Electric Vehicle for Solution to Reduce Pollution

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ABSTRACT

Electric vehicles have become a trending topic of research since world campaigns related to the use of clean and renewable energy to overcome environmental pollution. In addition, the support for the G20 event campaign which was carried out in Indonesia became a role model in the use of electric vehicles as a modern mode of transportation. This research is a literature review using a bibliometric approach to compile a science mapping of literature on electric vehicles for solutions to reduce pollution. Bibliometric analysis was performed on literature collected via PoP on the Google Scholar database. Electric vehicle research is currently more focused on hybrid electric vehicles, vehicle energy, technology, development, smart grid, system, cost, station and energy transfer. So that future topics related to electric vehicles such as the impact of electric vehicle policies, electric vehicle regulations, electric vehicle subsidies, air pollution, supporting infrastructure and the sustainability of electric vehicles need to be carried out to support the effectiveness and sustainability of electric vehicles in supporting renewable energy in the future.

Keywords: *electric vehicle, solution, development, bibliometric, sustainable*

INTRODUCTION

Advances in adaptation of technology, information and communication demands the whole world to be able to innovative with the values of creativity in supporting world progress that leads to savings and skills in resource management. In realizing equitable and just development, creativity and innovation are needed in all sectors to be a solution in overcoming community problems (Henriyani, 2019). According to Rogers (1983) in Nursetiawan (2018), states that the importance of implementing an innovation is to change a situation based on people's thoughts so that several aspects can be realized, namely relative advantage namely an innovation can be adopted and implemented if it has a good impact on humans, compatibility, innovations made do not conflict with social norms or values adopted by society. Complexity meaning that these innovations are complex in nature capable of being a solution to the needs of society, and trial ability, meaning that these innovations can be easily tested and accessed by the public.

Based on Malthus' theory which revealed that population growth is like a geometric progression while means of satisfying needs is like an arithmetic progression, so that in this theory it provides a realistic implementation that the more developed an area is accompanied by an increase in population, but not supported by the availability of qualified natural resources (Todaro & Smith , 2006). Environmental damage due to the use of natural resources overcapacity, and exploitation with the aim of accumulating capital which has a significant contribution to environmental damage that occurs in a relatively short time. As a result of environmental damage that often occurs, such as air, soil, and water pollution, because of the capital accumulation activities of industrial, plantation and mining companies. Not infrequently people who are in a position powerless also suffer, even expelled from their own place of residence (Anggreta, 2015).

So that in this case it convinces us to be able to manage and utilize it natural potential or existing natural resources as well as possible while maintaining their sustainability.

The sustainability of an area can be classified into three basic elements, namely ecological, social, and economic sustainability for the benefit of present and future generations (Chang, 2015: 5). From the ecological dimension, residents as subjects and objects in regional development must be able to manage nature as well as possible while maintaining its balance without degrading the environment in an overcapacity manner. Likewise, the social sphere of the population always maintains peace between people by keeping the local wisdom of the region and practicing the principles of social life in society. From the economic aspect, the activities carried out must be able to contribute and multiplier effect for regional economic growth and development.

The more developed economic activity in a region or country the potential for environmental pollution will be higher, especially in producing air pollution. Busy activities, especially in the industrial sector and support for high mobility activities tend to have a negative impact on the environment related to the spread of air pollution. High population mobility tends to exist in urban areas, so negative impacts related to air pollution tend to be experienced by dense agglomeration areas due to the large number of industries/factories, motorized vehicle activities, and other activities that trigger pollution and result in clean air pollution. which is limited to be inhaled by residents. The threat of limited availability of fossil energy and the impact of utilization on the environment requires innovation in energy utilization to ensure access to affordable, reliable, sustainable, and modern energy (Wohon et al., 2021).

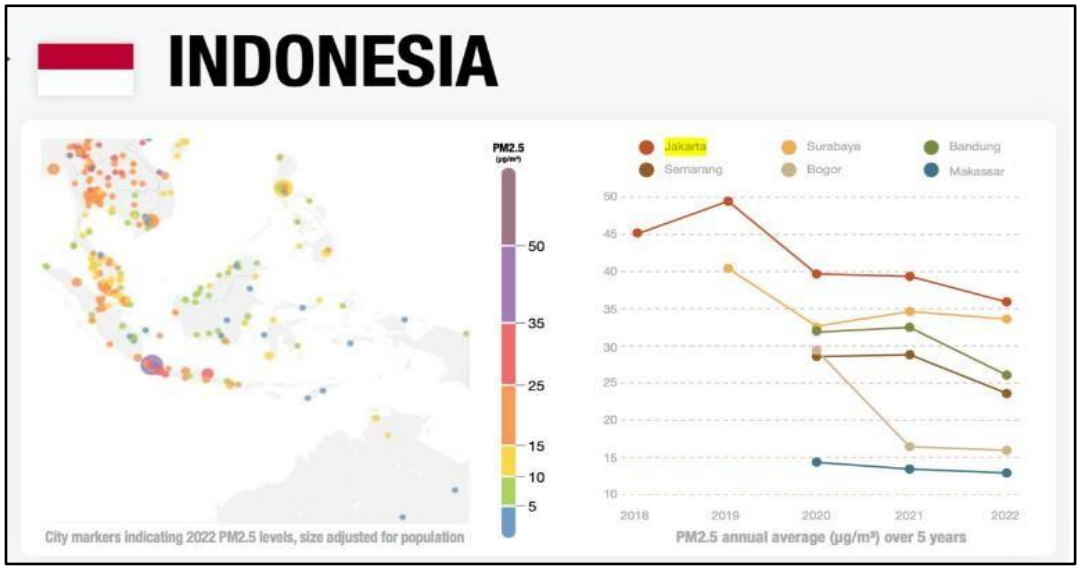


Figure 1. Pollution Levels in Indonesia, 2018-2022
Source: IQAir, 2023

According to IQAir data, it is known that besides Jakarta, big cities with high pollution levels in Indonesia are Surabaya (34.4 µgram/m3), Bandung (26.1 µgram/m3), and Semarang (24.3 µgram/m3). Referring to the same report, poor air quality contributes to more than six million deaths per year worldwide. The total economic loss reached 8 trillion US dollars, exceeding 6.1 percent of global GDP.

Clean air quality will affect the health of the population in the future, especially in Indonesia air pollution brings challenges, especially in big cities that are dense with industrial agglomerations, one of which is DKI Jakarta. According to research (Greenstone & Fan, 2019) which states that the average Indonesian can lose 1.2 years of life expectancy due to high levels of pollution because air quality fails to meet the World Health Organization (WHO) guidelines. This is a form of pollution conditions that must be properly addressed with various alternative solutions for the sustainability of air quality in the future.

Sustainable Development Goals (SDGs) programs on goals 7th which emphasizes aspects affordable and clean energy is a form of state development program that uses cheap and clean energy that is oriented towards a development pattern that seeks to achieve national energy security to avoid an energy crisis and to provide energy justice for all people (Winarsih et al., 2022). The urgency in developing clean and affordable energy that is oriented towards sustainable development becomes a logical consequence when faced with the reality that not all regions are included in the national energy development plan. Therefore, the use of new and renewable energy as a framework for utilizing clean and affordable energy can be the right step to achieve an independent region in terms of meeting energy needs in the region (Shafwan and Theresia, 2021). Renewable energy that can be used to encourage village self-sufficiency can come from hydropower, solar, biomass, and utilize gasification technology (Shafwan et al., 2017).

In response to this, the entire current era stakeholders existing companies can make optimal efforts in realizing renewable innovations through the provision of electric vehicles that save on the use of resources and as a solution in reducing air pollution due to vehicle pollution. In its implementation, this innovation must involve stakeholders who are able to ensure the smooth running of the program, the role of government and community participation is very important in realizing independence in a region (Muna et al, 2022). Environmentally friendly transportation policies are a must in the development of modern modes of transportation technology and sustainable development today. One of the technologies that has been developed in the field of environmentally friendly transportation is the electric vehicle (Simbolon et al., 2022).

Electric vehicles in Indonesia it is targeted to experience growth of up to 2.1 million units in 2025 with various policies issued by the government. According to research by Della Utami et al., (2020) which states that the sustainability of electric vehicles in the future will continue to increase along with the ability of technological innovation to provide transportation solutions that are environmentally friendly, energy efficient, and lower operational and maintenance costs. Several countries in the world such as Australia, Germany, Britain, France, Japan, Taiwan, South Korea and China have used electric vehicles as a substitute product for fossil fuel (Cattenaci et al., 2015). The following presents data on the development of electric vehicles in the world.

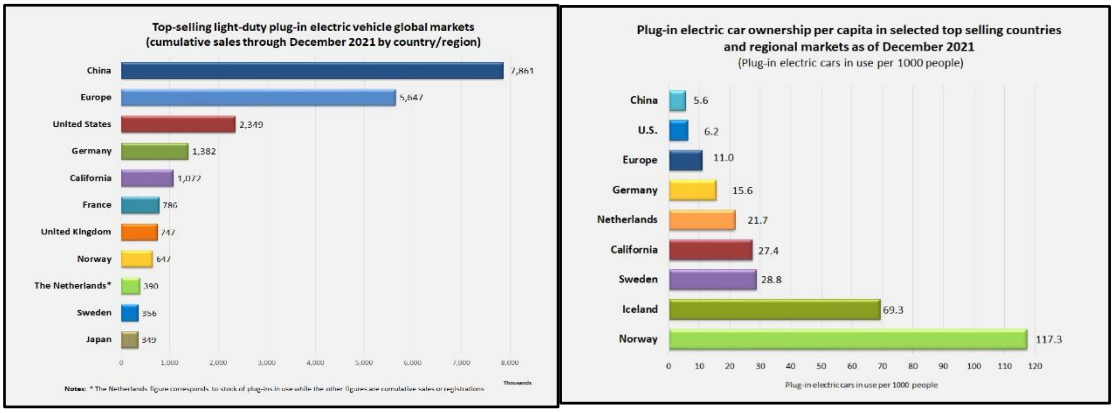


Figure 2 Best Selling Data by Global Market and Comparison Electric Vehicle Ownership Year 2021
Source: Wikipedia.org, 2023

Based on the data sales of electric vehicles between countries very depending on the ability to adopt electric vehicles which are dominantly influenced by consumer demand, market prices, availability of charging infrastructure, and government policies, such as purchase incentives and long-term regulations. Electric vehicle plug-ins (PEVs) are generally divided into electric or battery electric vehicles (BEVs), which run solely on batteries, and plug-in hybrid (PHEVs), which combine battery power with an internal combustion engine. The popularity of electric vehicles has grown rapidly due to government subsidies, increased range and lower battery costs, and environmental sensitivity. However, stock electric cars plug-ins representing only 1 per cent of all passenger vehicles on world roads by the end of 2020, of which two-thirds are pure electric (IEA, 2021 in Wikipedia, 2023). It is known that the biggest sales of electric vehicles in the world are occupied by China, Europe and America with an average of over 1 million vehicles in 2021. Meanwhile, when compared to the total usage/ownership/sales market share of electric vehicles, they are occupied by Norway, Iceland and Sweden with an average of qualified electric vehicle infrastructure support in these countries.

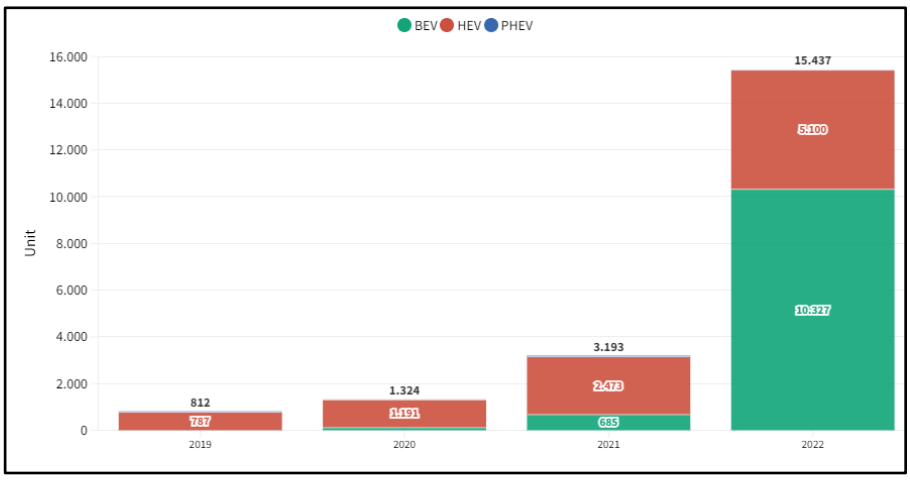


Figure 3 Electric Car Sales in Indonesia, 2019-2022
Source: Gakindo dataindonesia.id, 2023

Based on the data, sales of electric cars in Indonesia totaled 15,437 units throughout 2022. The number shot up by 383.46 percent compared to the previous year which amounted to 3,193 units. In detail, the number of battery-based electric cars (BEV) sold domestically was 10,327 units in 2022. That number skyrocketed 1,407.59 percent compared to the previous year which was only 685 units. Then as many as 5,100 units of electric cars were sold hybrid (HEVs). The number also increased by 106.23 percent compared to 2021 of 2,473 units. Then, only 10 electric- based cars hybrid plug-ins (PHEV) that were sold over the past year. The number decreased by 71.43 percent compared to 2021 of 35 units.

Based on the data, sales of electric motorbikes in Indonesia in 2022 amounted to 31,827 units, with the realization of special conversion subsidies given in 2023 of 50,000 units of vehicles and special subsidies for new electric motorbike users of 200,000 units of vehicles. The government continues to intensify the sale of electric motorbikes considering that the government is currently intensifying the use of electric vehicles as an effort to support energy saving that is environmentally friendly, besides that support is also given to Indonesian electric vehicle manufacturers to be able to produce electric motorbikes that are of interest to the public as an effort to support the growth of local businesses.

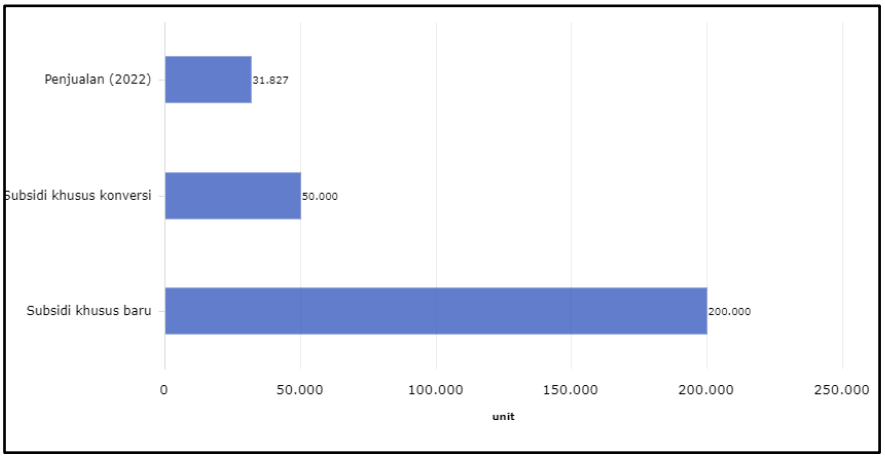


Figure 4. Total Sales of Electric Motorbikes in Indonesia and Subsidy Targets Government (2022-2023)
Source: Katadata.com, 2023

Various forms and steps have been taken by the government in addressing this, namely: firstly, by supporting both two-wheeled and four wheeled vehicle manufacturers in creating electric vehicle products that are liked by the public, secondly efforts to create pilot areas for electric vehicles to run effectively and become role models uniformity for other regions, the three governments began to intensively build electric vehicle support facilities to make it easier to charge batteries and maintenance electric vehicles, and the four governments are starting to provide subsidies for the purchase of electric vehicles as well as tax-saving support for electric vehicles to support an increasing number of people in using these electric vehicles, as well as support environmental sustainability.

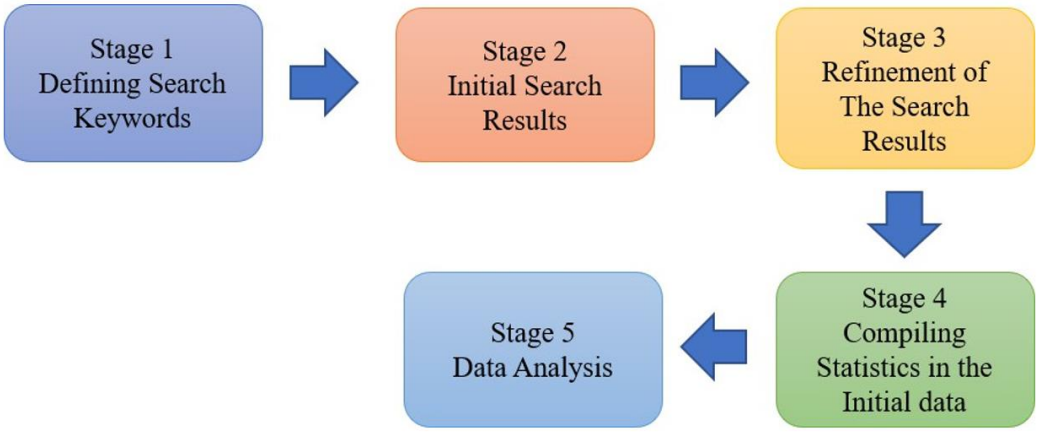
The electric vehicle campaign has been intensified since the declaration of the G20 event in Indonesia which massively brought change for society to be able to start

using electric vehicles to support their daily activities. This step change in the use of electric vehicles is a world effort in preserving the environment by reducing environmental pollution due to pollution and supporting the use of renewable energy. According to several studies stating the role of electric vehicles is a very important instrument in terms of decarbonizing transportation, by offering various co-benefits include reduced local pollution, noise emissions, and dependence on fossil fuels (Kester et al., 2018). For this reason, success in implementing electric vehicle policies is influenced by many factors including market stimulation policies and the provision of electric vehicle infrastructure (Simbolon et al., 2022). The purpose of this study is to analyze electric vehicles in reducing air pollution.

MATERIAL AND METHOD

This research is included in the type of literature review or literature reviews, which was carried out with a bibliometric approach. Something literature reviews discuss published information, on various research topics, and certain time periods (Ramdhani et al., 2014). In general, a literature reviews presents a summary of the sources of information that has been collected (Cronin et al., 2008). The time period for information sources also needs to be determined, so that they are in accordance with the expected goals, and can provide information on the topic being discussed up to date (Carnwell and Daly, 2001). In writing the results literature reviews, generally presented in several stages, which include: introduction, main body, and conclusion (Ramdhani et al., 2014).

Bibliometric analyst has two main functions, namely for performance analysis and science mapping (Cobo et al., 2011), where the intended performance analysis aims to view and evaluate the performance of research and publications of individuals and institutions. Where asscience mapping aims to find out the structure and dynamics of the scientific field so that it can review roadmap certain research. According to (Fahimnia et al., 2015), there are five steps in conducting a bibliometric analysis in this study, as presented in Figure 5.



Source: Fahimnia et al., 2015; Nurfauzan dan Faizatunnisa, 2021

Figure 5 Study Stage bibliometric Electric Vehicle for Solution to Reduce Pollution

Stage 1 – Defining search keywords

This stage is done by browsing through the literature Publish or Perish software

(PoP). The keywords used and entered inquiries PoP is "Electric Vehicles". As for data bases sourced from Google Scholar database with consideration to obtain a high quantity and variety of journal literature. The time for the literature to be traced is from 2010 to 2023, with the consideration that research is generally carried out with large sources so that it can support the accuracy of information from existing publications in addition to the information presented regarding Electric Vehicles will be more up to date and varied. A literature search through PoP was carried out in March 2023, and a total of 998 literatures was obtained from the maximum search limit of 1000 articles in PoP, where this amount is the maximum amount that can be searched on software PoP.

Stage 2 – *Initial search results*

At this stage we have reviewed and presented the top ten literature presented by PoP. Table 1 presents the ten literatures with the highest citation rates based on PoP searches.

Table 1 Articles with Citations Identified by PoP

Authors	Title	Citation	Year	Type
B Dunn, H Kamath, JM Tarascon	Electrical energy storage for the grid: a battery of choices	12414	2011	Article
JB Goodenough, Y Kim	Challenges for rechargeable Li batteries	9941	2010	Article
PG Bruce, SA Freunberger, LJ Hardwick…	Li–O2 and Li–S batteries with high energy storage	8962	2012	Article
S Chu, A Majumdar	Opportunities and challenges for a sustainable energy future	8101	2012	Article
JB Goodenough, KS Park	The Li-ion rechargeable battery: a perspective	7734	2013	Article
V Etacheri, R Marom, R Elazari, G Salitra…	Challenges in the development of advanced Li- ion batteries: a review	6221	2011	Article
JY Wong	Theory of ground vehicles	6096	2022	Book
MH Rashid	Power electronics handbook	6058	2017	Book
D Larcher, JM Tarascon	Towards greener and more sustainable batteries for electrical energy storage	5647	2015	Article
B Scrosati, J Garche	Lithium batteries: Status, prospects and future	5574	2010	Article

Source: Data processed from PoP results (2023)

Stage 3 - *Refinement of the search result*

Given that coverage Electric Vehicles quite holistic, the researcher does not remove or limit interfused. Besides that, literature is it limited to just one type literature. Articles and books were included in this analysis. Table 2 shows the metric data from search results on PoP.

Table 2 Search Matrix

Keywords	***Electric Vehicle***
Source	Google Scholar
Year	2010 – 2022
Article	998
Citation	788990
Cites/year	60691.54
Cites/paper	790.57
Authors/paper	3.69
h-index	532
g-index	882

Source: Data processed from PoP, (2023)

Stage 4 - *Compiling statistics in the initial data*

The screened literature is then stored in RIS format for bibliometric analysis using the VOS viewer application. As previously explained that literature reviews this through the method science mapping, where the VOS Viewer application can visualize the bibliometric web. The VOS viewer can work with both large and small data, and provides mapping methods based on scientific principles to create useful maps, networks, and data (van Eck and Waltman, 2013; Kahfi et al., 2022).

Stage 5 - *Data analysis*

The data analysis phase using the VOS viewer is carried out by importing previously saved reference data files from trace results via PoP. As for threshold term appears specified is as many as 10, and from 4704 terms there are 100 terms that meet threshold. Next from 100termsof these, there are 60 terms which is included in the 60% most relevant terms. As the final stage, screening is carried out, by issue in terms which is not significant, so that the result is 52 terms with 65 clusters.

RESULTS AND DISCUSSION

The VOS viewer application can visualize bibliometric maps in three forms, network visualization, overlay visualization, and density visualization.

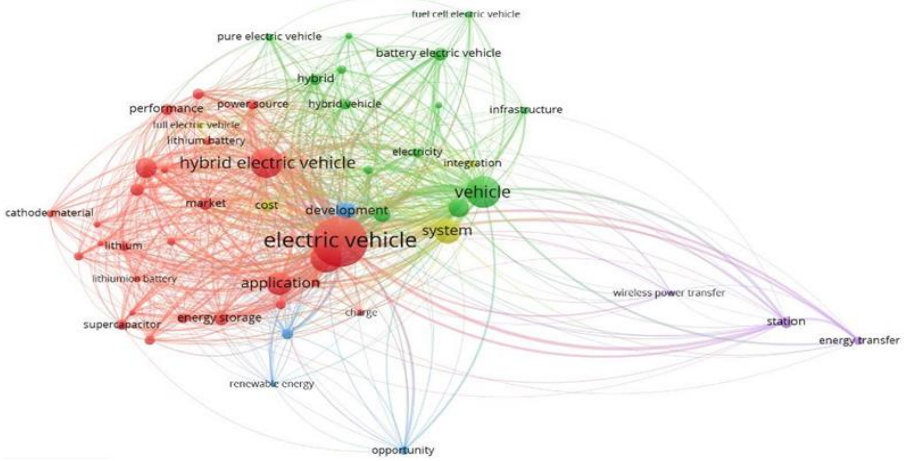


Figure 6 *Network Visualization Electric Vehicle,* Source : VOS Viewer Analysis Data, (2023)

Figure 6 presents network visualization, which is based on the figure the term "electric vehicles" as the dominant main term associated with other terms such as hybrid electric vehicle, vehicle, technology, development, smart grid, system, cost, station and energy transfer. In general, previous studies have examined more about the technology/components of electric vehicles.

The color combinations in Figure 5 show the terms cluster, where the VOS iewer maps all terms into 5 clusters as detailed in Table 3.

Table 3. Claster Terms

Claster No.	Number of Items	Items
1	27 (Red color)	Application, battery, cathode material, charge, electric vehicle, electric vehicle application, electronic device, energy density, energy storage, energy storage system, high energy, high energy density, hybrid electric vehicle, large scale application, li ion battery, lithium, lithium battery, lithium ion, lithium ion battery, lithiumion battery, market, performance, portable electronic, portable electronic device, power source, rechargeable battery, supercapacitor.
2	14 (Green color)	Battery electric vehicle, electric motor, electricity, energy, fuel cell electric vehicle, future, hybrid, hybrid vehicle, infrastructure, internal combustion energy, pure electric vehicle, strategy, technology, vehicle.
3	4 (Blue color)	Development, opportunity, renewable energy, smart grid.
4	4 (Yellow color)	Cost, full electric vehicle, integration, system.
5	3 (Violet color)	Energy transfer, station, wireless power transfer.

Source: Data analyzed on VOS Viewer, (2023)

As a depiction literature river in this research, several supporting journals are presented to strength then the results of this research which originate from several related countries that have carried out research one electric vehicles in Table 4.

Table 4 Literature Review Related Research

No	Authors	Year	Title	Result's
1	Viktor Pirmana, Armida Salsiah Alisjahbana, Arief Anshory Yusuf, Rutger Hoekst, Arnold Tukker	2023	Economic and environment al impact of electric vehicles production in Indonesia	Based on these findings, it is concluded that electric vehicle production increases productivity, gross value-added, and job creation with a relatively small impact on the environment. A limitation of this study is that we assumed EVs were produced for export only, and we did not assume a reduction in economic activities in the supply chain of conventional vehicles.

2	Reed T. Doucette, Malcolm D. McCulloch	2011	Modeling the prospects of plug-in hybrid electric vehicles to reduce CO2 emissions	Amongst the results it was shown that with a highly CO2 intensive power generation mix, such as in China, PHEVs had the potential to be responsible for fewer tank to wheel CO2 emissions over their entire range than both a similar electric and conventional vehicle. The results also showed that unless highly CO2 intensive countries pursue a major decarbonization of their power generation, they will not be able to fully take advantage of the ability of EVs and PHEVs to reduce the CO2 emissions from automotive transport.
3	Valerie J. Karplus, Sergey Paltsev, and John M. Reilly	2009	Prospects for Plug-in Hybrid Electric Vehicles in the United States and Japan: A General Equilibrium Analysis	If a low cost vehicle is available we find that the PHEV has the potential to reduce CO2 emissions, refined oil demand, and under a carbon policy the required CO2 price in both the United States and Japan. The emissions reduction potential of PHEV adoption depends on the carbon intensity of electric power generation and the size of the vehicle fleet. Thus, the technology is much more effective in reducing CO2 emissions if adoption occurs under an economy-wide cap and trade system that also encourages low-carbon electricity generation.
4	Xinying Liu, Diane, Hildebrandt, David Glasser	2012	Environmental impacts of electric vehicles in South Africa	In this study, the environmental impacts of electric vehicles in South Africa were investigated. We found that, as the bulk of South Africa's electricity is generated from relatively low-quality coal and the advanced exhaust clean up technologies are not implemented in the current coal-fired power plants, the use of electric vehicles in South Africa would not help to cut greenhouse gas emissions now (2010) or in the future (in 2030 using the IRP 2010 Revision 2, policy-adjusted IRP scenario), and actually would lead to higher Sox and NOx emissions.

5	Ana Filipa De Castro, Martins Oliveira Ribeiro	2020	Electric Cars Impact in the Economic Growth and the CO2: Case of European Union	The findings in this study suggest that investing in electric vehicles, in the long run, is beneficial to the European Union, economically and environmentally. Increasing the fleet of EVs, improves the quality of air, and increases the GDP.
6	Apurba Sakti, Jeremy J. Michalek, Erica R.H. Fuchs, Jay F. Whitacre	2015	A techno- economic analysis and optimization of Li-ion batteries for light-duty passenger vehicle electrification	The find that economies of scale in battery manufacturing are reached quickly at a production volume of 200-300 MWh annually. Increased volume does little to reduce unit costs, except potentially indirectly through factors such as experience, learning, and innovation. We also find that vehicle applications with larger energy requirements are able to utilize cheaper cells due in part to the use of thicker electrodes. The effect on cost can be substantial.
7	Javier Sanfélix., Cristina de la Rúa., Jannick Hoejrup Schmidt., Maarten Messagie., and Joeri Van Mierlo.	2016	Environmental and Economic Performance of an Li-Ion Battery Pack: A Multiregional Input-Output Approach	The results of the MRIO analysis show the stimulation that the life cycle of the EES has in the economy, in terms of production of goods and services. The manufacturing is the life cycle stage with the highest environmental load for all the impact categories assessed. The geographical resolution of the results show the relevance that some countries may have in the environmental performance of the assessed product even if they are not directly involved in any of the stages of the life cycle, proving the significance of the indirect effects.
8	Ya Wu., and Li Zhang	2017	Can the development of electric vehicles reduce the emission of air pollutants and greenhouse gases in developing countries?	The results show that compared to gasoline ICEVs, EVs have a significant effect on CO2 emission reduction. However, the corresponding air pollution due to SO2, PM10, NOx, etc. for a given EV varies substantially in different countries because of the influence of several factors (electrical power structure, line loss rate, and so on). As developing countries use larger proportions of thermal power

				present high line loss rates, pollutant emission produced by a certain EV is much higher than that in developed countries.
9	Hawkins, Troy R., Bhawna Singh., Guillaume Majeau-Bettez., and Anders Hammer Strømman	2012	Comparative Environmental Life Cycle Assessment of Conventional and Electric Vehicles	Results are sensitive to assumptions regarding electricity source, use phase energy consumption, vehicle lifetime, and battery replacement schedules. Because production impacts are more significant for EVs than conventional vehicles, assuming a vehicle lifetime of 200,000 km exaggerates the GWP benefits of EVs to 27% to 29% relative to gasoline vehicles or 17% to 20% relative to diesel. An assumption of 100,000 km decreases the benefit of EVs to 9% to 14% with respect to gasoline vehicles and results in impacts indistinguishable from those of a diesel vehicle. Improving the environmental profile of EVs requires engagement around reducing vehicle production supply chain impacts and promoting clean electricity sources in decision making regarding electricity infrastructure.
10	Hienuki, Shunichi	2017	Environmental and Socio- Economic Analysis of Naphtha Reforming Hydrogen Energy Using Input-Output Tables: A Case Study from Japan	During the continuous operation and maintenance stages, these values were found to be 69%, 56%, and 91%, respectively. The effect of naphtha reforming was dominant in GHG emissions and the effect of electrical power input on the entire system was significant. Production and employment had notable effects in both the direct and indirect sectors, including manufacturing (pumps, compressors, and chemical machinery) and services (equipment maintenance and trade). This study used data to introduce a life cycle perspective to environmental and socio- economic analysis of hydrogen energy systems and the results will contribute to their comprehensive risk assessment in the future.

Sumber : Diolah dari berbagai sumber jurnal, 2023

Next Figure 7 presents overlay visualization, where the color combinations indicate trends over the period of the literature. There are several terms in the literature that have recently been written related to terms such as electric vehicle, hybrid electric vehicle, vehicle, technology, development, smart grid, system, cost, station, and energy transfer. The figure also shows that research on electric vehicles dominated from 2013 to 2015, while for the following year until 2023 research related to this topic has begun to be reduced or published in google scholar sourced from PoP applications but the results of research related to usage electric vehicles has been widely applied in several electric vehicle producing countries such as China and Japan.

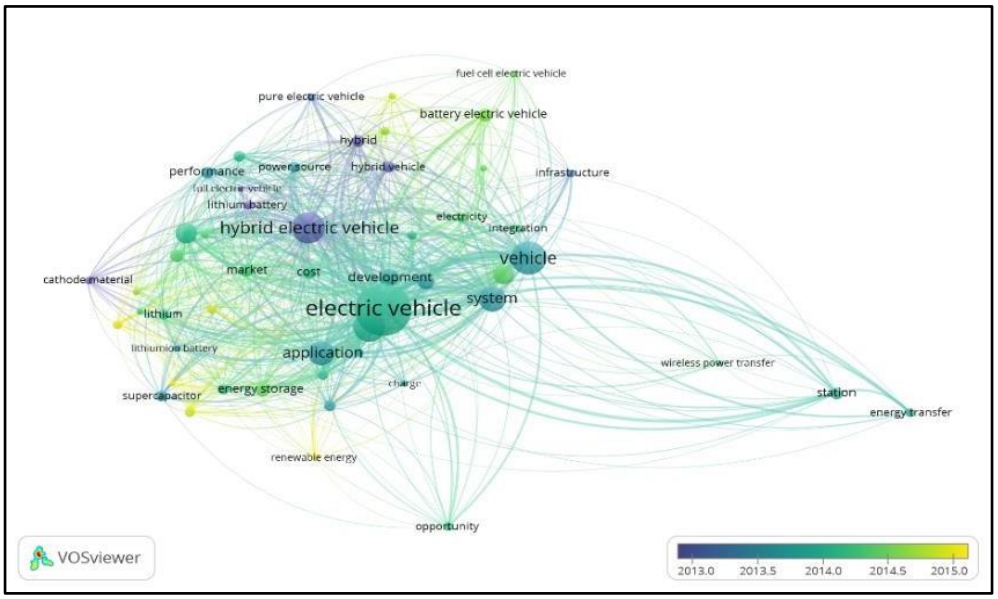


Figure 7. *Overlay Visualization Electric Vehicle*
Source: VOS Viewer Analysis Data, (2023)

While Figure 8 presents density visualization where is the distribution of density/density/emphasis on the other terms group Electric Vehicles tends to be evenly distributed, but some terms tend to be dense, such as Electrical vehicles, Hybrid electric vehicles, Vehicles, Systems, and Applications.

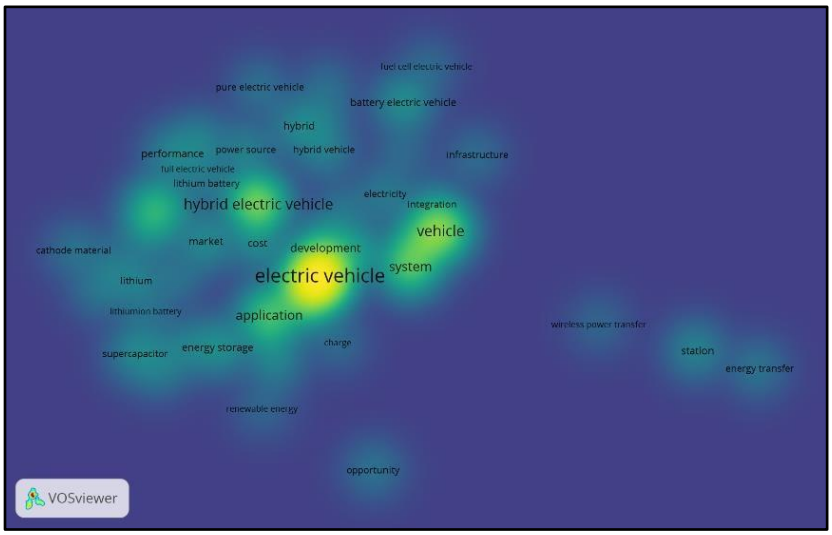


Figure 8. *Density Visualization Electric Vehicle*
Source: VOS Viewer Analysis Data, (2023)

So, from the dimensions Electric Vehicles, there are still more important and related relationships to be studied in the future. As with the use of clean energy (renewable energy), policy impact electric vehicle, rule electric vehicle, subsidy electric vehicle, air pollution, renewable energy, hybrid vehicles, continuity electric vehicles, opportunity electric vehicles, wireless power transfers, electric stations, vehicle infrastructure, pure electric vehicles, and renewable energy.

According to research by Pirmana et al (2023), which states that the use of electric vehicles can have two significant impacts on the country, namely economically and environmentally. Economic impact change in output, change in value added, change in employment if an area has the potential for the development of electric vehicles. Then the impact on the environment changes in emissions namely the reduction of air pollution as a result of reducing the use of conventional vehicles that use fossil fuels. This study also recommends that the effectiveness of electric vehicle energy requires research related to the availability of raw material sources and them sustainability with two types of electric battery models that are widely used today vizlithiumion (Li-ion) and nickel metal hydride (NiMH). Li-ion batteries use the metal elements lithium and cobalt as electrodes, while NiMH uses nickel.

Meanwhile, according to research (Hawkins et al., 2012) the use of electric vehicles (EV) coupled with low-carbon sources of electricity offers the potential to reduce greenhouse gas emissions and exposure to exhaust emissions from the use of conventional transportation. The continued use of electric vehicles requires the support of facilities and infrastructure/ infrastructure supporting electric vehicles, so that their long-term effectiveness can be used by the wider community and easy to reach. According to Wu and Li's research (2017) which revealed that the development of the electric vehicle (EV) industry is generally considered an effective way of reducing the imbalance between the supply and demand of oil and other types of conventional fuel, another thing as well as an effort to reduce environmental pollution. Developed countries and most of the developing countries including Brazil.

CONCLUSION

Electric vehicles in overcoming air pollution is a current policy solution that must be developed properly. Regions capable of being role models in development electric vehicles. This really needs support from various elements starting from the government, entrepreneurs, communities, and other related institutions. Use electric vehicles is a future modern mobility solution, especially in the model of replacing conventional fuel with an environmentally friendly model, besides that there are electric vehicles This is a step in saving energy, reducing environmental degradation due to pollution, as well as an effort to protect the family's economy from the cost of transportation modes that are economical and practical. Continuity electric vehicles very important support green energy and low-cost transportation solution in the new modern era for the improvement of the earth in the future is a reflection of the resilience of a healthy generation and full of innovation.

Improvement of supporting facilities and infrastructure electric vehicles this needs to be done starting from energy station, electric vehicle application, infrastructure vehicle and maintenance service for electric vehicles needs to be

developed, so that this program becomes more evenly distributed in all regions in Indonesia. Additionally, evaluation of policy steps related to electric vehicles needs to continue to be done to update/improve in the future so that the program uses electric vehicles can run continuously and sustainably.

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