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Exploring the Potential of Renewable Energy in Today's Engineering Development

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ABSTRACT
The utilization of renewable energy is becoming increasingly important in today's engineering development to address environmental challenges and energy sustainability. However, the full potential of renewable energy sources has yet to be fully explored. This study aims to explore the potential of renewable energy in the context of contemporary engineering development with a focus on identifying renewable energy sources that can be optimized and integrated in engineering infrastructure. The research methods used include literature survey, data analysis, and modeling to evaluate various renewable energy sources that can be applied in engineering development. An interdisciplinary approach was used to gain a holistic understanding of the potential and limitations of each energy source. The study identified that renewable energy, such as solar, wind, hydro, and biomass, has great potential in providing clean and sustainable energy sources for today's engineering development. In-depth analysis also shows that the integration of renewable energy systems can reduce dependence on fossil fuels and reduce greenhouse gas emissions. By tapping into the potential of renewable energy, today's engineering developments can become more sustainable and environmentally friendly. The integration of renewable energy in engineering infrastructure not only reduces negative environmental impacts but also creates new opportunities for innovation and sustainable economic growth.

Keywords: *Energy, Development, Engineering*

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INTRODUCTION

In an era of awakening awareness of sustainability and the need to reduce carbon footprints (Shen et al., 2019), today's engineering development is faced with a major challenge in ensuring the availability of clean and sustainable energy (Stiker, 2019). Tradisionally, much of the engineering infrastructure relies on fossil fuels (Caselli & Aricò, 2020), which not only causes environmental pollution but also has limitations in non-renewable resources (Farrokhnia et al., 2023). An emerging issue is the need for

energy alternatives that can replace fossil fuels in engineering infrastructure to reduce negative environmental impacts and improve sustainability.

With increasing awareness of the negative environmental impacts of fossil fuel use (Park & Kim, 2022), society and government are increasingly urged to switch to cleaner and more sustainable energy sources.

This research aims to identify and explore the potential of renewable energy sources as a solution to overcome dependence on fossil fuels in today's engineering development (Mancuso et al., 2024). The importance of this issue lies in the urgency of finding sustainable energy solutions to meet the world's energy needs without compromising the environment and the well-being of future generations.

By investing research and resources in exploring the potential of renewable energy (Zhang & Hu, 2023), we can develop technologies and infrastructure that enable the transition to cleaner and more sustainable energy systems in today's engineering development.

This research was conducted in response to the urgent need for clean and sustainable energy sources in today's engineering development. With the increasing awareness of the negative impacts of fossil fuel use (Lipson et al., 2019), Research on the potential of renewable energy is becoming increasingly important to meet the world's energy needs in an environmentally friendly way.

This research will contribute by identifying and exploring the potential of renewable energy sources that can be integrated in modern engineering infrastructure (Kim & Bae, 2023). To address such gaps, an interdisciplinary approach will be used (Ali et al., 2019), involves a literature survey (Mosco, 2023), Data analysis (Ryan & Deci, 2020), and modeling to comprehensively evaluate various renewable energy sources (King et al., 2023). The research will present the state of the art in the utilization of renewable energy in engineering development (Akhter & Sofi, 2022), and proposes innovations in technology and infrastructure development to improve the efficiency and effectiveness of renewable energy use.

The novelty of this article lies in its holistic interdisciplinary approach in exploring the potential of renewable energy (Robinson et al., 2019), as well as on identifying innovative solutions to overcome challenges in the implementation of renewable energy in today's engineering development (Groeninck, 2021). In comparison with previous research (Chung et al., 2021), This article provides a deeper understanding of the potential and benefits of renewable energy in the context of modern engineering development.

Furthermore, this research will implement the proposed solution and conduct further evaluation of the performance of renewable energy in engineering infrastructure. It is hoped that this research will provide valuable guidance for future researchers in developing more advanced strategies and technologies to accelerate the transition towards renewable energy in today's engineering developments.

RESEARCH METHODOLOGY

Research Design

This research uses a quantitative research design, which is inputted into google form as many as 20 questions (D'Ancona et al., 2019). Which includes what influences will be caused when students use technology-enabled language learning (Rosa, 2019). This method is used in order to formulate a new thought that is useful for every level of students (Rahwan et al., 2019). Then developed into a research that can be held accountable for its accuracy (Hao & Ho, 2019), which is tailored to each event experienced by the student (Gupta et al., 2020). This collection method is useful to test the feasibility of language-based learning itself to improve student learning achievement (Njoku et al., 2023). The quantitative method can also be interpreted as a research stage that begins with making a questionnaire containing 20 items (Dwivedi et al., 2023), then every answer given by students is processed using the spss application (Payal et al., 2024). The data obtained can be proven accurate through a google form created by the researcher (Dong & Liu, 2023). And the researcher also inputted the highest gain and also the lowest gain from the questionnaire distributed to each student. Then conclude these statements.

Research Procedure

The steps taken in this study began by asking permission from the campus and working with English teachers (Rospigliosi, 2022). Then every student filled in, from the beginning of the questionnaire made by the researcher until it reached the acquisition of filling which the researcher considered to have fulfilled the expected acquisition by the researcher (Putawa et al., 2023). Then the researcher is also very concerned about ethics in making questionnaires that use good language and are also polite (Bajić et al., 2023). So that students can fill out this questionnaire in a short period of time (Pal & Vanijja, 2020), which makes it easier for researchers to examine various Exploring the Potential of Renewable Energy in Today's Engineering Development

Research Subjects

The subjects of this research are students of UIN Mahmud Yunus Batusangkar, the role of the researcher is to collect every answer given by students (Alkorta et al., 2020). Researchers are also assisted by English lecturers who teach at UIN Mahmud Yunus Batusangkar, especially educators who teach in the field of technology (Qiu et al., 2019). This study is to measure the ability of students using questions in the form of tests and then counted from the highest series of acquisition numbers to the lowest series of numbers (Jia et al., 2020). The researcher then inputted the score obtained through the research subject which became a reference to determine the category of Exploring the Potential of Renewable Energy in Today's Engineering Development (Eckhardt et al., 2019). The type of research conducted is research that strongly considers every answer given by students (Cao et al., 2020), which aims to determine the effect of Exploring the Potential of Renewable Energy in Today's Engineering Development.

Research Ethics

Of the approximately 1000 students enrolled at Mahmud Yunus State Islamic University Batusangkar, only 50 students contributed to this study (Bajić et al., 2023) (Maican & Cocoradă, 2021). Of these. 50 students participated in this study, of which 25 were male and 25 were female with a maximum age of 19 years and 18 years. The data collection participants came from various villages or jorongs that are close to UIN Mahmud Yunus Batusangkar (Ferri et al., 2020). This research has received permission from the lecturer who teaches the language course. This research uses several principles of research ethics. First, there was no coercion in filling out the questionnaire. This research only expects the volunteerism of students and female students who study here. Then every question must be answered completely without leaving any part of the questionnaire. This formular is very supportive and upholds rights and there is no coercion at all. This is done to ensure that the participants understand the essence of this study, out of 50 participants 80% expressed their willingness to fill out this questionnaire.

Data Collection Technique

The technique used by researchers in collecting data is to obtain various information that can be measured (Harris et al., 2020), compared, and carefully calculated (Aydın & Karaarslan, 2022). Through a google form format made by researchers, which was filled in by 50 students of UIN Mahmud Yunus Batusangkar (Rodin & Huda, 2021). Data collection was carried out on first semester students in the 2023/2024 academic year (Sholihah, 2021). After obtaining permission to conduct research from language lecturers, and also IT links, online questionnaires were distributed to students of various majors. The distribution of this questionnaire was carried out on March 1, 2024 to March 30, 2024. The process of processing data that has been collected from respondents in the research field. The questionnaire data was then downloaded into an Excel file and then transferred to SPSS. 20 questions to review, the final score data is recorded in the SPSS application which can be verified. Then recapitulated as interesting as possible so that readers are interested in reading the articles made by researchers.

Data Collection and Analysis

Then the data that has been collected is inputted and processed using the SPSS application. Distributed in the form of tables and also diagrams that can calculate the scores obtained from students. The way the data is analyzed is by comparing each answer given by each student with previous studies. Data is presented in the form of average scores and percentages. Then the data is tested using the oneway anova test. Which compares the acquisition score of each group that fills in each statement related to the questionnaire made by the researcher. Researchers also really take into account the scores obtained by each student who fills out the questionnaire previously made by the researcher. And will never leave the slightest answer given by students from the beginning

of filling out the questionnaire until the last student fills out this questionnaire. Furthermore, researchers will also summarize in an accurate conclusion.

Table 1. 1

Categories of Acquisition of Exploring the Potential of Renewable Energy in Today's Engineering Development

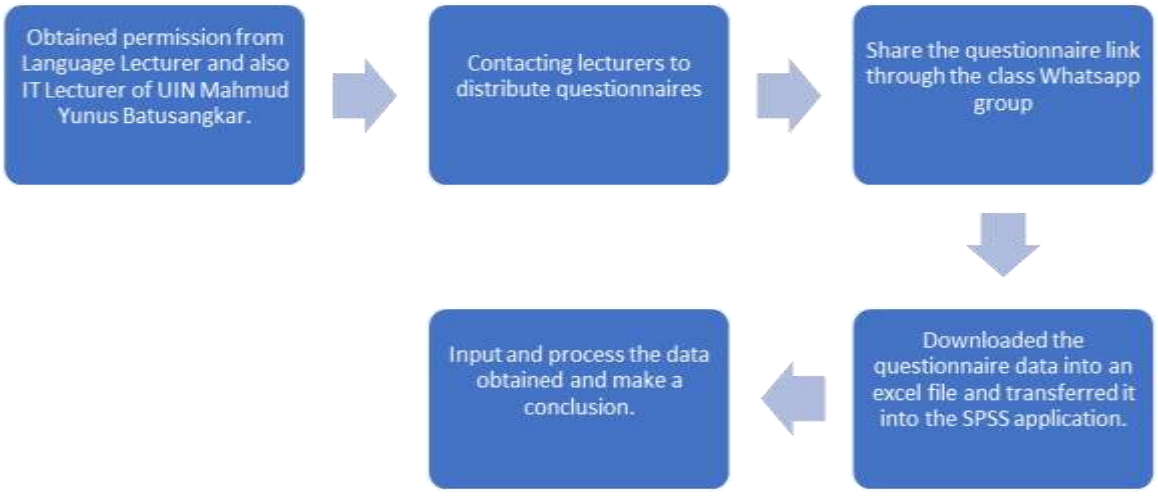
No.	Gain category	**Value interval**
1	Strongly agree	>90%
2	Agree	70-80%
3	Disagree less	50-60%
4	Do not agree at all	0-40%
Total		100%

Table 1. 2

Research Sample Details

No	**Student Batch**	**Gender**		**Total**
		Male	**Female**	
1	T.A 2022	10	10	20
2	T.A 2023	15	15	20
	Total	**25**	**25**	**50**

Flowchart of quantitative research



RESULT AND DISCUSSION

Table 1.3
Acquisition of batch 2022 on Exploring the Potential of Renewable Energy in Today's Engineering Development

No	Statement	SS	S	KS	SKS
1	Today's engineering development has a big challenge in meeting the growing energy demand, while also taking into account the environmental impact.	70%	30%	0%	0%
2	Exploring the potential of renewable energy is key to solving energy problems and reducing the carbon footprint in engineering development.	50%	50%	0%	0%
3	The utilization of renewable energy such as solar, wind, hydro, and biomass is the main focus in finding sustainable energy solutions.	60%	40%	0%	0%
4	The integration of renewable energy in engineering development provides an opportunity to reduce dependence on finite fossil fuels.	65%	30%	5%	0%
5	Innovations in renewable energy technologies enable more efficient and environmentally friendly infrastructure development.	50%	50%	0%	0%
6	The development of renewable energy distribution systems is key to improving energy access in remote and developing areas.	70%	30%	0%	0%
7	Research and development is ongoing to improve the efficiency and reliability of renewable energy in the context of engineering development.	60%	40%	0%	0%
8	Partnerships between the public and private sectors are needed to accelerate the development and implementation of renewable energy technologies.	75%	20%	5%	0%
9	Exploring the potential of renewable energy also involves the optimal utilization of waste and unused natural resources.	65%	30%	5%	0%

10	An integrated renewable energy system can improve infrastructure resilience and sustainability in the face of climate change.	50%	50%	0%	0%

Table 1. 4
Acquisition of the Class of 2022 Regarding Exploring the Potential of Renewable Energy in the Development of Contemporary Engineering Tested for Feasibility by One Way Anova Test

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
X.01	T. A 2022	2,400	4	,600	.	.
	T. A 2022	,000	5	,000		
	Total	2,400	9			
X.02	T. A 2022	1,100	4	,275	2,750	,148
	T. A 2022	,500	5	,100		
	Total	1,600	9			
X.03	T. A 2022	2,100	4	,525	.	.
	T. A 2022	,000	5	,000		
	Total	2,100	9			
X.04	T. A 2022	,900	4	,225	.	.
	T. A 2022	,000	5	,000		
	Total	,900	9			
X.05	T. A 2022	1,600	4	,400	4,000	,080
	T. A 2022	,500	5	,100		
	Total	2,100	9			
X.06	T. A 2022	2,100	4	,525	.	.
	T. A 2022	,000	5	,000		
	Total	2,100	9			
X.07	T. A 2022	1,600	4	,400	4,000	,080
	T. A 2022	,500	5	,100		
	Total	2,100	9			
X.08	T. A 2022	2,100	4	,525	.	.
	T. A 2022	,000	5	,000		
	Total	2,100	9			
X.09	T. A 2022	1,600	4	,400	.	.
	T. A 2022	,000	5	,000		
	Total	1,600	9			
X.10	T. A 2022	1,900	4	,475	4,750	,059

T. A 2022	,500	5	,100		
Total	2,400	9			

Exploring the Potential of Renewable Energy in Today's Engineering Development. This is an interesting and relevant topic in the context of global energy challenges and efforts to reduce environmental impacts. In the current era of engineering development, research and development of renewable energy is becoming increasingly important in finding sustainable solutions to meet the growing energy demand. This article will discuss various aspects related to exploring the potential of renewable energy in today's engineering development, including challenges, benefits, innovations, and implications for society and the environment.

First of all, it is important to understand that today's engineering development is faced with significant challenges related to the growing demand for energy. In recent decades, global energy consumption has seen a rapid increase in line with economic growth, urbanization and technological development. However, the majority of energy used today still comes from fossil fuels, such as coal, oil and natural gas, which have negative environmental impacts, including greenhouse gas emissions and air pollution. Therefore, finding more environmentally-friendly and sustainable alternatives has become an urgent necessity.

In this context, renewable energy is emerging as a promising solution. Renewable energy, also known as clean energy, is energy generated from unlimited natural sources, such as sunlight, wind, water and biomass. One of the main advantages of renewable energy is that its resources are widely available around the world and are naturally renewable. This makes renewable energy an attractive option to reduce dependence on increasingly scarce and expensive fossil fuels.

However, despite the huge potential of renewable energy, there are a number of challenges that need to be overcome in exploring its potential in today's engineering development. One of the main challenges is the technical issues associated with the storage and distribution of renewable energy. For example, energy sources such as solar and wind power are volatile, meaning that their energy production can vary depending on factors such as weather and time of day. Therefore, efficient storage and distribution systems are needed to overcome this uncertainty and ensure a stable and reliable energy supply.

In addition, the economic aspect is also a determining factor in adopting renewable energy in engineering development. Although the production cost of renewable energy has decreased significantly in recent years, there are still challenges in terms of initial investment and high infrastructure costs. This makes many countries and companies reluctant to fully switch to renewable energy without sufficient financial incentives or support policies from the government.

Furthermore, the sustainability aspect is also a concern in the development of renewable energy. Although renewable energy is considered more environmentally friendly compared to fossil fuels, there are still environmental impacts that need to be

taken into account. For example, the construction of solar or wind power plants may affect local ecosystems and wildlife habitats. Therefore, careful planning and mitigation of environmental impacts must be done to ensure that renewable energy development is not detrimental to the environment.

While there are challenges that need to be overcome, renewable energy development also offers a number of significant benefits in today's engineering development. One of the main benefits is that the use of renewable energy can help reduce greenhouse gas emissions and air pollution, which contribute to global climate change and public health issues. By replacing fossil fuels with renewable energy, we can reduce our carbon footprint and improve air quality in urban environments.

In addition, renewable energy can also provide significant economic benefits. Investments in renewable energy infrastructure can create new jobs and boost local economic growth in areas with abundant renewable energy potential. In addition, with renewable energy prices becoming increasingly competitive, the use of renewable energy can also help reduce energy costs in the long run, thereby increasing industrial competitiveness and reducing the financial burden for consumers.

In addition to the economic and environmental benefits, the development of renewable energy also opens up opportunities for technological innovation in engineering development. Research and development is ongoing to improve the efficiency and reliability of renewable energy technologies, as well as develop new solutions to address the associated technical and economic challenges. For example, improvements in energy storage technologies can help address the problem of unpredictable fluctuations in energy supply from renewable sources.

In addition to technological innovation, the development of renewable energy is also driving the creation of new business models in the energy industry. For example, the concept of microgrids and distributed energy systems allows people to be producers and consumers of energy simultaneously, which can improve the efficiency and resilience of the energy system as a whole. In addition, the adoption of renewable energy is also driving the development of a more decentralized and democratic energy market, where individuals and communities.

CONCLUSION

The conclusion of this exploration of the potential of renewable energy in today's engineering development is that the utilization of energy sources that are environmentally friendly is increasingly becoming a major focus in the effort to meet global energy needs. With the adoption of innovative technologies such as solar, wind and hydro power, society and industry can shift to sustainable solutions and reduce dependence on fossil fuels. These measures not only support climate change mitigation but also open up new opportunities for sustainable and inclusive economic development.

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