Green Vehicles For Sustanability In Support For Smart City Development

Bismantara[1*], BedyAndriansyah[2], dan Devira Felisya Purnama[3]

[1] Lecturer, STIE Sutaadmadja Subang, Indonesia.
[2] STIE Sutaadmadja Subang, Indonesia.
[3] STIE Sutaadmadja Subang, Indonesia.
[*]Corresponding Author:
Email: bisma@stiesa.ac.id

Abstract.

Green vehicles are vehicles that produce less harmful impacts to the environment than vehicles that use conventional internal combustion comparable to gasoline or diesel, or that use certain alternative fuels. Green vehicles consist of electric, hydrogen and hybrid. Where this green vehicle will help develop and advance smart cities. This research aims to Support the sustainability of Smart City Development and provide Innovation to research and develop green vehicles that are low emission and Dependent on renewable energy or renewable energy. This research was carried out by qualitative methods. By focusing on the sustainability of green vehicles to support smart cities.

Keywords: *Green vehicles, sustainability, smartcity and development.*

I. INTRODUCTION

Currently, almost 55% of the world's population lives in urban areas, and it is estimated to increase to 66% by 2030 (UN, 2016). Along with urban growth, new issues emerge (such as traffic congestion, waste management, pollution, parking allocation, etc.) and resources become scarcer. Therefore, striving for city adaptation to current (and future) needs is a priority for all of us, including researchers. The urgency to make cities more suitable places for quality living has triggered many initiatives worldwide (European Commission, nd; US Department of Transportation, nd), ranging from city councils and companies to research laboratories. People from various disciplines, cultures, histories, and interests find common ground in making cities smarter (Andres Camero 2019, Enrique Alba 2019).

Here is the data below stating which countries have implemented smart cities:

Table 1.1. Smart Cities (Panagiotis Tsarchopoulos)

City | Index

kota		index
1	Tokyo	100%
2	London	84%
3	New York	81%
4	Zurich	80%
5	Paris	79%
6	Geneva	76%
7	Basel	71%
8	Osaka	69%
9	Seoul	68.3%
10	Oslo	68%

Based on the above data, Tokyo, London, and New York are the "smartest" cities in the world for three consecutive years, according to the IESE Cities in Motion Index (ICIM). From the top 20 cities, 10 are from Europe, 6 from America, 3 from Asia, and 1 from Oceania. Switzerland has the best overall results, with three of its cities in the top 10. The index beside it indicates the percentage of the related countries that have become fully smart cities.Cities are ranked based on several dimensions considered key to determining their efficiency: Governance, Public Management, Urban Planning, Technology, Environment, International Outreach, Mobility and Transportation, Human Resources, and Economy (IESE Cities in Motion Index 2021). Information and communication technology is used in smart cities for various urban services, including hospitals, traffic and transportation, power plants, water supply, waste management, and law

enforcement.Cities also consume a significant amount of energy, demanding over 75% of energy production and producing 80% of greenhouse gas emissions. Currently, large and small districts propose a new city model, called "smart city." Achieving smart city goals can be accomplished through the support of various information and communication technologies. These can be integrated into solutions considering electricity, water, and gas consumption, as well as heating and cooling systems, public safety, waste management, and mobility.

The transportation system poses evolving and significant challenges for sustainability, while current mobility schemes are more focused on private vehicles, conditioning the lifestyles of citizens and cities (Lazaroiu 2012, George Cristian Roscia 2012, Mariacristina 2012). Transportation holds significant weight in sustainable development, given the environmental pressures, social and economic impacts involved, and its interconnection with other sectors. Currently, about 20% of global primary energy use and around 25% of CO2 emissions related to energy are caused by transportation contributions.Moreover, half of the emissions for transportation come from passenger vehicles, mostly based on internal combustion engines (ICE). One of the most promising technologies to address the above issues is represented by green vehicles such as electric vehicles, hybrid vehicles, and hydrogen vehicles (Lucian 2018, Sergio 2018). The development and use of green vehicles, such as electric, hybrid, and hydrogen vehicles, have significant potential to support smart city development. By integrating green vehicles into urban transportation infrastructure, we can achieve sustainability goals and improve the quality of life in increasingly dense cities (Xiongbin 2019, Jiawen 2019).Innovations in green and low-emission vehicles are considered solutions to reduce greenhouse gas emissions and correlate with climate change impact mitigation. Countries in Europe, China, and the United States have heavily adopted electric vehicles (Erika Farkas Csamangó 2020). One implementation of CO2 reduction in the transportation sector is the use of electric, hydrogen, and hybrid vehicles. These vehicles play a crucial role in achieving zero-emission plans (Sanguesa, J.A. 2021, Torres-Sanz, V. 2021, Garrido, P. 2021, Martinez, F.J.; Marquez-Barja, J.M. A 2021).

1. Problem Identification

(a) Why are green vehicles important for smart city sustainability?
(b) What are the benefits of sustainable green vehicles?
(c) How is the implementation of green vehicles in society to support smart city sustainability?

2. Reaserch Objectives

Research in this field is important to address climate change challenges and ensure economic, social, and environmental sustainability in smart cities. With continuous research and proper implementation, green vehicles can become an integral part of smart city sustainability, bringing long-term benefits in reducing emissions, improving air quality, and creating a better environment for city residents.

II. THEORETICAL FRAMEWORK

A. Green Vehicles

Green vehicles are vehicles that have a less harmful impact on the environment compared to vehicles using conventional internal combustion engines fueled by gasoline or diesel, or using specific alternative fuels. To protect the environment, governments introduce various policies and incentives to support green vehicle development. Among them, governments commonly subsidize consumers purchasing green vehicles, such as electric, hybrid, and hydrogen vehicles. One aim is to reduce fossil fuel usage. As time progresses, fossil fuel usage will diminish, but more emphasis will be placed on using and thus transportation will eliminate all dependence on fuel by using modern transportation technologies, such as renewable and efficient electric, hybrid, and hydrogen vehicles (Binod Vaidya 2020, Hussein T. Mouftah 2020). Green vehicles operate quietly and do not produce pollution. This significantly improves air quality.

B. Electric Vehicles

Electric vehicles are vehicles propelled by a DC electric motor, using electric energy stored in batteries or energy storage devices. Electric vehicles avoid air pollution, CO2, and other greenhouse gases. Over the past decade, increasing concerns about the depletion of fossil fuels as a negative impact of climate change have driven the transition to zero-carbon energy systems. Especially in terms of energy transportation

systems, electric vehicles are considered efficient transportation technologies to reduce greenhouse gas emissions (GHGs) and regional emissions in urban areas such as cities (Nanaki 2016, Koroneos 2016). Electric cars are much more environmentally friendly than gasoline cars, with lower maintenance costs, plus advancing battery technology. Electric cars can use electric propulsion or use ICE as additional power.

C. Hybrid Vehicles

Hybrid vehicles are vehicles that use two or more different types of power. Hybrid vehicles combine more than one driving energy source to power a vehicle (Emadi, 2015). Hybrid vehicles combine technology from battery-operated electric vehicles (BEVs) and internal combustion engine vehicles (ICEs) (Erjavec, 2012). HEVs use less fuel when driving in urban conditions than conventional/ICE vehicles. This is because the ICE does not always provide power to the vehicle. The power from the electric vehicle assists or provides additional power at that time. The operation of different hybrid vehicles always focuses on the electric drive needed for vehicle speed, and on the other hand supplies the average energy needed for motion. HEVs can provide unlimited performance with higher efficiency, less noise, less pollution without changing driving style (Dhole et al, 2018).

D. Hydrogen Vehicles

Hydrogen vehicles are vehicles that use hydrogen fuel for propulsion. Power is generated by converting chemical energy of hydrogen into mechanical energy, either by reacting hydrogen with oxygen in fuel to power the electric vehicle or by burning hydrogen in an internal combustion engine. This is the least polluting fuel that can be used in internal combustion engines and potentially available anywhere. These vehicles can use clean water resources (Peter Speers 2018).

E. Smart Cities

Smart cities are cities that aim to make themselves "smarter," more sustainable, efficient, fair, and livable (NRDC, 2012). Smart cities encompass several elements including what makes a city smart, what resources need to be utilized, what characteristics need to be presented, and the goals and scope of smart cities. Smart cities are a concept of cities that use digital, information, and communication technology to support human quality of life in a city. Instead of letting the market determine how a city grows and develops, smart city growth is a movement that implies we can achieve greater efficiency through coordination of leading forces. For laissez-faire growth: conservation transportation, and economic development (Caragliu 2009, Del Bo 2009, Nijkamp 2009). Smart cities are also instruments to enhance competitiveness so that communities and quality of life improve.

III. METHODS

This research method uses Literature Review. A literature review is a scholarly study focusing on a specific topic. A literature review will provide an overview of the development of a specific topic. A literature review will enable a researcher to identify a theory or method, develop a theory or method, identify gaps between a theory and relevance in the field/or a research result. Performing a literature review is similar to performing activities:

1. Collecting data/information
2. Evaluating data, theory, information, or research results,
3. Analyzing publication results such as books, research articles, or others related to the research questions previously prepared (eko 2019, sutomo 2019, haris 2019).

Data collection from this analysis uses secondary data, data obtained by researchers through existing sources. For example, it can be through literature reviews, books, or from previous research.

IV. RESULTS AND DISCUSSION

In this study, 209 scientific research articles were obtained which have undergone the selection process from a total of 1000 journals with the search topic "green vehicles", "sustainability" and "smart city". From the 209 articles, if grouped based on the ranking of the scimagojr site (table 4.1)

Table 4.1. Selected table ranking (Scimagojr)

No	Quartile	Jumlah
1	Q1	10
2	Q2	12
3	Q3	3
4	Q4	5
5	*Not indexed*	156
Total		209

It can be seen in the table above that there are several journal rankings from 209 articles Figure 4.2: journals from publish or perish that have been Researchers selection, including journal publication rankings Q1 with a total of 10 articles, Q2 with a total of 12 articles, Q3 with a total of 3 articles, Q4 with a total of 5 articles, and the last is not ranked but in terms of relevance Researchers consider the article worthy of review, with a total of 156 articles. Based on the relevance and relevance of the articles the author found that in this article the author uses 30 journals ranked above which are continuous with the topic to be included in this article.

V. CONCLUSION AND IMPLICATIONS

Conclusion

From the research results that the researchers obtained regarding "green vehicles for sustainability in support for smart city development", electric, hybrid, and hydrogen vehicles offer many benefits, one of which is increasing national energy security by reducing oil consumption, supporting climate change initiatives by reducing harmful emissions, reducing public health risks due to poor air quality, and helping economic growth through the introduction of new technologies and infrastructure. Environmental solutions are the best solution to address and meet transportation needs for growing urban populations and the transportation of goods faced by large cities. Sustainable transportation can be interpreted as all forms of transportation that consider humanity, offer affordable, safe transportation modes, and various types of transportation. Moreover, this transportation also relies on renewable or renewable energy, not fossil fuels, and has a low impact on the environment.

Achieving sustainable and environmentally friendly transportation is complex and has many objectives. This requires strategic planning framework preparation. Strategic planning requires creating a vision that is more than just the concept of 'predicting and providing'. Effective transportation plans need to identify guidelines that support the vision of the plan (Mona 2020, Nanis 2020).The benefits of green city sustainability can include fewer or no greenhouse gas emissions, saving money because supporting environmentally friendly transportation modes does not require gasoline and does not need to buy gasoline, contributing to building a sustainable economy. This will reduce the use of fossil fuels, which will result in reduced emissions in the economy, better health and better quality of life, reducing traffic congestion and reducing demand for fuel and gasoline (Mona 2020, Nanis 2020).

Implications

With this journal, it is expected to Support Sustainable Smart City Development and provide innovation to research and develop low-emission green vehicles and Relying on renewable energy or renewable energy. It can also Improve the quality of life in densely populated cities to create a healthier and more comfortable environment for city residents.

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