

Utilization of solar thermal energy as a supplier of electric car batteries in indonesia

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Abstract

Utilizing solar thermal energy as an energy source to supply electric car batteries in Indonesia is a big solution for reducing carbon gas emissions and the use of fossil fuels. This research aims to provide an alternative energy source for electric vehicle batteries and apply design concepts to electric vehicles in Indonesia. The method applied is a qualitative approach with literature analysis and literature study. The research results show that in a comparative analysis of the use of solar thermal energy in electric cars with conventional vehicles that use fossil fuels, there is a significant difference in reducing carbon emissions. The results of the analysis also strengthen the argument about the superiority of electric cars in terms of environmental friendliness so that the design concept for implementing solar thermal energy in electric vehicles in Indonesia becomes very effective to implement.



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1. INTRODUCTION

Solar thermal energy, which is used as an alternative energy source to supply electric car batteries in Indonesia, is increasingly receiving attention in line with global efforts to reduce dependence on fossil fuels which are dwindling. Dependence on the continued use of fossil fuels has resulted in increasingly depleted supplies due to the difficulty of obtaining these fuels. Fossil energy sources, which are non-renewable resources and are limited in quantity, have a negative impact on the environment (Iskandar et al., 2024). The negative impact resulting from the use of fossil fuels is increased carbon dioxide (CO₂) emissions. These emissions also cause a greenhouse effect that influences global climate

change. In addition, the use of fossil fuels has a negative impact on air pollution which can affect air quality and human health (Dwisari et al., 2023).

Indonesia is one of the highest CO₂ emitting countries in the world (Iskandar et al., 2020). The transportation sector is the second largest producer of greenhouse gas emissions at 23% with land transportation contributing up to 90% of this sector, so that total energy sector emissions will approach 600 MtCO₂eq in 2021 (Institute for Essential Services Reform, 2023). This increase continues to increase as people's interest in using transportation increases. According to data from the Association of

Vehicle Industries (GAIKINDO), passenger car sales have reached 406,928 units during 2021. This fairly high sales figure is a factor in the increase in carbon emissions produced. The rapid increase in the number of vehicles in Indonesia is a factor in the increase in CO₂ emissions produced, so special attention is needed to deal with it (ITS, 2021).

Several issues related to the increasing number of vehicles, increasing CO₂ emissions and the depletion of fossil resources have become problems due to changes in lifestyle and the ever-increasing needs of modern humans (Worldbank, 2021). Therefore, in various parts of the world, including in Indonesia, many efforts and research have been carried out to find energy alternatives that can deal with these problems. One alternative energy that can be used as a solution to these problems is the use of solar thermal energy sources (Kibtiah et al., 2024).

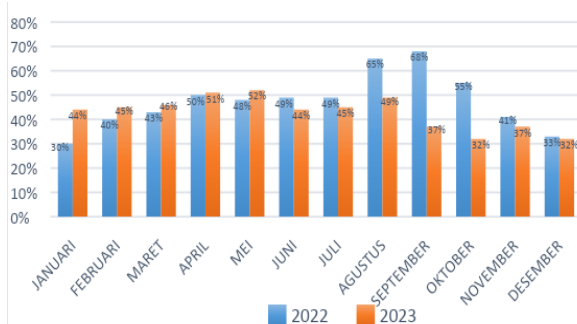


Figure 1. Solar Radiation in Indonesia

Solar heat as a renewable energy source is an alternative energy solution that can be used. Indonesia is a tropical country with high solar heat which is one of the advantages of being able to make maximum use of solar heat into alternative energy. The sun's heat radiation in Indonesia is quite constant so that in the implementation of the use of solar heat energy it can be utilized evenly.

In an effort to make maximum use of solar thermal energy, scientists and researchers continue to develop many advanced methods and technologies. One technology implementation that can be used to maximize the potential of solar thermal energy is the use of electric cars (Luthfiansyah et al., 2023). Utilizing solar thermal energy through solar cells used in

electric cars as a battery supplier can reduce several negative impacts such as reducing gas emissions and overcoming the scarcity of fossil fuels (Reza et al., 2023).

In Indonesia, the use of solar thermal energy in electric cars has not been widely implemented due to the large number of people's dependence on fossil fuels (International Monetary Fund, 2022). So, this article will explain some of the differences between the use of solar thermal energy and fossil energy. Apart from that, the design related to the implementation of solar cells in car vehicles as a battery supplier for electric vehicles is an alternative solution that can be utilized.

2. RESEARCH METHODS

The method used in this research is a qualitative method. Where the qualitative method used was literature review with library analysis using data collection through written works, library sources and documents. The keywords used are solar thermal, energy, electric vehicle, Indonesia in Indonesian and English. Databases for searching secondary data sources, namely Google Scholar. Data was selected based on title screening, abstract screening, no duplicates, full-text documents such as the prism diagram stages (Fuatzin et al., 2025; The University of North Carolina, 2025). Research using literature studies is also included in research and can be said to be written work because data collection is carried out with a strategy in the form of research methodology (Melfianora, 2019).

3. RESULTS AND DISCUSSION

Indonesia is a tropical country with high exposure to sunlight throughout the year. The intensity of sunlight in Indonesia varies depending on geographical location. However, most regions in Indonesia receive quite high exposure to sunlight, such as Java, Bali, Nusa Tenggara, Sulawesi and Kalimantan. Apart from that, variations in Indonesia's topography from lowlands to high mountains also influence the potential for solar energy in various regions. However, solar heat in Indonesia has the

potential to be used as an alternative energy source. Solar energy is categorized as a renewable energy source that will be used as replacement energy in 2025 with a renewable energy target of 23% (Direktorat Jenderal Kekayaan Negara, 2022).

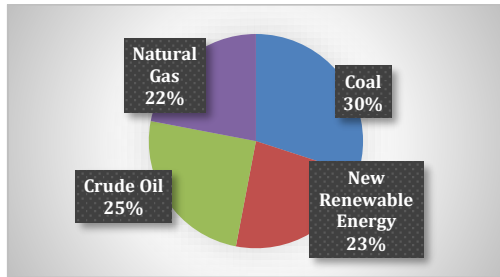


Figure 2. Primary Energy Mix Target 2025

Even though the target for using renewable solar thermal energy in 2025 is only 23% compared to fossil fuel energy which is still used, it is hoped that the use of fossil fuels will periodically decrease significantly and be replaced by renewable energy. Based on this data, it can be seen that the use of solar thermal energy as renewable energy has an important and supportive role in overcoming several existing environmental problems. An environmental problem that is increasingly occurring is increasing CO₂ gas emissions. The use of electric cars can be the right solution to reduce CO₂ emissions in Indonesia. Implementation of the use of solar thermal energy as a battery supplier for electric cars is the right innovation for the problems that occur.

3.1 Implementation of the Use of Electric Cars

Electric cars are environmentally friendly vehicles because they do not produce any residual gas emissions at all. The advantage of using an electric car is that it can be one of the right solutions to overcome the problem of CO₂ gas emissions.

Electric cars use electricity as their main source of fuel, with the source coming from the charging process which is stored in the battery. Throughout the world, especially in Indonesia, they are starting to provide massive subsidies to their citizens to switch from fossil fuel vehicles to electric vehicles. Several automotive industries are starting to compete to produce

vehicles that can get their supply from electrical energy (Nurfitri, 2005).

3.2 Design for Using Solar Panels as a Battery Supplier

Utilization of solar thermal energy to supply car batteries in Indonesia is carried out using the solar panel concept. This application is carried out by designing the installation of solar panels on the car body (Sinuraya et al., 2022). In the design of the electric car which is an example in this research, the car is where in the designs we make there are additions to the exterior and interior designs.

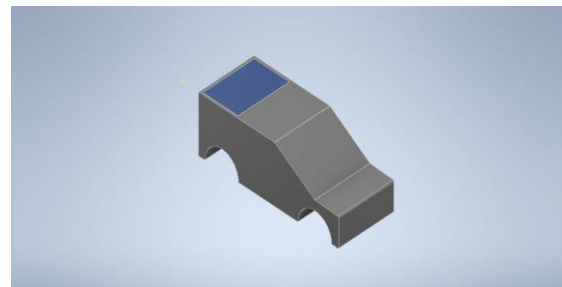


Figure 3. Solar Panel Car Design

The addition of solar panels to an SUV has been modified so as not to affect the vehicle's aerodynamics (He, 2023). The roof of the car is equipped with flexible solar panels or solar glass which is weather resistant and efficient in capturing sunlight. Apart from that, the shape of the SUV has also undergone slight changes to adjust it for optimal energy absorption. Apart from that, the path connecting the solar panels to the battery has also undergone slight changes so as not to add weight to the vehicle.

In the interior, an electronic system is added which supports the management of power distribution from the solar panels to the battery. And drivers can also direct the energy produced from the solar panels directly to the battery or use it for the car's electrical system. Riders can find out the condition or status of the battery.

4. CONCLUSION

Based on the analysis that researchers have carried out, Indonesia has a high potential for solar energy, it is hoped that it can be a

substitute for fossil fuel energy which has long been used and can minimize the pollution it causes. Solar energy can be used to supply electric batteries in cars. This application can be done by installing solar panels on the vehicle body. Installation of solar panels is carried out on the roof of the SUV so that the absorption of solar energy is more efficient and maximum. Apart from that, an electronic system is added that supports the management of power distribution from solar panels to batteries. Researchers realize that there are still many shortcomings in this research. We hope that future research will further examine the efficiency of using solar energy and people's interest in using renewable energy. Society should abandon fossil fuel energy. Utilization of renewable energy needs to be done to reduce existing pollution problems.

5. DECLARATION/STATEMENT

5.1. Acknowledgment

We would like to express our gratitude for the preparation of this article to Mr. Ranu Iskandar, S.Pd., M.Pd. as a teaching lecturer who has facilitated and provided direction in the preparation of this article.

5.2. Author Contributions

The abstract preparation was written by Ainun Nur Rahmah. The introduction was prepared by Fadhil Fayisa Tisara and Ainun Nur Rahmah. Research method prepared by Yahya Chairil Ambia. The discussion and research results were compiled by Arga Farid Ahmadi and Ainun Nur Rahmah. The conclusion was prepared by Aghista Alfian Pradana. Making Figure 1. Solar radiation in Indonesia made by Fadhil Fayisa Tisara. Figure 2. Energy Mix Target in 2025 and Figure 3. Comparison of Vehicle Maintenance made by Arga Farid Ahmadi. The design drawings for implementing the solar cell concept were made by Fadhil Fayisa Tisara. References managed by Ainun Nur Rahmah

5.3. Conflict of Interest

In preparing this article, no conflicts of interest occurred so that the preparation of this article went quite well.

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