



The Role of Electric Vehicle Innovation in Realizing Green Economy and Sustainable Development in Indonesia

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Abstract. This research aims to determine the development of electric vehicles in Indonesia, the impact of using electric vehicle, and explore how electric vehicle innovation can be a major driver in realizing a green economy and sustainable development in Indonesia. By understanding this role of innovation, it is expected to provide concrete recommendations for the development of effective policies and business strategies, so that Indonesia can move towards a more sustainable future. This research uses a qualitative descriptive method. Data collection techniques by means of literature studies. The result of this research indicate that electric vehicles have an important role in achieving a green economy and sustainable development in Indonesia. With the support from the government as well as the presidential regulation issued in 2019, the development of electric vehicles is getting more attention and has the impact of a significant increase. In terms of usefulness, electric vehicles can be a solution in the creation of environmental sustainability by reducing the level of air pollution caused by vehicle exhaust gases so as to reduce the greenhouse effect.

Keywords: Electric Vehicle, Green Economy, Sustainable Development

1 Introduction

Global warming is one of the most significant environmental issues the world is now experiencing. Which poses a significant obstacle to achieving sustainable development for the global community. This problem is driving many countries that are improving their economies to find ways to use alternative energy that has low carbon emissions. As a country with a large population and rapid economic growth, Indonesia has become one of the countries that face significant challenges in terms of environmental sustainability and carbon emission reduction. Increasingly evident climate change and air pollution that threatens public health is driving the urgent need to switch to more environmentally friendly solutions.

In Indonesia, the high number of motorized vehicles and cars has led to severe road congestion which is very severe. Because of this issue, air pollution is also produced by burning fossil fuels, which include chemicals that are bad for the environment. Moreover, air pollution will rise in tandem with the growing number of fossil fuel-powered automobiles. In the context of Indonesia, the transportation sector accounts for 45% of the overall energy consumption, with motorized vehicle fuels accounting

for 94% of that consumption [1]. Therefore, in order to reduce this percentage, concrete steps can be taken with the aim of reducing carbon emission in the transportation industry so that technological innovation can be carried out by making electric vehicles. With this innovation, it can be an impetus for Indonesia to achieve the growth of a green economy.

The increased in carbon dioxide gas directly contributes to climate change through the greenhouse effect. Based on data from NASA, [2] from 2011-2022 carbon dioxide emission have always increased. Thus, resulting in global climate change because of global warming due tho the greenhouse gas effect.

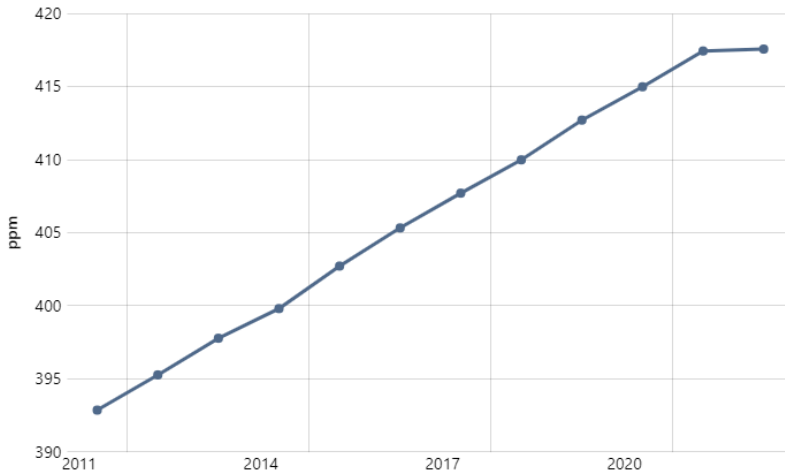


Fig. 1. Carbon Dioxide Value Increase Chart 2011-2022.

The increase in atmospheric CO₂ concentrations, which is largely due to the human activities. Transportation is the largest contributor to carbon emission due to the use of fossil fuels, which has harmful effects on the environment and quality of life as described above [3]. In Indonesia, fossil fueled transportation has relatively increased from year to year. Vehicles that are often used in performing mobility are motor vehicles and cars.

Table 1. Number of motorized vehicles 2020-2022

Number	Vehicle Type	2020	2021	2022
1	Motorcycle	115.023.039	120.042.298	125.267.349
2	Passenger Cars	15.797.746	16.413.348	17.175.632
3	Goods Car	5.083.405	5.299.361	5.528.669
4	Bus	233.261	237.566	241.215
Total		136.137.451	141.992.573	148.212.865

Source: Indonesian National Police (Polri) (2023)

As the number of motorized vehicles in Indonesia increases, the impact on the environment is increasingly being felt. One of the main issues affecting the environment and various aspects of human life is climate change. The impact of climate changes is becoming more apparent and profound in Indonesia, which is a tropical country located between the Indian and Pacific Oceans. As a result, the country has become highly vulnerable to the effect of global warming. Indonesia, with its large population and rapidly growing economy, is experiencing a significant increase in the number of vehicles, especially in urban centers such as Jakarta, Surabaya, and Bandung. The majority of these vehicles run on fossil fuels, resulting in greenhouse gas emissions and harmful air pollutants such as PM_{2.5} and NO_x. Based on the IQAir World Report (2022) shows that Indonesia recorded daily PM_{2.5} concentration of 30.4 µg/m³, placing it 26th in the list of countries with the worst air pollution. Meanwhile, the Energy Institute Data (2022) places Indonesia in the sixth place as contributor to global carbon dioxide (CO₂) emissions from the energy sector, totaling 691.97 tons of CO₂. In Indonesia itself, the transportation industry produces 45% of the total gasoline used by motor vehicles, which makes up 94% of the total. Therefore, it is crucial to put into place specific policies aimed at lowering carbon emissions in the transportation sector [1].

The concept of “green transportation” or environmentally friendly transportation is emerging and has emerged as a crucial component in addressing today’s environmental challenges. This approach aims to minimize the adverse effects of the transportation sector on the ecosystem by implementing technological innovations and regulations that support sustainability, environmental awareness, and energy efficiency. The significance of green transportation lies in its role as a foundation toward a green economy and sustainable development. One of the efforts to realize green transportation is the existence of electric vehicles. As an effort to adapt to climate change, humans are starting to switch to the use of electric vehicles as an alternative solution [4]. The advancement of electric vehicles has led to a rise in environmental consciousness among the people. Hopefully, this can bring balance to the environment and help overcome climate change. Electric vehicles have the potential to reduce dependence on fossil fuels, which have been the main cause of air pollution and carbon emissions. By utilizing renewable energy for charging, electric vehicles can contribute to reducing environmental impact. Additionally, this idea offers a fresh framework for economic growth that is enhanced to a greater degree by the transportation [5]. Therefore, innovations in electric vehicles technology are not only a transportation solution, but also a strategic step to achieve sustainable development goals.

The Indonesian government has started to put policies in place to foster the development of electric vehicles, including rules and tax breaks that entice automakers to make investments in this technology. However, to realize the full potential of electric vehicles, effective management and sustainable business strategies are needed. This includes collaboration between the government, private sector and society to create a supportive ecosystem. Then it is necessary to know that in Indonesia, electric vehicles contribute to the reduction of carbon dioxide emissions. In the context of economy, electric vehicles are emerging as a product that is not only economical but also environmentally friendly [6]. Electric vehicles that are being

developed are part of an innovation in improving the achievement of green economy programs through the transportation sector.

The impact of implementing electric vehicle innovation can be felt in various aspects, ranging from economic, social, to environmental. Economically, the development of electric vehicle industry can create new jobs and increase national competitiveness. On the social side, public awareness about the importance of a clean environment will increase, encouraging more sustainable behavior change. However, challenges remain, such as limited charging infrastructure and high initial costs for consumers. Therefore, in depth analysis of the role of electric vehicle innovation is essential to identify solutions that can overcome these barriers. A comprehensive and strategic approach will help ensure that the transition to electric vehicles can run smoothly and provide maximum benefits to society.

Accordingly, this study attempts to ascertain how electric vehicles have developed in Indonesia, the effects of using them, and investigate how the innovation of electric vehicles can be a major factor in achieving sustainable development and a green economy in Indonesia. By understanding the role of these innovations, it is expected to can provide concrete recommendations for the development of effective policies and business strategies, so that Indonesia can move towards a more sustainable future.

2 Literature Review

2.1 Adoption of Electric Vehicle

A green economy, a program introduced at the 1992 UN Conference in Rio de Janeiro as part of the idea of sustainable development, is positively impacted by the existence of electric vehicles [7]. The adaptation of electric vehicles is one way that people are adjusting to climate changes [4]. Public understanding of the value of environmental protection has increased as a result of the rise of electric vehicles. It is anticipated that this state will stabilize the ecosystem and address the climate issue. Because they produce less pollution than fossil fuel vehicles, electric vehicles have a higher chance of meeting emission-free goals [7].

Currently, Indonesia is in the early stages of developing an electric vehicle ecosystem. In the organization of the 30th IIMS in 2023, the Head of State of Indonesia urged national automotive industry players to pay attention to the advancement of electric vehicles and participate in their development. Jokowi also urged stakeholders to actively encourage the public to switch to electric vehicles. The increasing trend of electric vehicles has the potential to boost state revenue from taxes, royalties, profits, export duties, and non-tax state revenue. With a target of 50% electrification in the near future and Indonesia's ambition to control 60% of the global electric vehicle market, the revenue potential from this sector is very significant. Furthermore, the development of the electric vehicle ecosystem can also help improve government spending efficiency. Technological advancements in the form of electric vehicles, autonomous vehicles, and smart transportation systems have the potential to transform our travel patterns by reducing carbon emissions, optimizing energy use, and improving air quality. The utilization of environmentally friendly transportation

technology is not just an effort to increase efficiency, but also part of the realization of a sustainable green economy concept for a better future for the Earth [1]

2.2 Green Economy and Sustainable Development

A sustainable economic system for both land and marine ecosystems (blue economy) is included in the notion of a "green economy." Renewable energy is given precedence over fossil fuels for industry and transportation in all of its operations, including investments and infrastructure. This idea promotes the growth of circular economies that are friendly to the environment, low-carbon industries, and productivity gains without endangering ecosystems. As a result, there were substantial chances for green economic growth, which improved natural capacities and bolstered social bonds, helping to accomplish the Sustainable Development Goals [8]. To achieve the concept of a green economy, one of the ways is through alternative innovations in green transportation. Green transportation is based on meeting current mobility needs while still considering the interests of future generations. In the field of urban planning, this is realized through the development of facilities for cyclists and pedestrians, communication infrastructure, as well as cost-effective and environmentally friendly mass transportation systems such as the use of electric vehicles, electric trains, and other public transportation, in order to reduce dependence on private vehicles that still use fossil fuels [9].

In keeping with the Sustainable Development Goals (SDGs), Indonesia's development plan places a high priority on environmental issues, including renewable energy and climate change mitigation. By 2030, Indonesia aims to cut CO₂ emissions by 29% to 41%. Since electric automobiles use eco-friendly resources and technology, they are seen as a solution to today's environmental issues. Electric cars can also lessen air pollution and mitigate the effects of the energy crisis. Consequently, electric vehicles emerge as a sustainable substitute in the transportation sector that aids Indonesia's SDGs initiative [10].

3 Research Method

This research uses a qualitative descriptive method. Research that uses qualitative descriptive approach aims to describe an events or symptoms encountered at the research location. This method presents information in a structured and factual according to the facts, accurately reflecting the phenomena in the field [11]. In this study using data collection techniques by means of literature studies. Literature study is data collection by identifying and collecting relevant literature sources, including books, journals, articles, thesis, dissertations, and online sources related to the research theme. Analyzing the quality and relevance of the sources obtained, this includes considering the credibility of the author, the year of the publication, and the methodology used.

The application of qualitative methods in research prioritizes in-depth observation. This method can produce a more comprehensive analysis of phenomenon. The focus of qualitative research on aspects of humanism or human behavior is a response to awareness of the influence of internal individual factors, such as political view,

beliefs, and social background, on the consequences of human actions. That is why, qualitative research requires sufficient understanding of the problem being studied.

4 Result and Discussion

4.1 Electric Vehicle Development in Indonesia

Electric vehicle innovation is instrumental in addressing carbon emission solutions and air pollution levels by being an environmentally friendly means of transportation, low opening and maintenance costs in realizing a green economy in Indonesia. Since the last few years, Indonesia has introduced various policies to support the development of electric vehicle. With Presidential Regulation No. 55/2019, the government set an ambitious target to reach 2.1 million electric vehicles by 2030. Infrastructure support, such as charging stations, is also being built to support EV adoption. The Director General Of Land Transportation said that the Indonesian Government continues to strive for gradual transition of the public to the use of electric vehicles. The latest data from the Indonesian Electric Motorcycle Industry Association (Aismoli) as of January 2024 shows the number of electric motorcycles in the country shows a significant increase, with a surge of 262% by 2023, reaching 62,409 units. This rapid development is evident when compared to 2020, where the number of electric vehicles was only a few hundred units. This drastic increase to 2024 reflects the serious efforts of the government and industry sector in encouraging the adoption of electric vehicles through various incentive and subsidy programs.

Indonesia's 90% road transportation dominance has resulted in high CO² emissions. However, the adoption of electric vehicles and their supporting infrastructure has the potential to reduce the country's carbon emission levels. One of the key infrastructures in the electric vehicle ecosystem is the Public Electric Vehicle Charging Station (SPKLU), which is spread across various locations and accessible to the public [13]. Throughout 2023, PT PLN (Persero) [14] managed to build 54 new SPKLU units, bringing the total to 624 SPKLUs in 411 locations throughout Indonesia, PLN's President Director emphasized the company's commitment to supporting the electric vehicle ecosystem through the provision of widespread SPKLUs. The increase in the number of SPKLUs is expected to increase public confidence in switching to electric vehicles. In 2023, PLN recorded a significant jump in the number of transactions in 2022. Electricity consumption at SPKLU also increased rapidly, reaching 2,464,824 kilowatts (kWh) in 2023, up 564% from 436,656 kWh in 2022. This increase in the number of transactions and electricity consumption at SPKLU is a positive indicator of the growth of electric vehicle adoption in Indonesia.

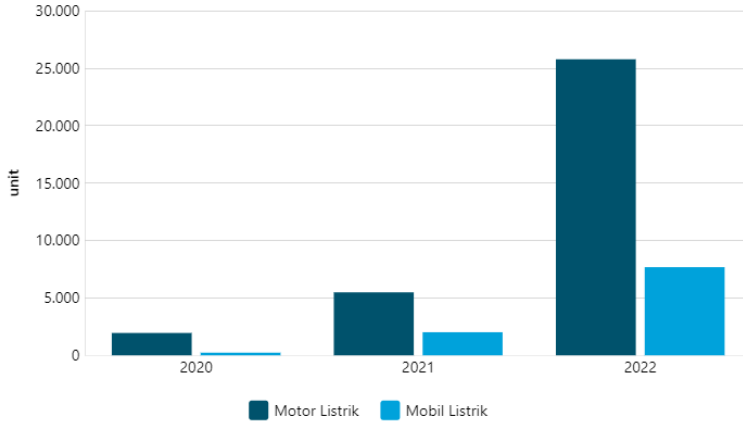


Fig. 2. Increase in the number of electric vehicles in Indonesia

As per data above [15] the number of requests for electric vehicles in Indonesia has always increased every year. Even the number of increases in electric vehicles, especially motorcycles, has increased quite rapidly. Likewise with electric cars, based on information from the Indonesian Automotive Industry Association (Gaikindo), there has been a significant increase in sales of electric cars in Indonesia. Data up to September 2021 shows that sales Battery Electric Vehicle (BEV) type vehicles reached 611 units. Meanwhile, Plug-in Hybrid Electric Vehicle (PHEV) sold 44 units, and Hybrid Electric Vehicle (HEV) managed to record sales of 1,737 units. So, it can be said that the government is really serious in increasing electric vehicles in accordance with the direction of the President of the Republic of Indonesia, so that the number of electric vehicles continues to be increased.

The Indonesian government is persistently striving for innovation in order to hasten the development of the domestic electric vehicle market. This is consistent with global trends that favor the adoption of ecologically friendly and energy efficient automobiles. The Director General of Metal, Machinery, Transportation Equipment and Electronics Industry (ILMATE) said the government has set a goal of producing 400 thousand tho wheeled battery-powered electric motorized vehicles (KBLBB) by 2025. The goal is established to help the government reach its 2030 aim of reducing greenhouse gas (GHG) emissions by 29%. Furthermore, it elevates Indonesia to the forefront of the global automobile industry.

In order to encourage the development of the domestic electric vehicle industry, a ban on nickel ore exports was imposed by the government. To support the reduction of fuel imports, especially gasoline, by 2030, the Ministry of Energy and Mineral Resources also plays a role in the development of the electric vehicle ecosystem in Indonesia. Projection shows that by 2030, the number of electric vehicles operating on the road is expected to reach 2 million units. To support this growth, the government plans to procure 30,000 units of Public Electric Vehicle Charging Station (SPKLU) and 67,000 electric vehicle battery swap station. As an additional incentive, the government also provides tax relief in the form of 0% PPnBM for electric vehicles [16].

4.2 Electric Vehicle for Environmental Sustainability

As the population in Indonesia grows, the need for transportation has also increased significantly over the years. In response to this development, innovations in transportation in Indonesia have given rise to electric vehicles which are seen by the public as a more environmentally friendly alternative. The perception of electric vehicles as an environmentally friendly option is based on the use of batteries as their main power source, replacing conventional fossil fuels. In addition, electric vehicles are also considered to have high technological intelligence. This is because the advanced system embedded in them allow vehicles to detect and respond to various objects and traffic conditions adaptively, improving driving safety and efficiency in various situations. Permen of ESDM Number 13 of 2020, which addresses the provision of energy charging infrastructure for battery-based electric vehicles, was released by the Ministry of Energy and Mineral Resources [17]. Electric vehicles also offer a number of advantages that appeal to users. One excellent feature is the ability to charge quickly through fast charging technology, allowing users to recharge the battery in a relatively short time.

Electric vehicles offer a range of significant benefits to the environment and society. Key benefits include reduced air pollution, reduced carbon emission, more affordable operating costs, and conservation of natural resources. The aspects is strengthen the reputation of electric vehicles as an environmentally friendly transportation solution. Contributing to addressing the increasingly pressing ecological crisis and offering zero-pollution mobility. The positive impact of electric vehicles on air quality is significant, especially in urbanized and densely populated areas. With reduce exhaust emissions, the air becomes cleaner and healthier. In addition, the use of batteries as the primary energy source reduces the carbon footprint substantially, driving the transition towards more sustainable renewable energy sources. In terms of efficiency, electric vehicles are more efficient than those with traditional internal combustion engines. Furthermore, the adoption of electric vehicles has the potential to spur the development of smart and green infrastructure in Indonesia. Innovation in electric vehicle technology and their energy system can catalyze the development of more sustainable infrastructure across the country. Additional benefits of electric vehicles include reduced greenhouse gas emission, which contribute to climate change mitigation efforts. Better air quality as a result of using electric vehicles is also a draw for consumers, driving wider demand and adoption of this green transportation technology.

4.3 Electric Vehicle in Achieving Green Economy and Sustainable Development

Electric vehicle plays an integral role in the transition to a green economy. According to an International Energy Agency (IEA) study, electric vehicles can reduce CO₂ emissions by 50% compared to fossil fuels vehicles, even when accounting for emission from electricity production. Electric vehicle produces significantly lower emission than conventional vehicles. The adoption of electric vehicle creates demand for charging infrastructure, which can be integrated renewable energy sources such as

solar and wind power. This drives investment and innovation in the clean energy sector, a key component of the green economy. Electric vehicles help reduce dependence on oil imports, improving national energy security. This is in line with the green economy principle of reducing dependence on non-renewable resources. The use of electric vehicles can also reduce emission of particulates and other pollutants, especially in urban areas. This improvement in air quality reduces public health costs, in line with the green economy's goal of improving well-being.

The preservation of economic ecosystem has the potential to ensure the welfare of future generations through production methods that do not overexploit natural resources. In its implementation, the establishment of a green economy requires the consistent application of five fundamental principles: creating equitable prosperity across all levels of society, realizing intergenerational justice, maintaining, restoring, and investing in natural capital, optimizing consumption patterns for the sustainability of future generations, building an integrated and resilient system [18]. Essentially, creating a green economy requires an active role for the state in directing innovation and investment. We need ambitious and mission-oriented industrial policies to drive the transformation of key sectors such as energy, transportation, and manufacturing towards more sustainable practice.

Developing nations are actively pushing the idea of a "green economy," hoping to create an economic structure that not only puts environmental sustainability first but also benefits society as a whole. In this context, the industrial sector plays a vital role as the main driver in realizing the vision of a green economy. In Indonesia, the increasing trend in the use of motorized vehicles, both two- and four-wheelers, continues to show significant growth. Responding to this dynamic, the government is now directing its focus on the development of electric vehicles. This initiative is seen as a strategic step to strengthen energy security in the transportation sector, while offering solutions that produce clean and environmentally sound energy. This approach confirms that the green economy concept not only focuses on meeting the needs of society, but also places consideration of environmental impacts as an integral aspect in every policy and development [19]. Thus, the green economy offers a holistic development paradigm, balancing economic progress, social welfare and environmental preservation. All of this requires a robust integrated system.

Electric vehicles offer a potential solution to reduce air pollution in urban areas. Innovations in the form of electric cars and bicycles have great potential to substantially reduce emission of various pollutants such as CO, NO_x, PM, HC, and SO₂. In the context of overall CO₂ emissions, the three main contributors are the power sector (42%), transportation (23%), and housing (6%). The Indonesian government is currently actively encouraging the development of electric vehicles and their charging infrastructure. This is made possible by Presidential Regulation No. 55/2019, which established guidelines for the Road Transport Battery Electric Vehicle (BEV) Acceleration Program. Additionally, Minister of Industry Regulation Number 27 of 2020, which includes technical specifications, an EV roadmap, and a calculation of the Domestic Component level (TKDN) for electric vehicles, has established a roadmap for the development of the Battery-Based Electric Motor Vehicle (KBLBB) industry. Compared to Internal Combustion Engine (ICE)-based vehicles, battery electric vehicles have a number of significant advantages. They are capable drastically reducing air pollution levels and greenhouse gas emissions, even to near

zero. Other advantages include high efficiency, little influence on the environmental, minimal noise disturbance, flexibility of energy sources, ease of maintenance, reliance on renewable energy sources. These characteristics make electric vehicles a promising alternative for more sustainable transportation future [10].

The Indonesian government gives full support to initiatives stemming from collaboration between South Korea and Indonesia in investing in the development of electric vehicles to create an environmentally friendly economy. This investment can open up opportunities to establish electric vehicle companies, which will also create jobs for community [20].

Electric vehicle innovations make a significant contribution to sustainable development efforts. By reducing reliance on fossil fuels and minimizing greenhouse gas emissions, electric vehicles offer a more environmentally friendly transportation solution. However, to maximize their positive impact, a holistic approach is needed that involves developing charging infrastructure, improving battery efficiency, and adopting renewable energy sources for electricity production. Collaboration between governments, the automotive industry, and the research community is essential to drive further innovation and address a challenge. With shared commitment and supportive policies, electric vehicles can be a major catalyst in transforming the transportation sector towards a more sustainable future, supporting not only environmental goals but also economic growth and social well-being.

5 Conclusion

The results of this study show that electric vehicles have an important role in achieving a green economy and sustainable development in Indonesia. With the support of the government and the presidential regulation issued in 2019, the development on electric vehicles is getting more attention and has a significant increase in impact. With this innovation, many companies began to emerge to work together in encouraging economic growth in the automotive sector. So that it can open up jobs an investment. In terms of usefulness, electric vehicles can be a solution in creating environmental sustainability by reducing level of air pollution caused by vehicle exhaust gases so as to reduce the greenhouse effect. As technology advances and public awareness increases, the role of electric vehicles in sustainable development is expected to become even more significant, paving the way for a cleaner, more efficient, and more sustainable mobility system for future generation.

References

1. R. D. Saniyyah, "Peran Inovasi Teknologi dalam Green Transportasi : Mewujudkan Green Economy dan Pembangunan Berkelanjutan," 2024, Accessed: Oct. 02, 2024. [Online]. Available: <https://ejurnal.esaunggul.ac.id/index.php/Eko/article/view/7632>
2. Databoks, "Konsentrasi CO2 di Atmosfer Terus Naik, Ini Rinciannya Tingkat Konsentrasi CO2 di Atmosfer (2011-2022*)," 2022. Accessed: Oct. 02, 2024. [Online]. Available: <https://databoks.katadata.co.id/demografi/statistik/9232a4932fdbb34/konsentrasi-co2-di-atmosfer-terus-naik-ini-rinciannya>

3. G. Zola, S. D. Nugraheni, A. A. Rosiana, D. A. Pambudy, and N. Agustanta, "Inovasi kendaraan listrik sebagai upaya meningkatkan kelestarian lingkungan dan mendorong pertumbuhan ekonomi hijau di Indonesia," Yogyakarta, Dec. 2023. Accessed: Oct. 02, 2024. [Online]. Available: file:///C:/Users/Lenovo/Downloads/30229-Article%20Text-93198-1-10-20240207.pdf
4. R. Subekti, "Urgensi Regulasi Kendaraan Listrik Untuk Pengendalian Iklim dan Penggunaan Energi Terbarukan (Analisis Komparatif Antara Indonesia, China, dan Amerika Serikat)," *Rechts Vinding*, vol. 150, Dec. 2022, doi: 10.1016/j.techfore.2019.119770.
5. Y. Mao and X. Li, "A Review of Research on the Impact Mechanisms of Green Development in the Transportation Industry," Dec. 01, 2023, *Multidisciplinary Digital Publishing Institute (MDPI)*. doi: 10.3390/su152316531.
6. A. N. Kemenangan, "Mimpi Mobil Listrik Nasional dan Dukungan Terhadap Ekonomi Hijau," 2022. Accessed: Oct. 02, 2024. [Online]. Available: <https://klc2.kemenkeu.go.id/kms/knowledge/mimpi-mobil-listrik-nasional-dan-dukungan-terhadap-ekonomi-hijau-76953cfc/detail/>
7. S. I. Ehrenberger, J. B. Dunn, G. Jungmeier, and H. Wong, "An international dialogue about electric vehicle deployment to bring energy and greenhouse gas benefits through 2030 on a well-to-wheels basis," *Transportation Research Part D: Transport and Environment*, vol. 74, pp. 245–254, 2019.
8. A. Putri Lestari *et al.*, "GREEN ECONOMY INDEX: A STEP FORWARD TO MEASURE THE PROGRESS OF LOW CARBON & GREEN ECONOMY IN INDONESIA," 2022. Accessed: Oct. 23, 2024. [Online]. Available: <https://www.unpage.org/static/a911305ae19443ddf4a76c7794ac6b5a/green-economy-index-a-step-forward-to-measure-the-progress-of-low-carbon-and-green-economy-in-indonesia.pdf>
9. I. M. T. H. Mulyani and B. P. R. Gandhi, "Peranan Green Transportation Untuk Mewujudkan Green Urban Area Pada Kawasan Pusat Kota Simpanglima Semarang," *Jurnal Lingkungan Binaan Indonesia*, vol. 5, no. 4, pp. 204–209, 2016.
10. C. Sudjoko, "Strategi Pemanfaatan Kendaraan Listrik Berkelanjutan Sebagai Solusi Untuk Mengurangi Emisi Karbon," p. 2, 2021, Accessed: Oct. 02, 2024. [Online]. Available: <https://journal.ugm.ac.id/paradigma/article/view/70354/pdf>
11. H. I. Pujiastuti, "Analisis Tentang Kualitas Pelayanan Publik di Lingkungan Kantor Kecamatan Samarinda Ilir Kota Samarinda," *Jurnal Administrasi Publik*, vol. 3, pp. 529–540, 2019.
12. CNN Indonesia, "Populasi Motor Listrik di Indonesia Nyaris 75 Ribu Unit," <https://www.cnnindonesia.com/otomotif/20240126131720-603-1054724/populasi-motor-listrik-di-indonesia-nyaris-75-ribu-unit>.
13. M. F. N. Maghfiroh, A. H. Pandyaswargo, and H. Onoda, "Current readiness status of electric vehicles in indonesia: Multistakeholder perceptions," Dec. 01, 2021, *MDPI*. doi: 10.3390/su132313177.
14. PT PLN (Persero), "Kaleidoskop 2023 Dorong Pertumbuhan EV di Tanah Air, PLN Bangun Lebih Dari 624 SPKLU Hingga Tahun 2023." Accessed: Oct. 04, 2024. [Online]. Available: <https://web.pln.co.id/cms/media/siaran-pers/2024/01/kaleidoskop-2023-dorong-pertumbuhan-ev-di-tanah-air-pln-bangun-lebih-dari-624-spklu-hingga-tahun-2023/>
15. Databoks, "Riset Deloitte dan Foundry: Penggunaan Motor Listrik di Indonesia Naik 13 Kali Lipat dalam Dua Tahun," 2023. Accessed: Oct. 02, 2024. [Online]. Available: <https://databoks.katadata.co.id/transportasi-logistik/statistik/cd3975440c6d764/riset-deloitte-dan-foundry-penggunaan-motor-listrik-di-indonesia-naik-13-kali-lipat-dalam-dua-tahun>
16. S. Istiqomah, W. Sutopo, M. Hisjam, and H. Wicaksono, "Optimizing Electric Motorcycle-Charging Station Locations for Easy Accessibility and Public Benefit: A Case

- Study in Surakarta,” *World Electric Vehicle Journal*, vol. 13, no. 12, Dec. 2022, doi: 10.3390/wevj13120232.
17. L. C. Nisa and A. Susanti, “Strategi Penerapan Mobil Listrik di Surabaya Sebagai Smart Mobility I N F O A R T I K E L ABSTRAK,” Surabaya, Aug. 2023.
 18. M. R. Mahaputra and F. Saputra, “Determination of Public Purchasing Power and Brand Image of Cooking Oil Scarcity and Price Increases of Essential Commodities,” 2022, doi: 10.38035/ijam.v1i1.
 19. A. Priantoko *et al.*, “TINJAUAN PENERAPAN EKONOMI HIJAU DALAM PARIWISATA DI PROVINSI BALI REVIEW OF THE APPLICATION OF GREEN ECONOMY IN TOURISM IN BALI PROVINCE,” vol. 2, no. 1, 2021.
 20. H. Ali, F. Saputra, and M. R. Mahaputra, “Pariwisata dan Batu Bara (Studi Literature),” vol. 1, no. 1, 2023, doi: 10.38035/jhesm.v1i1.

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