug-in Electric Vehicle on-Road Demonstration Data."
[230] David Howell, "US DOE Electric Vehicle Battery R&D Progress and Plans," *ECS Meeting Abstracts* MA2016-03, no. 1 (June 10, 2016), https://doi.org/10.1149/MA2016-03/1/2.
[231] Steven Boyd and David Howell, "An Overview of the Hybrid and Electric Systems R&D at the U.S.–DOE (FY 2015–2016)," *World Electric Vehicle Journal* 8, no. 2 (June 24, 2015), https://doi.org/10.3390/wevj8020461.
[232] "Plug-in Electric Vehicle Deployment," Environmental and Energy Study Institute, October 2, 2012, https://www.eesi.org/papers/view/fact-sheet-plug-in-electric-vehicle-deployment.
[233] "One Million Electric Vehicles by 2015," 05.
[234] "Plug-in Electric Vehicle Deployment."

that had covered MYs 2011-2016. [235] Under the new standards, EVs were considered to have a zero grams per mile emissions rate, which disregards the emissions due to electricity generation.[236] Furthermore, the EPA initiated an EV multiplier, which allows for a single EV to count more than once when calculating a company's compliance with the new standards. Those multipliers were set at two for MYs 2017-2019 and were later reduced to 1.75 and 1.5 for 2020 and 2021 respectively.[237]

In terms of policy implications of credit multipliers, one study on the US case found them to be most effective in the early stages of EVs market growth when the production costs are high and producing EVs is unprofitable. At that stage, employing an EV multiplier would incentivize car makers to produce EVs that they would not produce otherwise. On the other hand, as the industry grows and EVs sale becomes profitable even by a small margin, such crediting schemes can become counterproductive as it would allow carmakers to use it to produce more inefficient cars simultaneously.[238]

Obama also took measures to enhance collaboration between federal and state governments. One pertinent example is his support of California, which is the "EVs state" of the US.[239] As early as the 1990s, California had required all car manufacturers that are active in state to sell a specific percentage of Zero Emission Vehicles.[240] For a long time,

[235] Peter Huether, "To Undo Damage, Biden Needs to Set Stronger Car Standards," American Council for an Energy-Efficient Economy, July 26, 2021, https://www.aceee.org/blog-post/2021/07/undo-damage-trump-rollbacks-biden-needs-set-car-standards-stronger-obamas.
[236] Kenneth T. Gillingham, "Designing Fuel-Economy Standards in Light of Electric Vehicles" (National Bureau of Economic Research, July 2021), 06, https://www.nber.org/papers/w29067.
[237] Gillingham, "Designing Fuel-Economy Standards in Light of Electric Vehicles," 6.
[238] Gillingham, "Designing Fuel-Economy Standards in Light of Electric Vehicles," 27.
[239] Bridie Schmidt, "One Million EVs Sold in US, and Half of Them in California," The Driven, December 11, 2018, https://thedriven.io/2018/12/11/one-million-evs-sold-in-us-and-half-of-them-in-california/.
[240] Stokes and Breetz, "Politics in the U.S. Energy Transition: Case Studies of Solar, Wind, Biofuels and Electric Vehicles Policy," 82.

California was able to set its own CO2 emissions regulations. In 2007, the US Supreme Court held that the EPA has the authority to regulate greenhouse gas emissions.[241] Under Obama, the Clean Power Plan as part of the Clean Air Act, granted California a waiver to set its own emissions standards and allowed other states to apply those without needing an EPA approval.[242]

In 2016, President Obama alongside tens of EVs industry leaders signed the "Guiding Principles to Promote Electric Vehicles and Charging Infrastructure"[243], to provide a comprehensive policy document that includes all the available federal support opportunities and how they can be acquired.[244] In that same year, the White House announced that it will guarantee that a 4.5 billion USD in loans will be made available to support the establishment of EVs charging infrastructure.[245] Although all the above-mentioned policies did support EVs promotion, it took until 2016 for around half of Obama's announced goal to be reached and another two years until the US car market crossed the one million mark, keeping in mind that half of that million was sold in California alone where state-level policy had been heavily supporting EVs promotion.[246]

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[241] Stokes and Breetz, "Politics in the U.S. Energy Transition: Case Studies of Solar, Wind, Biofuels and Electric Vehicles Policy."
[242] Gillingham, "Designing Fuel-Economy Standards in Light of Electric Vehicles," 02.
[243] Jocelyn Preston Blier, "Promoting Electric Vehicles in the Trump Era: What Can Feasibly Be Done to Drive Electric Vehicle Purchases in the United States for the Next Two Years in the Current Political Climate," *Environmental Claims Journal* 31, no. 3 (2019): 252–75.
[244] "Guide to Federal Funding, Financing, and Technical Assistance for Plug-in Electric Vehicles and Charging Stations" (United Sates Department of Energy, July 20, 2016), https://www.energy.gov/eere/vehicles/downloads/guide-federal-funding-financing-and-technical-assistance-plug-electric.
[245] Chris Mooney, "This Is Obama's Plan to Line the Country's Roads with Electric Vehicle Chargers," July 21, 2016, https://www.washingtonpost.com/news/energy-environment/wp/2016/07/21/this-is-obamas-plan-to-fill-the-countrys-roads-with-electric-vehicle-chargers/.
[246] Schmidt, "One Million EVs Sold in US, and Half of Them in California"; Drew Desilver, "Today's Electric Vehicle Market: Slow Growth in U.S., Faster in China, Europe" (Pew Research Center, June 7, 2021), https://www.pewresearch.org/fact-tank/2021/06/07/todays-electric-vehicle-market-slow-growth-in-u-s-faster-in-china-europe/.

In November of 2016, Donald Trump was elected as the 45th president of the United States. His inauguration was followed with a drastic policy shift[247] that had serious implications on EVs.[248] On the campaign trail, Donald Trump had expressed scepticism of climate change[249] arguing that environmental restrictions such as CO2 emissions standards that were set by his predecessor are hurting the US economy. More specifically, Trump promised to make full use of the United States' resources, including fossil fuels to transform the country into a net energy exporter.[250] That point of view had also been popular among conservative elites, especially in congress, many of whom saw opportunity with the election of Donald Trump to reverse the effects of Obama's environmental policy. Following his election, Trump maintained his stance on the issues above and took several measures to deliver on his campaign promises.[251]

Although Trump's stance on EVs was not always explicitly unfavourable, his overall energy-related approach had significant negative implications on EVs. Here, Trump's EVs policy approach can be divided into two major categories. The first refers to Trump repealing or changing Obama regulations that had direct or indirect relevance to EVs promotion. The second refers to Trump's inaction at a time when governments all over the world, especially China had been strategically supporting their EVs industries.

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[247] Dooley Erin, "Obama Undone: In First Year, Trump Unravels Predecessor's Signature Achievements," ABC News Network, January 17, 2018, https://abcnews.go.com/Politics/obama-undone-year-trump-unravels-predecessors-signature-achievements/story?id=52234311.
[248] Shepardson, "Trump Finalizes Rollback of Obama-Era Vehicle Fuel Efficiency Standards."
[249] Alejandra Borunda, "The Most Consequential Impact of Trump's Climate Policies? Wasted Time.," National Geographic Society, December 11, 2020, https://www nationalgeographic.com/environment/article/most-consequential-impact-of-trumps-climate-policies-wasted-time.
[250] Alan J. Krupnick, "Energy Policy and a Trump Administration" (Resources for the Future, November 2016), 02, https://www.rff.org/publications/issue-briefs/energy-policy-and-a-trump-administration/.
[251] Guliyev, "Trump's 'America First' Energy Policy, Contingency and the Reconfiguration of the Global Energy Order," 02–03.

Since his arrival to the White House, Trump and his appointees announced on multiple occasions their intent to decrease or even eliminate the federal tax credit for EVs.[252] While Democrats stopped them in Congress, their intentions were explicit and highlighted a consistent pattern of "hostility" or at least "indifference" towards EVs.[253]

Trump also repealed or changed seven major climate-related policies from Obama's presidency, many of which had direct EVs relevance. In April of 2017, he ended Obama's artic drilling ban. On June 1, 2017, he formally announced that the US will withdraw from the Paris Agreement. This announcement signalled that the new administration's environmental deregulation policy will go beyond the national level.[254] On that same day, he ended the United States' contributions to the Green Climate Fund.[255]

In August of 2018, he replaced the Obama's standards for the 1976 Corporate Average Fuel Economy standards, with the Safer Affordable Fuel-Efficient vehicles rule. In that same month, he also replaced Obama's Clean Power Plan with the Affordable Clean Energy rule. On September 10, 2018, he changed Obama's Methane rule. Lastly, he ended the "Comprehensive Environmental Response, Compensation, and Liability Act", and the "Emergency Planning and Community Right-to-Know Act" and replaced them with the "Fair Agricultural Reporting Method Act".[256] While not all those decisions

[252] David Shepardson, "Trump Budget Proposes Ending Electric Vehicle Tax Credit," March 11, 2019, https://www reuters.com/article/usa-trump-budget-autonomous-idUSL1N20Y0W2.
[253] Smith, "Trump's Plan to Kill Subsidies for Electric Cars Is a Mistake."
[254] McGrath, "Climate Change: US Formally Withdraws from Paris Agreement"; "President Trump Announces Withdrawal from Paris Agreement," Columbia Sabin Center for Climate Change Law, accessed June 24, 2022, https://climate.law.columbia.edu/content/president-trump-announces-withdrawal-paris-agreement-0.
[255] Justin Worland, "Trump's Paris Agreement Withdrawal Slows Projects Globally," *Time*, June 13, 2017, https://time.com/4813115/paris-agreement-climate-change-trump-green-climate-fund/.
[256] S Niggol Seo, "Economic Questions on Global Warming during the Trump Years," *Journal of Public Affairs* 19, no. 1 (2019): 02.

had EVs relevance, together, they showed that Trump's opposition to environmental restrictions are merely campaign slogans that won't be followed once he is elected.

The changing of the CAFE standards and replacing them with the SAFE vehicles rule has had significant EVs-related implications. Obama's CAFE amendments had required an increase of around 4.7% of annual efficiency growth for MY 2021-2025.[257] Trump's EPA lowered this value to 1.5%.[258] This granted more flexibility to car making companies allowing them to dedicate less and less resources for cleaner vehicles.[259]

Similarly, the Trump administration reviewed the EVs multiplier that was implemented under Obama to motivate EVs production. Not only did the Trump administration return the EVs multiplier to zero for MY 2017 and on, but it also created a multiplier for certain ICEVs to incentivize carmakers to invest in efficient combustion engine cars instead of EVs.[260] This change had important implications on companies that solely produce EVs such as Tesla, which used to sell their credit surplus to other ICEV companies.[261] Consequently, this rule change also signalled further disinterest and even hostility towards clean energy and electric vehicles.

One major issue with Trump's above decision is that he broke away from the bipartisanship that had characterized the emissions regulation program since the 1970s.[262] For instance, when Obama tightened the emissions standards for the first time, it happened

[257] Huether, "To Undo Damage, Biden Needs to Set Stronger Car Standards."
[258] Huether, "To Undo Damage, Biden Needs to Set Stronger Car Standards."
[259] Huether, "To Undo Damage, Biden Needs to Set Stronger Car Standards."
[260] Gillingham, "Designing Fuel-Economy Standards in Light of Electric Vehicles," 6.
[261] "Tesla Pushes U.S. to Boost Fuel Economy Penalties," Reuters, September 22, 2021, https://www reuters.com/article/usa-tesla-emissions-idCNL1N2QO351.
[262] Claiborne, "The SAFE Vehicles Rule: How the Trump Administration's Course Change on Vehicle Emissions Reflects a Larger Policy Shift Away from Environmentally Friendly Regulations," 13.

after lengthy collaboration with the Bush administration to create "One National Program" that brings together the DOT, the EPA, the State of California, the environmental community, and car manufacturers.[263] In addition to disrupting the unity of purpose of such rules it took some time after the initial announcement of the program for the EPA and the DOT to finalize their joint fuel economy GHG rules, making its potential outcomes rather unclear[264] and arguably disrupting adequate planning among car manufacturers.

Trump also ended California's ability to set stricter standards and the ability of other states to adopt them. It can be argued that Trump's EVs approach may have also discouraged EVs promotion in other states as well. One potential indicator in that area is the decrease in the number of states that implement some type of EVs policy on the state level. For instance, by 2015, 27 states had already created some type of in state EVs purchase subsidy. Since Trump's arrival, the number of states with purchase subsidies went down to 15 and the number of states providing subsidies for installing chargers went down from eight to two.[265]

Unlike his predecessor, President Trump and his cabinet did not directly support the deployment of EVs charging infrastructure. For instance, the 30% tax credit for installing EVs chargers was left to expire in 2017.[266] Similarly, the Department of Energy under Trump halted Obama's plan to unlock the 4.5 billion USD loans for charging

[263] Shoshana Lew, "The Trump Administration's Fuel-Efficiency Proposal Is Unnecessary and Harmful," *Brookings* (blog), August 3, 2018, https://www.brookings.edu/blog/the-avenue/2018/08/03/the-trump-administrations-fuel-efficiency-proposal-is-unnecessary-and-harmful/.
[264] Doug Obey, "GM Plant Closures Point to Muddled Politics of Auto GHG Rule Rollback," *Inside EPA's Clean Air Report* 29, no. 25 (2018): 13.
[265] Sherilyn Hayashida, Sumner La Croix, and Makena Coffman, "Understanding Changes in Electric Vehicle Policies in the U.S. States, 2010–2018," *Transport Policy* 103 (March 1, 2021): 212, https://doi.org/10.1016/j.tranpol.2021.01.001.
[266] Anders Hove and David Sandalow, "Electric Vehicle Charging in China and the United States" (The Center on Global Energy Policy at Columbia University, February 2019), 29–30.

infrastructure before it took effect.[267] As a result, much of the growth of EVs infrastructure during Trump's term happened solely because of private and state-led initiatives. Although such initiatives did put hundreds of thousands of chargers on the roads, they did not come close to the number deployed in China, one of the US' primary competitors.[268]

Like their lack of support to public EVs infrastructure, the Trump administration did not take any significant measures towards the promotion of EVs fleet procurement by federal and state entities. In terms of R&D, the Trump administration worked towards decreasing funding for EVs R&D for fiscal years 2018, 2019, and 2020. While that type of funding remained at 700 million USD for 2018 and 2019, it was significantly cut down to 163.5 million USD for fiscal year 2020.[269]

Looking at the above, it is evident that national EVs policy in the US experienced both ups and downs. While the Obama presidency exhibited a clear interest in mainstreaming EVs through national policy, the Trump administration followed a different path. Trump's national EVs approach was part of a broader environmental deregulation policy in the name of economic gain. As a result, Trump reversed key EVs regulations that were introduced by his predecessor. Similarly, he did not take any largescale measures to mainstream EVs, especially when it comes to deploying chargers, electrifying public fleets, and expanding R&D, just to name a few. At a time, when China, and Europe had been heavily investing in their EVs industries, Trump's approach arguably jeopardized the US' position in the "EVs Race".

[267] Mooney, "This Is Obama's Plan to Line the Country's Roads with Electric Vehicle Chargers."
[268] "Global EV Outlook 2021," 38.
[269] Bill Canis, Corrie E. Clark, and Molly F. Sherlock, "Vehicle Electrification: Federal and State Issues Affecting Deployment" (Congressional Research Service, June 3, 2019), 09.

# Chapter Five

# Comparative Analysis: China and the United States

Having discussed EVs policy in China and the United States and having highlighted some of their most significant implications, this chapter comparatively analyses the two cases to further answer the main questions behind the thesis. Below, we identify the key differences on the national EVs policy level between the two countries.

Looking at the systems of governance and the political dynamics, one can argue that both have granted China advantages over the United States when it comes to enacting and implementing national EVs policy. In China, the pairing of a one-party system with a state-led economy did not appear to face the same type of political challenges that the two-party system has faced in the United States.

As we have discussed in Chapter Three, Political power in China is centred around the CCP and its small circle of leaders. Since 2012, the country has been led by Xi Jinping, who has managed to further expand his influence in both public and private spheres.[270] As a result, national EVs policy in China has benefited from a large degree of political consistency as the positive attitude of the central government towards EVs has not changed since it started booming.[271] This political climate has likely benefited the industry as it can reassure carmakers and consumers alike to invest more in electric vehicles, especially in the early stages of market growth. Similarly, the CCP's strong presence in

[270] Albert, Maizland, and Xu, "The Chinese Communist Party."
[271] Yu Nakamura, Kazuyuki Okudaira, and Ken Moriyasu, "China Goes All Out To Be King of the Electric Car," Nikkei Asia, October 11, 2017, https://asia nikkei.com/Spotlight/The-Big-Story/China-goes-all-out-to-be-king-of-the-electric-car.

the private sector grants it certain influence on the behaviour of such entities to follow the government's policy direction.[272]

In the case of the US, the government structure posed many challenges ahead of national EVs policy. Due to checks and balances, all three branches of government have relative oversight and veto powers. For instance, Presidents can prevent the enactment of laws by refusing to sign them.[273] Congress on the other hand has the power to overturn presidential executive orders that US presidents have long used as a major policy tool.[274] Furthermore, the Supreme Court can overturn decisions by both Congress and the President on constitutional grounds.[275] In terms of national EVs policy, we have already identified examples for all the three above-mentioned issues.

Since the mid-1970s, both US parties have enacted several environmental legislations, which created a relatively favourable environment for EVs on many levels.[276] EVs promotion peaked during the Presidency of Barrack Obama, who was elected in 2009 at a time when the commercial EVs industry began booming in the world.[277] Nonetheless, political division over climate change matters kept growing.

The culmination of that polarization further materialized with the arrival of Donald Trump to the White House in 2017. His Climate Change scepticism and his friendly stance towards the fossil fuel industry rendered him indifferent and sometimes hostile towards

[272] Thomas, "Party Committees See Rising Prevalence in Private Sector."
[273] "Presidential Vetoes | US House of Representatives."
[274] "Executive Orders," American Bar Association, November 28, 2021, https://www.americanbar.org/groups/public_education/resources/teacher_portal/educational_resources/executive_orders/.
[275] "The Judicial Branch."
[276] Stokes and Breetz, "Politics in the U.S. Energy Transition: Case Studies of Solar, Wind, Biofuels and Electric Vehicles Policy."
[277] "Global EV Outlook 2021."

the mainstreaming of EVs.[278] As a result, his term on the environmental front was characterised by deregulation and repealing Obama-era rules that supported EVs.[279] That policy shift between the two administrations has been reflected on the national EVs policy level in the US as we have explained at length in the preceding chapter. This political change, especially after Trump's arrival to the White House is a key factor in understanding how the US fell behind China in the "EVs Race".

In terms of financial policy, tax credits and purchase subsidies have been a major policy approach in both countries since 2009. While both were rooted in a similar rationale, which is to counter the cost factor,[280] financial EVs policies in the two countries had several key differences that influenced the extent of their outreach and cost effectiveness. One key difference in that regard was the target of this type of EVs policy.

In the US, the first major EVs tax credit was enacted in 2009 as part of the ARRA, in which all individuals qualified for an EVs tax credit.[281] On the other hand, China, followed a phased approach where purchase subsidies were first given to local authorities to electrify their public fleets and later were extended to individuals.[282] By including provincial and municipal entities in the national purchase subsidy program, China arguably further incentivized local authorities to start EVs promotion programs of their own. By 2015, local authorities in around thirty of China's biggest cities had already implemented their own EVs mainstreaming policy that shouldered China's top-down

[278] Claiborne, "The SAFE Vehicles Rule: How the Trump Administration's Course Change on Vehicle Emissions Reflects a Larger Policy Shift Away from Environmentally Friendly Regulations"; Rabe and Mills, "State Energy Policy in the Trump Era: Insights from Public Opinion."
[279] Shepardson, "Trump Finalizes Rollback of Obama-Era Vehicle Fuel Efficiency Standards."
[280] "Comparing U.S. and Chinese Electric Vehicle Policies."
[281] "Recovery Act."
[282] Hao et al., "China's Electric Vehicle Subsidy Scheme: Rationale and Impacts."

centralized EVs policy. In those cities, the EVs average market penetration rate was at 2.7%, which is more than three times the national average.[283] Today, the number of those cities is still increasing and in five of China's biggest cities, one in five newly sold vehicle is electric.[284] On the other hand, we saw above how the number of EVs policy that are implemented by states in the US has significantly decreased since President Trump arrived at the White House.[285]

Chinese financial EVs policy also differed from that of the US in terms of its value. While the US tax credit range was fixed at 2,500 to 7,500 USD depending on the vehicle's specifications,[286] Chinese purchase subsidies were readjusted over the years. Furthermore, some of the Chinese subsidies had much higher caps in comparison to the US. In China, the subsidy for small vehicles ranged from 20,000 CNY to 60,000 CNY or the equivalent of around 3,000 USD to around 9,000 USD, while the credit for buses could go as high as 600,000 CNY or the equivalent of around 90,000 USD at the time.[287] This difference in the value of the subsidies has been equally reflected in the overall cost of the policy. it was estimated that in 2015 alone, China spent close to 8.4 billion USD on EVs financial incentives, which totals to more than four times the amount that the US federal

[283] He et al., "Assessment of Electric Car Promotion Policies in Chinese Cities," 45.
[284] "In China's Biggest Cities, One in Five Cars Sold Is Now Electric," Bloomberg, May 10, 2021, https://www.bloomberg.com/news/articles/2021-05-10/in-china-s-biggest-cities-one-in-five-cars-sold-is-now-electric.
[285] Hayashida, La Croix, and Coffman, "Understanding Changes in Electric Vehicle Policies in the U.S. States, 2010–2018," 212.
[286] Meckling and Nahm, "When Do States Disrupt Industries? Electric Cars and the Politics of Innovation," 519.
[287] Hao et al., "China's Electric Vehicle Subsidy Scheme: Rationale and Impacts," 723–24.

government had spent on EVs tax credit from 2010 until 2019.[288] That difference in spending is reflected in the EVs market gap between the two countries.[289]

The fixed subsidies rate in the US and the adjustable ones in China are relevant as purchase subsidies for EVs have been shown to be relatively costly, especially in comparison to other EVs promotion measures.[290] Studies have also shown that the effectiveness of EVs purchase subsidies depends on several dynamic factors.[291] For instance, the overall effectiveness of purchase subsidies marginally diminish as markets grow and EVs production costs decrease,[292] which makes financial policy review and sometimes phase out necessary.

While studies have already shown that the marginal effectiveness of EVs subsidies tends to decrease, subsidies can still stimulate demand even when markets become more mature, and many studies have already shown the drops in demand when subsidies are decreased or ended.[293] As a result, any national subsidy phase-out must be coupled with the introduction of other national EVs policy that can fill the gap in more efficient ways.

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[288] Walter et al., "Electric Vehicles Should Be a Win for American Workers."
[289] Hui and Lingzhi, "How China Put Nearly 5 Million New Energy Vehicles on the Road in One Decade."
[290] Lijing Zhu, Peize Wang, and Qi Zhang, "Indirect Network Effects in China's Electric Vehicle Diffusion under Phasing Out Subsidies," *Applied Energy* 251 (October 1, 2019): 113350, https://doi.org/10.1016/j.apenergy.2019.113350.
[291] Jean-Francois Fournel, "Electric Vehicle Subsidies: Cost-Effectiveness and Emission Reductions" (McGill University, January 2022), 2; Joshua Linn, "Is There a Trade-off Between Equity and Effectiveness for Electric Vehicle Subsidies?," Resources for the Future, January 21, 2022, https://www resources.org/common-resources/is-there-a-trade-off-between-equity-and-effectiveness-for-electric-vehicle-subsidies/.
[292] Ng et al., "How Governments Can Encourage Adoption of Battery Electric Vehicles."
[293] Ng et al., "How Governments Can Encourage Adoption of Battery Electric Vehicles."

While the Chinese government has gradually decreased subsidies, this decision has not been part of an anti-EVs sentiment. Instead, it was part of a nationwide comprehensive plan to allocate more funding towards other EVs policy, such as infrastructure investment, R&D, and the dual-credit system. It was due to the belief that more cost-effective policy measures, such as R&D support and investments in the infrastructure can yield more efficient results. For instance, China as part of its phase out plan had published a toolkit on the alternatives that will be implemented such as "access to free parking and toll-free highways".[294]

Here, it is important to consider the role that Trump played in that EVs policy area. Having shown that gradual phase out of a subsidy policy may be adopted under certain circumstances, one should ask whether Trump's attempts to end the EVs tax credit could have been an optimal policy decision at the time, given the above-mentioned considerations about financial incentives as an EVs policy. Unlike China, Trump's attempt to end the EVs tax credit, although unsuccessful was to cut cost and not to replace it with other potentially more efficient national EVs policy, such as investing in the charging infrastructure or R&D.[295] Instead, Trump seeking to end the tax credit came in the spirit of reversing "EVs privileges" and further deregulating the market irrespective of the potential implications on EVs promotion. In that sense, Trump pursuing the ending of that policy had negative implications on the industry as it led to more uncertainty about its future and concerns about equity among new consumers.[296]

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[294] Hao et al., "Plug-in Electric Vehicles in China and the USA: A Technology and Market Comparison," 348.
[295] Shepardson, "Trump Budget Proposes Ending Electric Vehicle Tax Credit."
[296] Chris Teale, "White House Proposal to End EV Tax Credit Comes Under Fire," Utility Dive, December 6, 2018, https://www.utilitydive.com/news/electric-vehicle-tax-credit-cut-controversy/543791/.

Another important policy area to consider is traffic regulations. In our analysis, we found that this type of policy can be relatively cheap and yield significantly positive implications, when applied correctly. In China, special EVs traffic regulations are rather common, especially when it comes to the issuance of special license plates and granting certain traffic-related privileges to EVs owners, such as access to special driving lanes and parking spots.[297] China has also granted car registration lottery exemptions for new EVs owners.[298] Here, one should note that this type of policy did not appear to be common in the US. For instance, it is plausible to argue that the creation of a lottery system for car registration in the US would not necessarily be received well by the public.

A key category under national EVs policy in both countries pertains to emissions regulation and how they have been used to incentivise car makers to produce more EVs. In the US, Obama introduced stricter car efficiency requirements alongside an EVs multiplier, granting car makers some flexibility to produce lesser efficient cars on the condition that they produced more EVs.[299] Following Trump's arrival, both the strict standards and the EVs multipliers were reversed. Trump also installed a credit system that incentivized companies to produce more ICEVs, given they fell within a specific efficiency bracket.[300]

The policy implications of Trump's decision in that area resemble to a large degree those that surrounded his attempt to end EVs tax credits. Like tax credits, the marginal return of EVs multipliers is also sensitive to the cost of production of EVs as companies

[297] Dixon, "China Green Licence Plate Scheme Going National."
[298] Ge, "Electric Vehicle Regulation and Law in China."
[299] Gillingham, "Designing Fuel-Economy Standards in Light of Electric Vehicles," 06.
[300] Gillingham, "Designing Fuel-Economy Standards in Light of Electric Vehicles," 06.

begin producing them at more competitive prices.[301] In that sense, Trump's successfully reversing the EVs multipliers and creating one for ICEVs models has not benefited the industry as it was not replaced by any other EVs promotion policy alternative.

In 2018, China decided to build on the US and California experiences and implemented a similar mechanism that took effect in 2018, as part of the CAFC dual-credit system.[302] As we explained in Chapter Three, a major implication of China's dual-credit policy was reflected in increased R&D tendencies among car making companies, which would allocate more budgets to R&D because of the dual-credit system.[303] As a result, it is plausible to say that the EVs industry in China benefited from the application of that policy mechanism more than its counterpart did in the US.

[301] Gillingham, "Designing Fuel-Economy Standards in Light of Electric Vehicles," 27.
[302] Chen and He, "How Will the Dual-Credit Policy Help China Boost New Energy Vehicle Growth?"
[303] Li and Xiong, "Phased Impacts of China's Dual-Credit Policy on R&D."

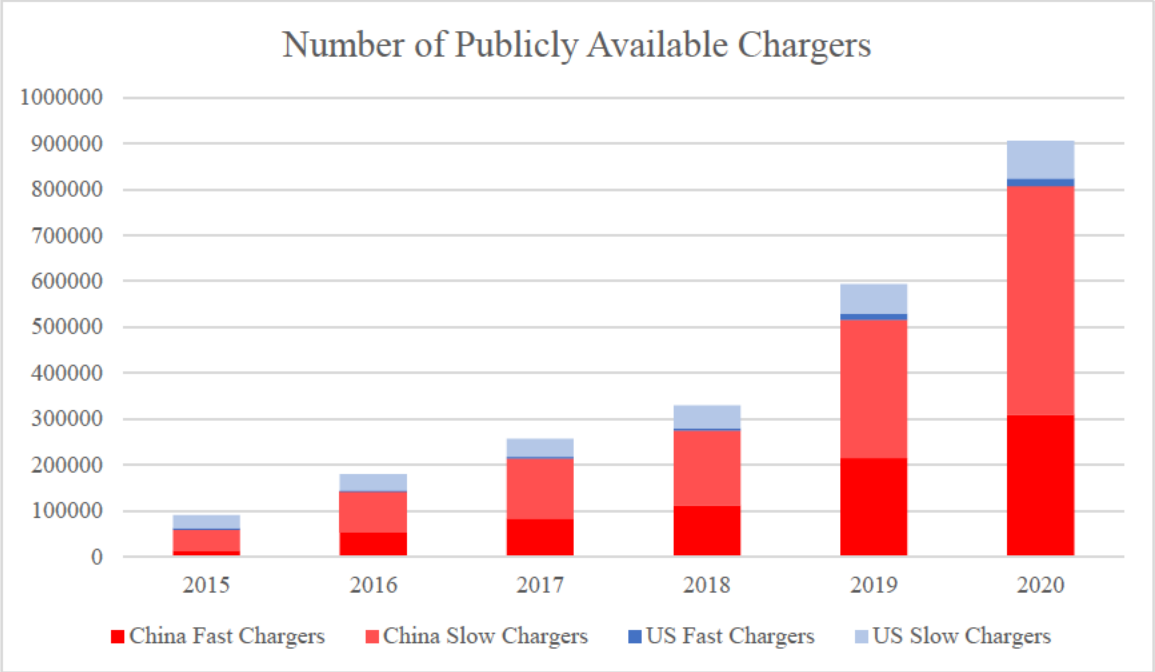


*Figure 1. Number of Publicly Available Chargers in China and the United States*
Source: International Energy Agency[304]

As mentioned in the previous chapters, public investment in EVs infrastructure has been identified as one of the most effective and relatively cheap policy measures that a government can put in the EVs sector. In China, the government has been proactive in that area and has significantly developed its charging infrastructure. In the United States, the situation differed, although President Obama did support the deployment of charging points through publicly funded "demonstration" projects,[305] the Trump administration dedicated no special effort in that area.

[304] "Stock of Fast Public Electric Light Duty Vehicles Chargers, 2015-2020," International Energy Agency, April 28, 2021, https://www.iea.org/reports/global-ev-outlook-2021; "Stock of Slow Public Electric Light Duty Vehicles Chargers, 2015-2020," International Energy Agency, April 28, 2021, https://www.iea.org/reports/global-ev-outlook-2021.
[305] "One Million Electric Vehicles by 2015," 05.

One comparative study on EVs charging in China and the US, identified six different types of EVs infrastructure sub-policy that were nationally implemented in China but not the US. Those include planning EVs motorway; creating EVs charging plug standards; requiring EVs charging installation at new private building; requiring EVs charging installations at new public buildings; and regulating time-of-use charging fees.[306] That discrepancy in policy is also reflected in the number of publicly accessible chargers.

Figure 1 shows the numbers of fast and slow chargers that are available to the public in China and the US. In five years, China went from having around two times the numbers of US chargers to having more than eight times that number. China's lead is more significant on the fast chargers' front, a quality that is much more valuable in the public domain, where it is not as feasible to charge for long hours like one could when plugging to a personal charger at home.

In addition to the evident public charging gap between the two countries, it is important to recognize that the featured number of chargers does not exclude those that are installed by regional or provincial authorities. For instance, California alone had around 36,000 publicly accessible chargers by the end of 2020, accounting for around 36% of the total US number for that year.[307] Given California's strong involvement on the state level in supporting the deployment of EVs chargers, the numbers above further indicate the lack of US national involvement on that front, given that the relatively small number of EVs public chargers is not the result of national policy.[308] This becomes even

[306] Hove and Sandalow, "Electric Vehicle Charging in China and the United States," 34.
[307] "Alternative Fuels Data Center: Alternative Fueling Station Counts by State," The United States Department of Energy, accessed July 8, 2022, https://afdc.energy.gov/stations/states.
[308] Schmidt, "One Million EVs Sold in US, and Half of Them in California."

more relevant when we consider existing literature that has consistently shown the positive role that EVs public chargers play in stimulating and maintaining demand,[309] especially that range anxiety is one of the biggest deterrents that consumers consistently have reported.[310]

Furthermore, another important difference between the two countries is at the level of the power grids and their operation. The entirety of China is powered by two electricity grids owned by the government, the US grid is run by around 3,000 producers with no more than 7% of net generation being produced by the federal government.[311] As a result, China has an advantage when it comes to powering newly established charging infrastructure for the following reasons. Unlike the US, Chinese power grids tend to view EVs mainstreaming as a social responsibility and therefore are willing to dedicate certain resources to power it.[312] Furthermore, the relatively large number of entities that produce power in the US arguably adds more regulatory and internal operation layers that can render the process more complicated.

Having discussed the key differences between the two countries, it is also important to look at national EVs policy from a wider lens. Here it can be argued that the most significant difference between the two states is not limited to any specific policy type. Instead, the biggest factor that seems to separate the two countries is the network effect that China has created because of all the different policy types coming together as a package and complimenting one another. It is about China being able to reach a certain

[309] He et al., "Assessment of Electric Car Promotion Policies in Chinese Cities."
[310] Lee, "How Long Does It Take to Charge an Electric Car?"
[311] "Electricity 101," The United States Department of Energy, 101, accessed July 9, 2022, https://www.energy.gov/oe/information-center/educational-resources/electricity-101.
[312] Hove and Sandalow, "Electric Vehicle Charging in China and the United States," 58.

tipping point where an EVs-friendly environment is created and can sustain itself.[313] An environment where different forms of EVs policy intertwine and fill each other's' gaps.

For instance, by including public buses under its subsidy scheme, China managed to put around 500,000 electric buses on its roads, which accounts for 98% of all E-buses in the world.[314] In that way, China employed subsidies not only to incentivise E-bus production but to also fund one of the largest EVs "demonstration" projects in the world. Increasing the number of public E-buses also fell in line with China's decision in 2016 to electrify more than 50% of its fleet over the five following years.[315] Similarly, China's investment in EVs public chargers further complimented those subsidies and encouraged local authorities to electrify their fleets. This policy coordination is equally evident when we look at the pairing of special EVs traffic regulations and financial disincentives for ICEVs. Not to forget the discussed findings on the strong correlation between the dual-credit system and R&D tendencies among private companies.

While local entities in both the US and China have invested in EVs, what distinguishes the latter was the heightened cooperation among those entities as part of one coordinated strategy.[316] This strategy is further solidified under the FYPs that clearly outline the country's direction on the socio-economic front.[317] The US on the other hand took a different course when it comes to federal and state-level collaboration. While both state and federal entities took various initiatives to support the EVs industry, they were

[313] "Winning the Chinese Electric Car Market: How Leading International Oems Compete," McKinsey & Company, May 4, 2021, https://www mckinsey.com/industries/automotive-and-assembly/our-insights/winning-the-chinese-bev-market-how-leading-international-oems-compete.
[314] Buchholz, "What's Really Driving the Trend in e-Vehicles?"
[315] "Guide to Chinese Climate Policy: Electric Vehicles."
[316] He et al., "Assessment of Electric Car Promotion Policies in Chinese Cities."
[317] "What Is China's Five-Year Plan?"

not necessarily part of a centrally coordinated strategy like in China, especially after the election of Donald Trump. Similarly, such efforts were not necessarily consistent as the approach towards clean energy changed depending on which of the two parties held Congress.[318]

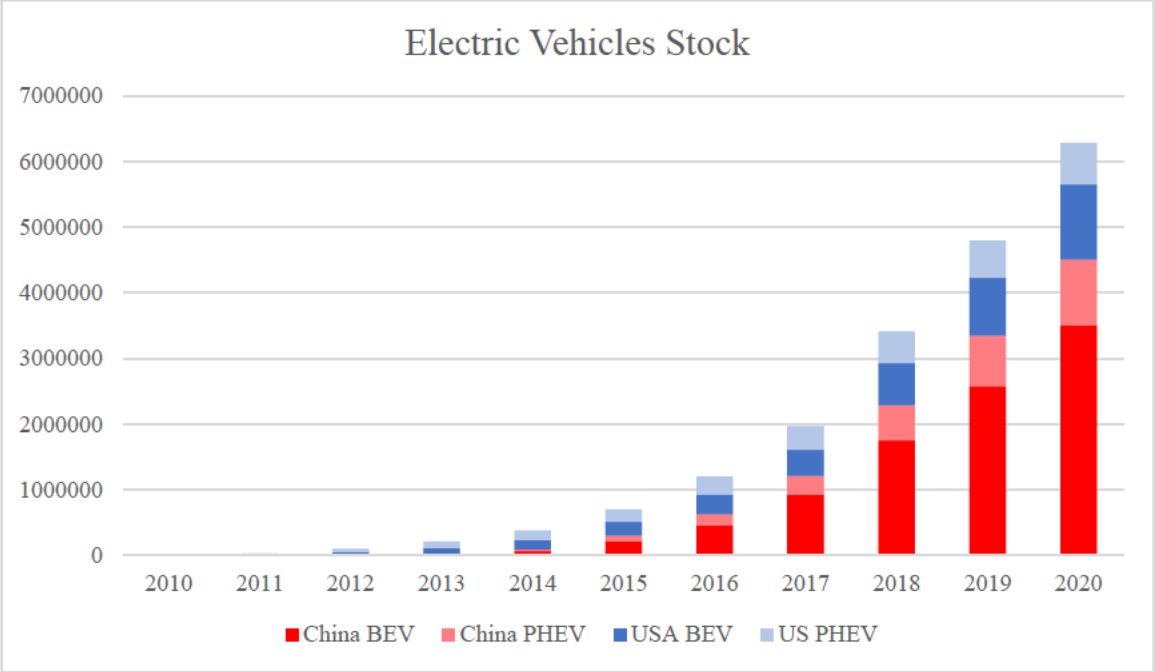


*Figure 2. Electric Vehicles Stock in China and the United States*
Source: International Energy Agency[319]

As a result of China's ability to create such an EVs friendly environment, its EVs industry has been able to outperform the US one based on many indicators. First and foremost, China is leading the US in terms of its EVs market stock as we can see in Figure 2. In addition to holding close to 50% of the EVs global market share, China today builds PHEVs with longer electric ranges than the American competition.[320] On the supply chain

[318] Borunda, "The Most Consequential Impact of Trump's Climate Policies?"
[319] "Global Electric Car Stock by Region and Mode, 2010-2020," International Energy Agency, October 21, 2021, https://www.iea.org/reports/electric-vehicles.
[320] Hao et al., "Plug-in Electric Vehicles in China and the USA: A Technology and Market Comparison."

level, China has built even a bigger lead. Today, while China produces 68% of the world's EVs cathode components and 84% of anode components, the US produces no more than 1% of each,[321] meaning that US companies must import those parts.

Furthermore, China's influence has by no means been limited to native companies. For instance, in 2018, Shanghai authorities and Tesla, a US company signed an agreement to build one of the world's largest car production plants.[322] Today, the factory's output is close to 17,000 cars per week.[323] If this pace is maintained, China's Tesla factory will come close to outperforming the company's plant in California.[324] Chinese policy has also been effective in targeting consumers' attitudes. For instance, consumer interest in EVs in China has been steadily growing in comparison to the rest of the world and has arguably reached an inflection point.[325]

[321] Ben Geman, "U.S. Playing Catch-up on EVs," Axios, May 23, 2022, https://www.axios.com/2022/05/23/electric-vehicles-us-china-europe.
[322] Robert Ferris, "Tesla Has Signed an Agreement to Build a Factory in Shanghai," Consumer News and Business Channel, July 10, 2018, https://www.cnbc.com/2018/07/10/tesla-has-signed-an-agreement-to-build-a-factory-in-shanghai.html.
[323] Kane Mark, "Tesla Production Sites by Model Assignment, Capacity," Insideevs, April 22, 2022, https://insideevs.com/news/581460/tesla-production-sites-model-assignment-april2022/.
[324] Mark, "Tesla Production Sites by Model Assignment, Capacity."
[325] Yang Jian, "China's Shoppers Now Hot for EVs," Automotive News, July 16, 2021, https://www.autonews.com/china/chinas-shoppers-now-hot-evs.

# Chapter Six

# Conclusion

In this thesis, we looked at state involvement in the EVs industry in China and the United States, focusing on the national policy shift after the election of President Donald Trump in 2016. Our main objective was to understand the extent to which national policy in China and the US has allowed one of them to outperform the other in the EVs realm. Below we reiterate the key points from the thesis, and we list some of the key findings. After introducing the topic, we identified the underlying rationale that renders the EVs industry a policy area of interest for governments all around the world, and highlighted the major environmental, political, and economic factors that come into play. We discussed the many challenges that have thus far faced the industry and the main policy types that can be employed to counter them. Most importantly, we were able to clearly highlight the relevance of national EVs policy and its crucial role in supporting a newly emerging industry like EVs.

In Chapter Three, we looked closely at the case of China and discussed how the national EVs policy has unfolded over the years. First, we provided a detailed discussion of China's system of governance and political context to better understand underlying decision-making processes. This chapter highlighted some of the key policy efforts that have thus far been applied in China. We also identified the value of purchase subsidies and their positive role in generating demand. Another important policy mechanism that we analysed in this chapter was China's investment in the charging infrastructure. We explained how it succeeded at building more than one million publicly accessible EVs

chargers by 2021, highlighting the significance of that step in mainstreaming EVs. We also found that efficiency standards regulations have also been another key mechanism in China. Here, we discussed at length the positive implications of China's dual-credit system on EVs R&D.

In Chapter Four, we looked at the national EVs policy in the United States. Like the previous chapter, we started by analysing the nature of governance and politics in the US to better understand EVs policy on the federal level. As expected, partisanship and the interactions among the three branches of government were identified as major policy drivers in the United States that had tremendous impacts on EVs. We also found that federal EVs policy is by no means a new phenomenon. In fact, some federally funded projects like the PNGV date all the way back to the 1990s.[326] Furthermore, we identified the series of congressional acts that regulated EVs-related matters starting with the emissions regulation laws in the mid-1970s[327] all the way to the ARRA of 2009 that was arguably the most significant congressional act for EVs in the US as it allocated more than four billion USD in federal budgeting.[328]

In our discussion about the role of the presidency, we found that EVs policy on the national level has been a key theme under the Obama administration. In addition to managing the ARRA funds and streaming them to encourage initial demonstration projects, the key role that the Obama administration played concerned regulating GHG emissions and introducing an EVs multiplier, which counted EVs output twice as much

[326] Chapman, *The Machine That Could*.
[327] Claiborne, "The SAFE Vehicles Rule: How the Trump Administration's Course Change on Vehicle Emissions Reflects a Larger Policy Shift Away from Environmentally Friendly Regulations."
[328] "2009 American Recovery and Reinvestment Act."

as that of ICEVs. As part of that intervention Obama granted California a waiver to set stricter emissions standards. The Obama White House also implemented several partnerships with private and state entities to advance EVs.

After discussing national EVs policy under Obama, we unpacked the shift that happened in the US after Trump's arrival to the White House. While Trump did not explicitly announce hostility toward EVs, his approach arguably had negative implications on EVs promotion. In that regard, his influence on the EVs industry can be divided into two main categories. The first refers to him repealing key Obama policy that were meant to promote EVs in the United States. The second type of influence can be understood by looking at the EVs policy areas that were disregarded by the Trump administration. At a time, when governments all around the world were taking steady steps to support EVs mainstreaming, especially when it comes to building the necessary charging infrastructure and allocating R&D funds, opting out of such policy measures has significant implications on the advancement of the industry. In other words, when it comes to national EVs policy, inaction is significant and should be studied.

After analysing data from the US DOE and the US DOT and many independent sources, we found that the Trump administration had offered little to no support when it comes to establishing EVs chargers. This view was also mirrored in the R&D area as the Trump administration attempted three times and succeeded once to significantly cut EVs R&D funding in federal budgets.[329] In addition to analysing the implications of repealing Obama EVs policy, we also deduced that Trump verbalizing his intent to rollback national

[329] Canis, Clark, and Sherlock, "Vehicle Electrification: Federal and State Issues Affecting Deployment," 09.

EVs policy on its own was impactful as major car makers consider potential policy shifts in their strategic planning.

In Chapter Five, we compared national EVs policy in the US and China to answer our research question. We discussed how China's political system has given it certain advantages in comparison to the US as it allowed for more consistency on the policy level, especially after President Xi Jinping consolidated power in 2012.[330] Unlike China, the direction of national EVs policy in the US faced many political limitations that were culminated with the arrival of President Donald Trump.

Here, we comparatively analysed charging infrastructure policy in both countries and discussed how China managed to build an edge in that area and how significant that was in their "EVs race". For instance, we found that by 2018, China had five times more charging stations that are available to the public in comparison to the United States. This charging gap increased to eight folds by 2020.[331] Similarly, we compared Chinese and US EVs financial policy programs and found that China's decision to phase out its subsidies as part of a comprehensive resource reallocation plan allows it to make a better use of EVs supporting funds.

When it comes to traffic regulations, we looked at key policies that were solely present in China, specifically the issuance of special green plates and exempting EVs from license lottery. Although this form of policy can be effective, it is not clear how it could have been feasibly applied in the US irrespective of the administration, given that this type

[330] Albert, Maizland, and Xu, "The Chinese Communist Party."
[331] Hao et al., "Plug-in Electric Vehicles in China and the USA: A Technology and Market Comparison," 345; "Global EV Outlook 2021."

of regulatory policy on the micro/individual level is more common in China. This is also the case when considering the special taxes that china had installed on ICEVs.

Most importantly, our comparative analysis allowed us to look at the broader picture. While China may have had more robust national EVs policy in comparison to the US on many levels, we argued that what set it apart is its ability to create an EVs-promoting environment where various types of policy interconnect. In that regard, we explained how China to a large degree managed to push the country towards a certain tipping point where demand for EVs may not need to be artificially induced.

Having discussed EVs policy in China and the US, it is important to consider some further ways to expand this thesis. Given that much of our analysis was centred around the policy shift between the Obama and the Trump presidency. And given that one of our key arguments was that Trump's decision to counter the policy of his predecessor did not help with EVs promotion, future studies can analyse the policy shift in terms of EVs national policy after the arrival of President Joe Biden to the White House. On the EVs front, Biden's approach consisted of restating many of Obama's rules and adopting his framework on EVs.[332] By analysing the shift after Biden's election and assessing the depth of its implication on the EVs industry, we might be able to cross check many of our assertions. In other words, if we can identify any reverse effects following Biden's approach, our claims about the significance of Trump's role can be further strengthened.

[332] Eisenstein, "Biden Ditches Trump Mileage Cuts, Targets EVs as Half of U.S. Car Sales by 2030."

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