E-ISSN : 2963-4946
Vol. 2 No. November 02, 2023
Asian Journal of Social and Humanities
https://ajosh.org/

Electric Vehicles in Indonesia: Public Policy, Impact, and Challenges

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KEYWORDS
Public Policy, Electric Vehicles, Impact, Energy Transitions

ABSTRACT
Indonesia's population is still growing, and the demand for energy for transport to sustain community mobility grows yearly. On the other hand, environmental challenges and green energy policies have become critical issues in today's countries, including Indonesia, and are the key subjects in sustainable development. So far, Indonesian transportation has relied on fossil-fuel vehicles. The Indonesian government has devised different regulations to stimulate the usage of electric vehicles to support the three key programs in the National Medium-Term Development Plan For 2020-2024. This study will go through electric car policy issues, including the consequences of the policy's implementation in Indonesia. The literature review strategy is used in this study. The author thoroughly evaluated prior studies on electric vehicles in the literature. The research findings reveal that the electric car policy impacts direct and indirect expenses, but the government will have difficulty assessing the program's indirect advantages. As a result, the author suggests that the government take immediate steps to anticipate various negative impacts that may arise so that they do not become problems in the future and do not become barriers to achieving the goals of Indonesia's battery-based electric vehicle program

Introduction

Based on calculations and projections conducted by multiple scientists, it is projected that the surface temperature of the Earth will experience a rise ranging from 1.4 to 5.8 degrees Celsius by the year 2100 (Apraku et al., 2018, p. 3). An elevation in temperature will be accompanied by alterations in relative air humidity and wind strength (Douville et al., 2022, p. 5). According to the projection made by the Head of the Indonesian Meteorological, Climatological, and Geophysics Agency, it is anticipated that in the absence of policy intervention, Indonesia may incur a potential economic loss of IDR 544 trillion because of climate change within the period of 2020-2024. (Putratama, 2023)

From 2000 to 2012, they had a notable rise in energy consumption, with an increase from 764 million BOE (barrel of oil equivalent) in 2000 to 1,079 million BOE in 2012. The energy consumption distribution 2012 was as follows: the industrial sector accounted for the highest proportion at 34.8%, followed by the residential sector at 30.7%, transportation at 28.8%, commercial at 3.3%, and other sectors at 2.4%. Between 2000 and 2012, the transport sector saw the most substantial expansion, with an annual growth rate of 6.92%. In the year 2012, the dominant proportion of fuel consumption was attributed to gasoline, accounting for 50% of the total. Diesel oil followed closely behind, constituting 37% of the overall consumption. In descending order of significance, aviation fuel, kerosene, and fuel oil accounted for 7%, 4%, and 2%, respectively. The facts are depicted in Figure 1, presented afterwards.(Kholiq, 2015, pp. 80–81) The substantial increase in final energy consumption within the transportation sector can be attributed to the notable expansion of motorised vehicles from 2000 to 2012. In 2012, the Association of Indonesia Automotive Industries (*Gabungan Industri Kendaraan Bermotor Indonesia*; GAIKINDO) documented the sale of 1,116,230 units of cars and 7,064,457 units of motorcycles. The sales figures for cars and motorcycles indicate a notable rise of approximately 157% and 50.68%, respectively, compared to the sales data from 2007 (Meliala, 2014, p. 338).

Suppose the current extensive utilisation of fossil fuels persists without a viable resolution. In that case, a distinct possibility exists of fuel scarcity, potentially precipitating an energy crisis within Indonesia. The government must establish an alternative approach to diminishing reliance on fossil fuels to mitigate this occurrence. One potential solution is the conversion of traditional fossil fuel-powered automobiles into electric vehicles (Mishra et al., 2021, p. 5).

The substantial pattern of fossil fuel usage has also influenced the magnitude of the government budget allocated towards energy subsidies. According to the 2023 State Budget, the government of Indonesia allotted IDR 339.6 trillion for energy subsidies and compensation, surpassing the budget for defence and security, which amounted to only IDR 316.9 trillion. (Ministry of Communications and Informatics, 2022) This highlights the current state of society's significant demand for and reliance on fossil energy, which has reached a crucial level. Furthermore, this situation is worsened by the decrease in domestic fossil energy output, resulting in an inability to fulfil the home market's energy needs adequately. Given the prevailing circumstances, the government cannot rely on imports to meet its needs. However, it is essential to note that this approach is susceptible to economic risks associated with fluctuations in the currency rate. To mitigate the escalating levels of carbon gas emissions, a viable measure involves the conversion of fossil fuel-powered automobiles into electrically powered vehicles.

In the context of efficiency, electric vehicles exhibit significantly greater levels of efficiency when compared to conventional vehicles. Electric vehicles demonstrate a total efficiency of 28%, beating the comparatively lower efficiency of conventional vehicles, which stands at approximately 14% (Subekti et al., 2014, p. 6). Consequently, electric vehicles exhibit efficiency levels that are twice as great as those observed in conventional automobiles. The efficiency calculation includes the energy consumption during vehicle operation and factors in the energy and fuel requirements associated with producing electric vehicles and conventional vehicles being compared. Conventional fuel refers to the widely used energy sources from non-renewable resources, such as fossil fuels. According to findings from the Massachusetts Institute of Technology's research, it has been demonstrated that adopting electric cars by the year 2035 will result in a fuel

consumption rate of approximately 1.5 litres per 100 km. The fuel efficiency of this mode of consumption is significantly higher than that of automobiles powered by fossil fuels, which have a consumption rate of 5.5 litres per 100 kilometres (Bandivadekar et al., 2008, p. 33).

Indonesia has formally committed to a collaborative effort to mitigate the climate crisis, as outlined in the legally binding National Determined Contribution (NDC) document. This commitment was ratified by enacting Law No. 16 of 2016 concerning ratifying the Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC). Since its establishment in 1992, the UNFCCC has served as the primary platform for international collaboration among governments about the issue of climate change caused by greenhouse gas (GHG) emissions. This initiative aims to stabilise greenhouse gas concentrations in the Earth's atmosphere at a level that effectively mitigates the risk of detrimental human intervention with the climate system. This target is pursued within a specific timeframe that allows for ecosystems' natural adaptation and facilitates sustainable development (Harrould-Kolieb, 2016, p. 623).

Indonesia's Nationally Determined Contribution (NDC) entails a firm commitment to mitigating carbon dioxide emissions and minimising the impacts of greenhouse gas emissions. The country aims to achieve a 29% reduction through its initiatives while seeking to further decrease emissions by 41% with the support and involvement of international stakeholders (Suroso et al., 2022, p. 189). The adoption of electric vehicles in Indonesia represents a tangible manifestation of the Paris Agreement, aimed at enhancing efficiency and bolstering energy security. Furthermore, it serves as a proactive measure to mitigate the escalating carbon emissions that contribute to climate change inside the country.

The Indonesian government is actively committed to developing and disseminating local electric vehicles to convert traditional fuel-powered vehicles into energy-efficient alternatives. Indonesia has set a goal of achieving 2 million electric vehicles on its roads by 2025 (Ministry of Industry, 2021). It is imperative to undertake three fundamental transformations simultaneously to mitigate greenhouse gas (GHG) emissions and the risks associated with global temperature rise. These transformations encompass the electrification of end-user sectors, the decarbonisation of electricity generation, and energy efficiency enhancement (Yudiartono et al., 2023, p. 67).

To attain the objective of this initiative, the Indonesian government has implemented a legal framework supported by various regulations. One such regulation is Presidential Regulation Number 55 of 2019 concerning accelerating the Battery-Based Electric Motor Vehicle Program for Road Transportation. This regulation addresses four crucial aspects of electric vehicle policy: 1) utilisation of domestically manufactured components; 2) provision of government incentives; 3) development of necessary infrastructure; and 4) registration and identification procedures.

Furthermore, in addition to Presidential Regulation Number 55 of 2019, the government has implemented derivative regulations through various ministerial regulations. One notable example is Regulation of Minister of Energy and Mineral Resources Number 13 of 2020 concerning Provision of Electric Charging Infrastructure for Battery-Based Electric Vehicles, which is the government's effort to improve the ecosystem and market appeal of electric vehicles by ensuring the completion of supporting infrastructure for public usage. This includes the implementation of mechanisms for payment in parking spaces and recharging stations (Robinson et al., 2013, p. 348). In addition, the government has also enacted Government Regulation Number 73

of 2019 regarding Taxable Goods Classified as Luxury in the Form of Motorized Vehicles Subject to Sales Tax on Luxury Goods. This regulation stipulates the rates of Sales Tax on Luxury Goods (*Pajak Penjualan atas Barang Mewah;* PPnBM) based on exhaust emissions rather than vehicle type. The government is actively promoting the growth of the electric vehicle industry from an industrial standpoint. This is evident through the issuance of Regulation of the Minister of Industry Number 7 of 2022 concerning Battery-Based Electric Motorized Vehicles in Completely Decomposed and Incompletely Decomposed Conditions. It aims to provide incentives to facilitate the transition from conventional motorised to electric vehicles, stimulating the market's supply side.

The primary factors influencing the government's directive to promote the utilisation of electric vehicles include cost-effectiveness, government subsidies, and issues related to charging infrastructure accessibility. In Indonesia, there are currently subsidies in the form of annual purchase tax reductions and exemptions from the odd-even rule on roads. The present situation in Indonesia, characterised by a limited number of charging stations, is intricately linked to the market dynamics surrounding the sale of electric vehicles. A pressing requirement exists to substantially augment the number of charging stations to exert a persuasive impact on individuals' inclination to procure and transition to electric automobiles (Egnér & Trosvik, 2018, p. 591).

Several previous studies have been conducted to investigate policies promoting the adoption and utilisation of electric vehicles. One notable contribution to electric vehicles is the research conducted by John D. Graham, Dean Emeritus of the Indiana University O'Neill School of Public and Environmental Policy, as documented in his book "*The Global Rise of the Modern Plug-In Electric Vehicle*". In his scholarly investigation, Graham delineates four policy drivers that promote adopting and advancing environmentally friendly automobile technology. These policy drivers, as expounded by Graham, are as follows: 1) the California Zero-Emissions Vehicle (ZEV) mandate, 2) concerns regarding energy security, 3) industrial competition, and 4) concerns regarding climate change (Hsu, 2022, p. 4). These four policy drivers are mainly interconnected with advancing environmentally sustainable vehicle technology.

Technological shifts made to address public sector concerns may necessitate corresponding developments in government strategy and markets. The electric vehicle case shows the need for policy and to work together to encourage technological shifts to which citizens will respond. Industry innovation can be hailed as technical entrepreneurship. Still, its reach can be limited if steps are not taken to make innovation affordable to individuals who stand to profit from it. Policy incentives can serve to reduce the cost of innovation, making it more accessible. Still, these incentives may be of limited utility or influence if the government and industry pursue technologies that benefit citizens but do not meet their requirements, concerns, and preferences. An important question for policymakers and administrators is, thus, how to stimulate private sector innovation to tackle public sector difficulties in ways consistent with the requirements and preferences of technology users. Scholars must investigate how to appropriately represent the effects of public and private sector actions in studies of technological transitions in robust and reliable ways.(Siddiki, 2023, p. 220)

According to William N. Dunn, policy analysis encompasses more than just the analysis of data and information; it covers all facets associated with the policy-making process. This includes problem analysis, information gathering, analysis, identification of policy alternatives, and communication of these alternatives to decision-makers. The policy alternatives that emerge from the policy analysis do not possess the inherent ability

to transform into policies on their own or in a direct manner. If this policy formulation process receives endorsement from an authorised entity, the proposed policy option will transition into an official policy. Procedures capable of generating alternative policies can be regarded as rational processes. Meanwhile, it is noteworthy that the policy in question is inherently a manifestation of the political domain. Dunn posits that policy problems possess several significant characteristics, including 1) the presence of interconnection among policy problems, 2) the subjective nature of policy issues, 3) the artificial construct of the problem, and 4) the dynamic nature of policy problems (Dunn, 2004, pp. 214–216).

Every policy must demonstrate its impact, as policy results assess policies' influence in real-world circumstances (Agustino, 2016, p. 191). Policy evaluation is an area of research that focuses on the estimation, assessment, and evaluation of the implementation process and the resulting impact of policies. Policy evaluation is conducted throughout all policy process stages rather than alone at the end. Moreover, it is imperative to consider multiple dimensions of a policy's impact while evaluating it. These dimensions encompass 1) the influence on the targeted public issue and the individuals involved; 2) the potential effects of the policy on other situations or groups beyond its intended scope; 3) the long-term consequences of the policy on both present and future conditions; 4) the direct costs associated with implementing the policy; 5) the potential indirect costs or effects experienced by society or specific segments of the population; and 6) the challenges in quantifying the indirect societal benefits resulting from public policy (Anderson, 1984, p. 136).

Research Methods

The current study employs a literature review as part of its research design. Library research, also known as a literature review, examines and critically evaluates knowledge, ideas, or conclusions from academic literature. Additionally, it entails the development of theoretical and methodological contributions to a particular subject matter (Cooper, 2016). A comprehensive literature evaluation enables the systematic organisation of existing research findings, establishing a solid groundwork for current research endeavours (Stockemer, 2019, p. 20)

Results and Discussions

The Indonesian government has expressed concern over the challenges posed by climate change. These challenges have been identified and addressed in the 2020-2024 National Medium-Term Development Plan by implementing three priority programs. These programs include improving environmental quality, increasing resilience to natural disasters and climate change impacts, and promoting low-carbon development policies. Subsequently, the government issued several additional regulations in response, namely Minister of Transportation Regulation Number 15 of 2022, Minister of Industry Regulation Number 07 of 2022, Minister of Energy and Mineral Resources Regulation Number 23 of 2023, Minister of Finance Regulation Number 38 of 2023, and Governor of DKI Jakarta Regulation Number 3 of 2020 concerning Tax Incentives for the Transfer of Battery Electric Vehicles for Road Transportation. All ministries and institutions have collaborated closely to implement the directives of the President as outlined in Presidential Regulation Number 55 of 2019. The main variables influencing the choice to adopt an electric vehicle are the cost, governmental incentives, and the convenience associated with charging infrastructure. The subsidies implemented in Indonesia consist

of annual purchase tax relief, tax relief, and exemptions from the odd-even rule on highways (Simbolon et al., 2022, p. 89). The Indonesian government has implemented relief measures to facilitate the transition from conventional fossil fuel-powered automobiles to electric vehicles. Furthermore, renewable energy sources have been identified as a potentially optimal approach to transportation with zero emissions (Albrechtowicz, 2023, p. 3820). This strategy encompasses reducing average emissions by substituting fossil fuel sources, encompassing local and systemic dimensions. The substitution of fossil fuel vehicles with electric fuel vehicles presents a potential solution for mitigating pollution and addressing climate change concerns at national and global levels, given the observed association between this transition and reducing carbon emissions. The discussion above highlights the advantageous aspects associated with the utilisation of electric vehicles.

Nevertheless, the government must consider the issue of policy emergence, as highlighted by Dunn (2004, pp. 214–216), who identifies the subsequent attributes: 1) The interconnectedness of policy problems; 2) The subjective character of policy issues; 3) The contrived nature of the problem; and 4) The dynamics inherent in policy challenges. Reflecting on California, it becomes evident that four key aspects serve as catalysts for developing environmentally friendly car technology. These factors include 1) the implementation of California's zero-emission vehicles mandate, 2) the pressing matter of energy security, 3) the presence of industry competitiveness, and 4) the growing concern about climate change. In 1990, California implemented a Zero Emission Carbon program, which garnered significant attention from countries such as Japan, China, and Europe, inspiring their transition towards electric vehicles. The policy implemented by California catalysed this development. The focal point of their invention lies in the advancement of technology associated with emission reduction, serving as a pivotal factor in the development of electric vehicles. During that period, California lacked sufficient technological infrastructure to develop electric vehicles. However, the California government maintained the belief that their regulatory measures would establish a framework wherein electric vehicle manufacturers would undertake their development efforts after implementing electric vehicle-related rules. The California government has shown a specific interest in energy challenges, drawing lessons from Japan following World War II. In response to an oil constraint and the need for national reconstruction, Japan directed its attention towards enhancing the fuel efficiency of motorised vehicles, leading to the development of advanced mass transportation systems. Then, in 1975, the United States implemented the Energy Conservation Law by establishing the Corporate Average Fuel Efficiency (CAFE). This regulatory framework aims to govern fuel efficiency and promote the development of electric vehicles. By offering incentives for electric vehicle development and ensuring the appropriateness of the established criteria, CAFE catalyses the growth of the electric vehicle industry. In addition, the industrial competition within electric vehicle development has evolved into a competition among nations. China offers comprehensive education on political science and researches the historical evolution of government policies about electric vehicle development. This includes disseminating data concerning electric vehicle production and sales in China to pertinent parties. About climate change, it is the responsibility of the Environment Protection Agency (EPA) to undertake studies about greenhouse gas emissions inside the United States.

The level of decrease attained by an electric vehicle is contingent upon the method of electricity generation (Xu et al., 2020, p. 3). In the context of West Virginia, a state

heavily reliant on coal for over 90% of its energy generation, the observed decrease in greenhouse gas emissions amounts to approximately 20%. It is worth noting that even in a hypothetical scenario where all fossil fuel vehicles were substituted with electric vehicles, the resultant reduction in greenhouse gas emissions would only account for approximately 12% of the total emissions in the United States of America. Another factor to be considered is the presence of self-interest in the United States, which seeks to establish dominance in the worldwide market for electric vehicle sales. This pursuit of dominance is rooted in the historical context of the 2008-2009 crisis, during which the United States implemented an emergency economic stabilisation law. As part of this law, taxes on electric cars were increased to salvage the economy. It can be inferred that four driving factors influence the creation of environmentally friendly vehicles. Firstly, a government mandate plays a crucial role in this regard. Secondly, energy security concerns may prompt the government to transition from fossil fuels to electric fuel. Thirdly, the government's preference for independent development or collaboration with the private sector to foster industrial competition is a significant consideration. Lastly, the production of batteries and their impact on carbon gas emissions is deemed more important than solely replacing fossil fuel vehicles with electric ones. Additionally, the economic benefits associated with the development of electric vehicles outweigh the focus on addressing climate change.

As part of the ICARUS project, more sensitivity analysis will be done on investments in battery technology, and biofuel cost modelling will be improved with the help of expert elicitation studies (Bosetti et al., 2012). The primary objective of the ICARUS (Innovation for Climate Change Mitigation: A Study of Energy R&D, Its Uncertain Effectiveness and Spillovers) project was to conduct an in-depth examination of innovation within the energy sector. A triangular methodology encompassed econometric research, computer modelling, and expert elicitation (Baker et al., 2015, p. 230).

The issue of decarbonising the entire transport sector will also be an essential avenue for future research. A review of modal shifts, mobility demands in passenger transport, and the decarbonisation of freight transport are key priorities. In a Reuters report, the GREET method is used to analyse the carbon footprint of EVs with fossil fuel vehicles. The break-even point is used as a comparison, where BEP depends on the type of energy source used to create EV components such as batteries. Reuters took a sample of a car with a Tesla Model 3 lithium-ion battery and a Toyota Corolla fossil fuel car, with a simulation using three energy source scenarios, namely: 1) 100% hydroelectric; 2) mixed energy of 23% coal-fired, plus other fossil fuels and renewables; and 3) 100% coal-fired. The simulation creates break-even points of 8,400 miles, 13,500 miles, and 78,700 miles, respectively. Thus, using 100% pure energy from hydroelectric, electric vehicles will be superior after a distance of 13,500 miles (equivalent to 21,725 km) compared to fossil fuel vehicles in terms of emitting carbon gas and clean air (Reuters, 2021).

As previously mentioned, the impact of policy, according to Anderson, can be seen from six dimensions: 1) the influence on the targeted public issue and the individuals involved; 2) the potential effects of the policy on other situations or groups beyond its intended scope; 3) the long-term consequences of the policy on both present and future conditions; 4) the explicit costs associated with implementing the policy; 5) the potential indirect costs or effects experienced by society or specific segments of the population; and 6) the challenges in quantifying the indirect societal benefits resulting from public policy (Anderson, 1984, p. 136).

The influence on the targeted public issue and the individuals involved

The EV acceleration program in Indonesia aims to provide a clean, cost-effective energy alternative and to realise domestic energy security and independence. To realise this goal, the Indonesian Government, through the Ministry of Energy and Mineral Resources in the Grand National Energy Strategy, targets that by 2030, the number of electric cars will be around 2 million units, electric motorbikes around 13 million units, public electric vehicle charging stations (*Stasiun Pengisian Kendaraan Listrik Umum*; SPKLU) around 30 thousand units, and exchange stations. Electric Vehicle Batteries (*Stasiun Penukaran Baterai Kendaraan Listrik*; SPBKLU): around 67 thousand units (Kementerian Energi dan Sumber Daya Mineral, 2021). The policy needs explicit clarification of the intended beneficiaries of electric vehicle sales and the mechanisms for implementing government subsidies.

In general, the problems faced by California can reflect Indonesia, where the policy regarding electric vehicles will be related to problems in other sectors outside the policy's direction. The connection between policy issues can be seen from research conducted by Best and Nazifi (2023, p. 106), who analysed the relationship between electric vehicle uptake based on actual household distribution in the United States, where the results of this research showed a relatively weak relationship between income and uptake of electric vehicles. In addition, the research found a strong relationship between education level and electric vehicle uptake. Hence, the research recommended increasing and providing support, education, and facilitation for low-income households to increase electric vehicle uptake. The relationship expressed by Rohan requires the government to provide outreach and incentives for weakly educated people to be more concerned about the issue of climate change and, ultimately, to make people aware of reducing carbon emissions. There needs to be a target for the subject of the policy, to whom it is directed, and how the Indonesian government distributes it.

The potential effects of the policy on other situations or groups beyond its intended scope

The Indonesian government has not yet targeted in detail who this electric vehicle policy is aimed at; the Ministry of Energy and Mineral Resources only mentions quantitative figures and the actors involved in it, such as PT Perusahaan Listrik Negara (Persero), other state-owned enterprises that also operate in the energy sector, and other business entities. The Indonesian government has forgotten about involving the public and private sectors in the implementation strategy for this program. Referring to America's experience in implementing the electric vehicle policy, non-governmental organisations are also measuring carbon gas emission levels in America. Manufacturing lithium-ion batteries for electric automobiles also has a greenhouse effect, as does using fossil-fuel vehicles. Then private parties such as Toyota and Honda were urged to develop improvements to challenge giant companies such as Ford, General Motors, AMC, and Chrysler, which were interested in selling the fossil fuel vehicles they produced. The California government did not have enough resources and knowledge to develop electric car technology then. Ultimately, they partnered with a company that was not in demand in America to produce electric automobiles with the support of California government subsidies. The Indonesian government must consider how this condition would influence enterprises manufacturing fossil fuel vehicles, or if it is brighter, how the Indonesian government can employ the resources and technology they have to produce electric cars in Indonesia.

The long-term consequences of the policy on both present and future conditions

The electric vehicle policy aims to save energy and mitigate CO2 emissions. According to projections by the Ministry of Energy and Mineral Resources, a complete transition to electric vehicles would reduce approximately 1.2567 million tonnes of CO2 emissions for petrol cars and 0.8731 million tonnes for diesel cars. These estimates are based on the assumption that the emission factor for the Jamali interconnection system is 0.877 tonnes CO_2/MWh, and the petrol emissions factor is 0.261 tonnes CO_2/MWh. The diesel emissions factor is 0.268 tonnes CO_2/MWh (Direktur Teknik dan Lingkungan Ketenagalistrikan, 2019, p. 6). The anticipated outcome that the Indonesian government aspires to achieve is adopting electric vehicles as an environmentally friendly and economically viable energy alternative, potentially enhancing domestic energy security and independence.

Nevertheless, the Indonesian government must consider the potential impact of the electric vehicle policy on the existing circumstances. The current availability of SPKLU remains constrained, with its deployment limited to Jakarta and Bali as pilot cities. Indonesia possesses the necessary infrastructure to speed up the adoption of electric motorised vehicles. The national electricity system has a total capacity of 45,121 MW, capable of meeting the peak load of 40,187 MW. Additionally, operating reserves of 4,934 MW are available to ensure the reliability and stability of the system (Direktur Teknik dan Lingkungan Ketenagalistrikan, 2019, p. 9). The Ministry of Energy and Mineral Resources, in conjunction with PLN, has developed a collaborative strategy to offer an incentive program to residential customers who utilise electric vehicles. This program entails providing discounts on the standard electricity tariff and implementing policies like free additional power or new connections facilitated by PLN.

Furthermore, the charging of electric vehicles is encouraged to take place during nighttime hours. During periods of low demand, namely between 22:00 and 04:00, the load at home is reduced. The extent to which emissions reductions can be achieved is greatly influenced by the accessibility of home charging, as it affects customers' willingness to purchase and utilise electric vehicles (Wu & Kontou, 2022, p. 18). The collaborative efforts of the Ministry of Energy and Mineral Resources and affiliated institutions in developing infrastructure may only prove helpful if measures are taken to encourage public adoption of electric vehicles. This can be achieved by expanding electricity capacity at various locations and the limited availability of charging stations in the two pilot cities. Furthermore, incentives such as tax reductions on electric vehicle purchases can significantly promote this transition.

The direct costs associated with implementing the policy

The Indonesian government has implemented a prioritised initiative to encourage the growth of an environmentally sustainable ecosystem. This endeavour is facilitated by issuing Presidential Regulation Number 55 of 2019. Additionally, the government is actively supporting infrastructure enhancement, including expanding national generators, substations, and other electricity-related facilities. The Indonesian government intends to implement a program to construct SPKLU facilities at petrol stations in office areas, mall areas, shopping centres, and conveniently accessible parking areas. These locations will be selected based on specific criteria, including the availability of designated parking spaces and adherence to the security, safety, order, and smoothness principles. This task necessitates and encompasses the participation and

collaboration of multiple actors, including the National Standardisation Agency, responsible for formulating and establishing Indonesian national standards regarding electrical power supply installations, flow control systems, voltage and power line communications, and protection and security systems. Business entities with an Electricity Supply Business Licence (*Izin Usaha Penyediaan Tenaga Listrik*; IUPTL) are responsible for establishing SPKLU infrastructure in the energy sector. The first allocation is to PT PLN, which can partner with other SOEs and entities. The present cross-sector collaboration needs to address the necessary partnership between electric vehicle manufacturers and the private sector to advance electric vehicle technology. This is due to the Indonesian government's current emphasis on infrastructure development, with limited involvement in the electric vehicle sector.

The potential indirect costs or effects experienced by society or specific segments of the population

The consequence felt by the Indonesian government, apart from the stated goals, is the expense of changing from fossil fuel vehicles to electric vehicles. The Indonesian government's readiness to allow facilities and infrastructure for recharging electricity also demands consideration of the target market. It is vital to carry out socialisation as carried out by China, where the government performed learning research on the history of world electric automobiles and distributed knowledge to the targeted group. While electric drive vehicles remain more expensive than traditional combustion alternatives, the inclusion of a carbon price results in a situation where low carbon options in the electric sector make the life cycle costs of an electric drive vehicle (EDV) lower than all other vehicle alternatives (Bosetti & Longden, 2013, pp. 210–218). Moreover, policies that foster innovation and adoption of EDV will likely have their financial rationale and, in the long term, will imply extremely significant benefits for climate change regulation. These extra costs come when the government wants to socialise the program to convert to electric vehicles and provide incentives to stimulate the move to electric vehicles. The government must consider how batteries are generated to limit the carbon emissions created. Implementing this new policy is expected to impact political costs regarding long-term income growth for people indirectly.

The challenges in quantifying the indirect societal benefits resulting from public policy

The author argues that implementing this electric vehicle policy can enhance Indonesia's economic growth, as using electric vehicles incurs cheaper expenses than conventional fossil fuel vehicles. Reflecting upon the California case, the California government ultimately reassessed its approach to lithium-ion production due to its extensive procedural requirements. Commencing with the extraction of ores, a practice that has significantly contributed to the amplification of the greenhouse effect, followed by the subsequent creation of batteries, and culminating in the utilisation of electric vehicles, which exhibit optimal environmental benefits solely after covering a distance of 13,000 miles as compared to their fossil fuel competitors. When considering the financial implications, achieving energy independence inside Indonesia entails substantial costs. Nevertheless, the Indonesian government focuses mainly on fuel usage efficiency rather than the network as a whole. Based on data obtained from the Ministry of Energy and Mineral Resources, it can be observed that electric vehicles exhibit much higher efficiency levels compared to their fossil fuel competitors, resulting in potential cost

savings of up to 50%. In a comprehensive analysis, it can be shown that an electric car, when travelling 100 km, necessitates a total energy consumption of 20 kWh. This energy requirement is equivalent to a monetary value of IDR 32,000. In contrast, conventional cars powered by fossil fuels necessitate a consumption of 10 litres, which is equivalent to IDR 85,000 (Direktur Teknik dan Lingkungan Ketenagalistrikan, 2019, p. 6). The lack of clarity in comparing electric vehicle types with fossil vehicle types poses challenges in conducting comprehensive data analysis to assess indirect benefits. Individuals must engage in initial attempts and make personal comparisons to determine the validity of the data. It is recommended that the government reevaluate the subsidy program for electric vehicles. This could involve either reducing the magnitude of the subsidy or imposing limitations on the number of vehicles eligible for subsidies annually (Harvey, 2020, p. 12). Additionally, the mandatory target for electric vehicle sales could be eliminated or diminished. Ultimately, the Indonesian government must carefully assess and evaluate the pros and cons associated with the sale of electric vehicles to determine whether the expenditures incurred are justified and if any additional consequences would be imposed on the government that deviate from its intended aims.

Conclusion

The government of Indonesia has accelerated the implementation of the battery-based electric vehicle program by issuing several policies generated from such programs. The Indonesian government's implementation of various policies and goals gives rise to additional consequences, encompassing public issues that affect the individuals involved. These policies may affect situations or groups beyond their intended targets and influence present and future conditions. Moreover, the policies incur direct and indirect costs, while measuring the indirect benefits of the policies themselves poses a challenge considering the implications caused. This is essential to prevent future complications hindering the objective of expediting Indonesia's battery-powered electric vehicle program.

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