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Energy Conversion Environmentaly Friendly Solutions To The Global Energy Crisis

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Abstract

The global energy crisis has become one of the major challenges facing the world today. The increasing demand for energy, limited fossil fuel resources, and negative environmental impacts are driving the need to seek sustainable and environmentally friendly energy solutions. Renewable energy conversion, such as solar, wind, hydroelectric, biomass, and geothermal, offers great potential as an alternative source of clean and renewable energy. This is literature review study. This article explores the important role of renewable energy conversion in addressing the global energy crisis and mitigating climate change. By analyzing the technology, policies, economic, social, and environmental aspects related to renewable energy conversion, this article highlights environmentally friendly solutions that can support a sustainable energy transition and ensure future energy security. Furthermore, this article discusses the challenges and opportunities in integrating renewable energy into the energy system, as well as the importance of public participation and co-ownership models in renewable energy projects.

1. INTRODUCTION

Energy is a vital component for modern life and economic development. However, the dependence on non-renewable fossil energy resources has caused a global energy crisis that threatens the sustainability of our planet. As emphasized in the 2025 Global Energy Progress Report by the World Bank, 'Access to affordable, reliable, and sustainable energy remains a critical challenge for poverty alleviation and sustainable development, with significant progress needed to meet international climate and development goals' (World Bank Group, 2025).

In addition, the exploitation and use of fossil fuels has contributed significantly to the increase in greenhouse gas emissions and climate change. As stated in the book "Renewable Energy Sources and Climate Change Mitigation" by the Intergovernmental Panel on Climate Change (IPCC), "The contribution of renewable energy in mitigating climate change involves substituting a large share of fossil-based energy supplies and related greenhouse gas emissions" (Pittion, 2018).

Therefore, the transition towards cleaner and more sustainable energy sources has

become an urgent need to address the global energy crisis and its detrimental environmental impacts. The conversion to renewable energy sources, such as solar, wind, water, biomass, and geothermal, offers environmentally-friendly solutions that can meet current and future energy demands while reducing greenhouse gas emissions (Iskandar et al., 2020).

As highlighted by recent research, renewable energy has a significant potential to meet a large portion of the global energy demand in the coming decades and plays a crucial role in addressing climate change. The International Renewable Energy Agency (IRENA) estimates that 90% of the world's electricity can and should come from renewable sources by 2050 to ensure a safer climate future (IRENA, 2022)

By exploring the pivotal role of renewable energy conversion, this article will provide insights into environmentally-friendly solutions for the global energy crisis, as well as the challenges and opportunities in the transition towards a sustainable energy system.

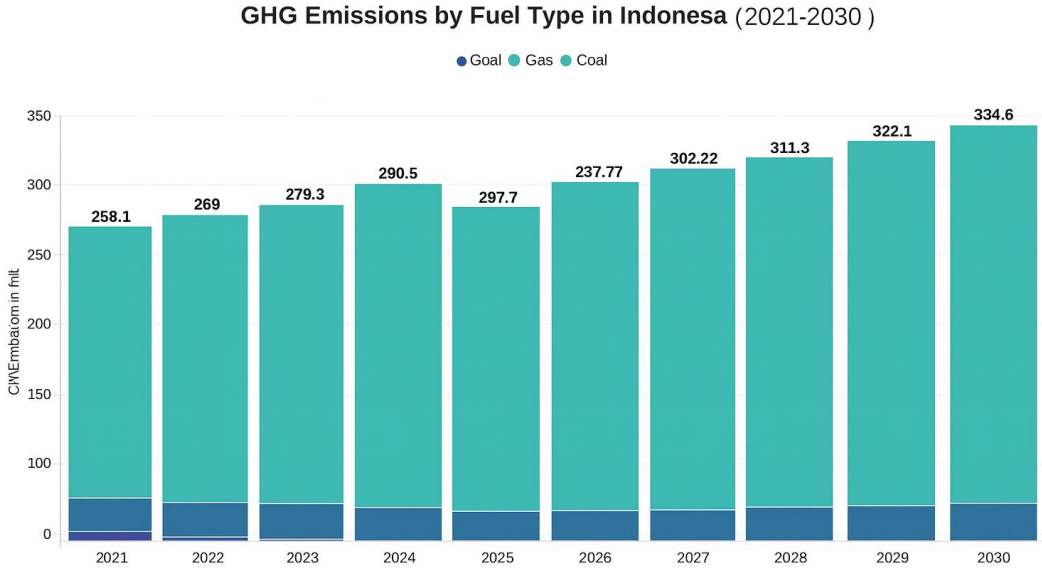

Figure 1. Greenhouse gas (GHG) emissions from types of fuel in Indonesia

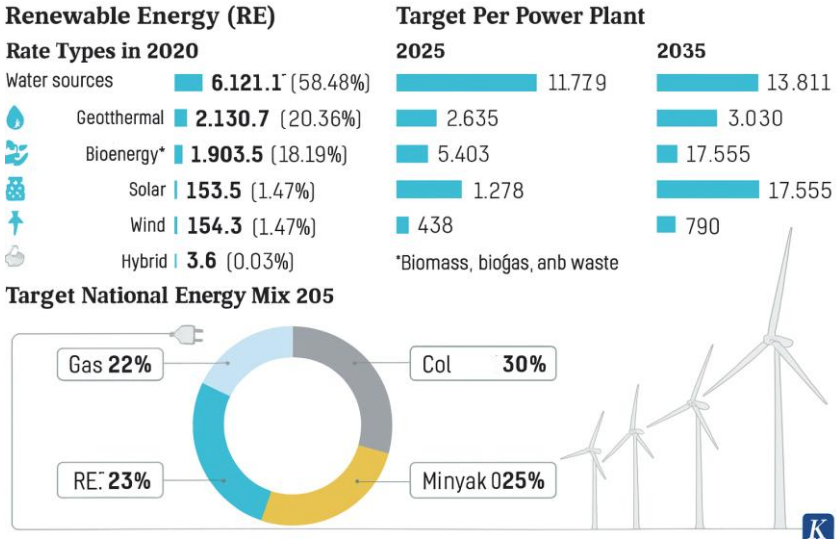

Figure 2. New and Renewable Energy

Figure 1 shows the annual increase in pollution produced by the greenhouse gas effect, which can cause the Earth to become hotter with gases accumulating beneath the

Earth's atmosphere. Figure 2, according to ESDM (Ministry of Energy and Mineral Resources), shows renewable energy targets with annual increases to reduce the use of non-renewable energy. This aims to suppress pollution production that spreads to the surrounding environment and can damage nature.

2. RESEARCH METHODS

This research will employ a qualitative approach by combining a comprehensive literature review and secondary data analysis from reliable sources. The goal is to explore the role of renewable energy conversion as an environmentally friendly solution to the global energy crisis, as well as identify challenges and opportunities in its implementation.

Literature Review. A literature review will be conducted to gather up-to-date information from various sources such as books, scientific journals, reports from international institutions, and relevant government publications on the topic of renewable energy conversion (Fuatzin et al., 2025; Iskandar et al., 2024; Prasetyo et al., 2025; Ramadhani et al., 2025; Yulianto et al., 2025). The literature to be reviewed will cover the following aspects:

1) Renewable energy technologies (solar, wind, water, biomass, geothermal)
2) Environmental impacts and climate change mitigation
3) Integration of renewable energy into energy systems

Analysis of Secondary Research Data This research will analyze secondary data from reliable sources such as reports from the International Energy Agency (IEA), International Renewable Energy Agency (IRENA), Intergovernmental Panel on. Climate Change (IPCC), and other related institutions. The data to be analyzed includes:

1) Analysis of the amount of costs required for energy processing budgets
2) Contribution of renewable energy in the energy mix
3) Projected growth and potential of renewable energy

3. RESULTS AND DISCUSSION

Potential for Renewable Energy Conversion Analysis of secondary data shows that renewable energy conversion has great potential to address the global energy crisis and serve as an environmentally-friendly solution. As discussed in the report "Renewable Energy Technologies: Cost Analysis Series" by (IRENA, 2022), renewable energy sources such as solar, wind, and geothermal have achieved cost parity with fossil fuels in many countries, and the costs of these technologies continue to decrease with technological advancements.

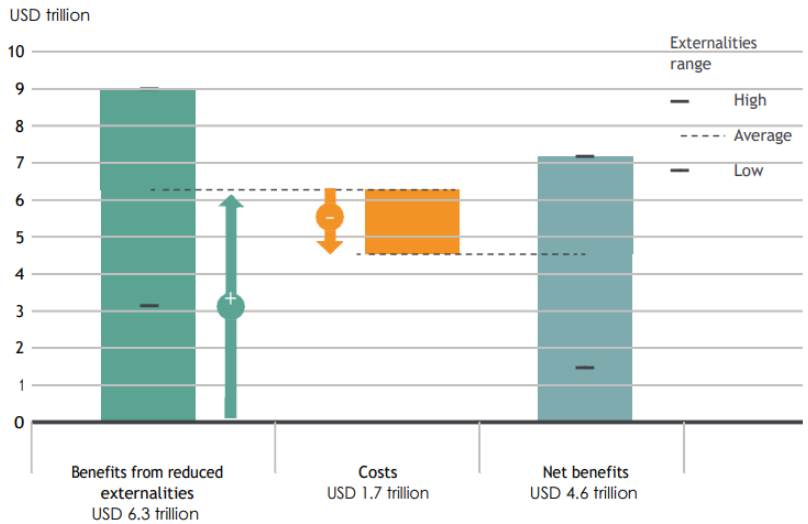

Figure 3. The energy transition will create more than 11 million additional jobs in the energy sector by 2050.

Figure 3 illustrates the projection of job creation in the energy sector through 2050. The energy transition toward renewable energy sources not only provides environmental benefits but also opens significant economic opportunities through the creation of more than 11 million additional jobs in the energy sector. This demonstrates that renewable energy conversion is not merely an environmental solution but can also drive economic growth and community welfare. According to Ram et al., (2019) in their study published in Energy Strategy Reviews, the global energy transition could create approximately 28 million jobs in renewable energy by 2050, significantly offsetting job losses in fossil fuel industries. The potential for job creation encompasses various fields ranging from manufacturing, installation, operation, to maintenance of renewable energy infrastructure. Research by Fragkos & Paroussos (2018) in Energy Policy further confirms that renewable energy investments generate more jobs per unit of energy produced compared to fossil fuel alternatives, particularly in solar photovoltaic and wind energy sectors.

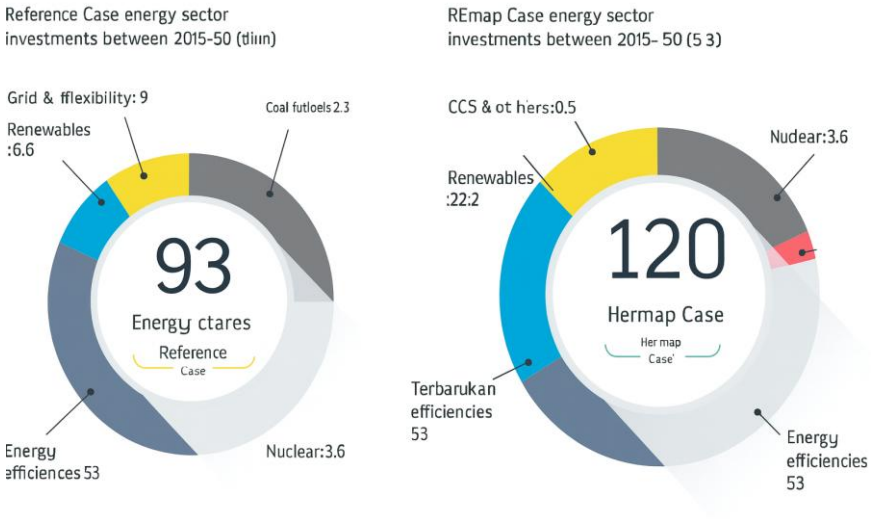

Figure 4. Investment needs to shift to renewable energy and energy efficiency Cumulative investment - Reference Case and Redirection, 2015-2050 (trillion USD)

Figure 4 illustrates the investment Figure 4 illustrates the investment needs shifting from fossil fuels toward renewable energy and energy efficiency during the period 2015-2050. The data shows that to realize an effective energy transition, a reallocation of cumulative investment in trillions of USD from the Reference Case to the Redirection scenario is required. This investment shift is crucial to address the challenges mentioned earlier, particularly regarding the need for new infrastructure and renewable energy technology development. A study by Gielen et al., (2019) published in Energy Strategy Reviews estimates that achieving a sustainable energy future requires cumulative energy investments of USD 110 trillion by 2050, with a significant shift toward renewable energy and energy efficiency measures. Although significant investment is required, the continuously decreasing costs of renewable energy technologies and the long-term benefits obtained make this investment increasingly economically viable. Research by Creutzig et al., (2017) in Nature Energy demonstrates that redirecting fossil fuel subsidies and investments toward renewable energy can accelerate the energy transition while providing positive economic returns and reducing climate-related risks.

Based on the literature review, renewable energy conversion provides a number of significant benefits. First, renewable energy is a sustainable energy source that will not run out, as stated in the book "Renewable Energy: Sources for Fuels and Electricity"

(Johansson, 2004). Secondly, renewable energy has a much lower environmental impact compared to fossil fuels in terms of greenhouse gas emissions and air pollution, as discussed in the (Change, 2012)

Challenges in implementing renewable energy nevertheless, the large-scale implementation of renewable energy conversion still faces several challenges. One major challenge is the intermittent nature of some renewable energy sources such as solar and wind, which requires efficient energy storage solutions and network management. This is discussed in the book "Renewable Energy Integration: Practical Management of Variability, Uncertainty, and Flexibility" (Jones, 2014).

Furthermore, the transition to renewable energy also requires significant investment in new infrastructure and technology. As discussed in the research "Energy Transition and Renewable Energy: A Socio-Economic Study" (Tandon, 2019), economic and policy challenges must be addressed to effectively accelerate the energy transition.

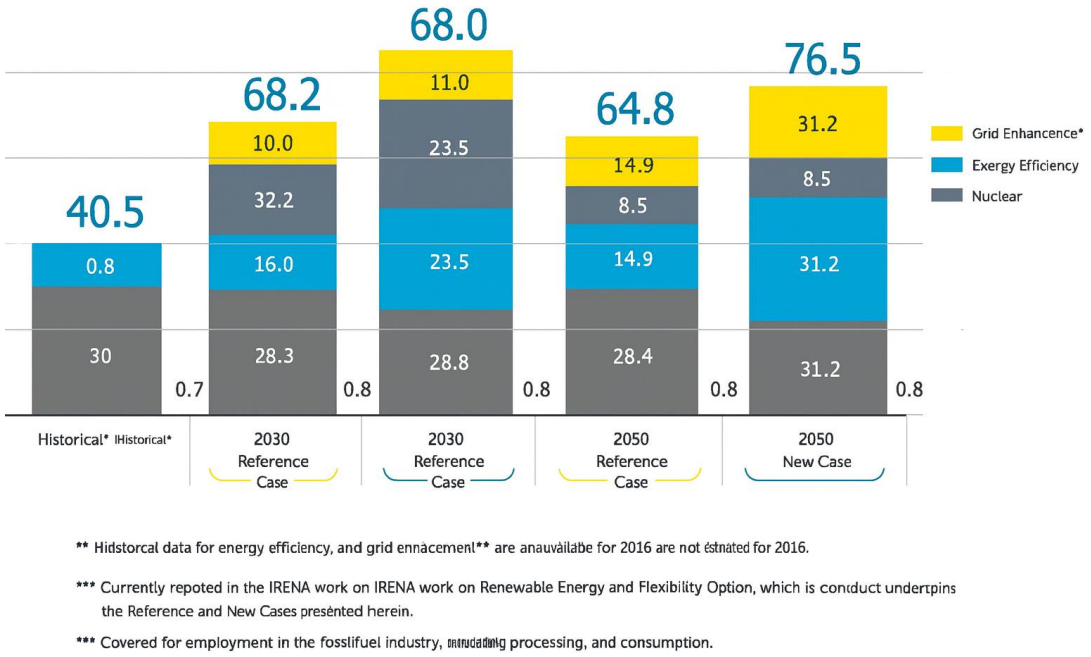

Figure 5. The energy transition will generate more than 11 million additional jobs in the energy sector by 2050.

Figure 5 reaffirms the significant employment impact of the energy transition, projecting the generation of more than 11 million additional jobs in the energy sector by 2050. This substantial job creation potential underscores the socio-economic benefits of renewable energy conversion beyond environmental advantages. According to Xu et al., (2019) the renewable energy sector demonstrates superior job creation potential compared to conventional energy sources, with solar PV and wind energy creating 2-3 times more jobs per unit of installed capacity. The data emphasizes that the transition to renewable energy is not only crucial for addressing climate change and energy security but also serves as a catalyst for economic development and job market expansion. Peltier (2017) reveals that investments in renewable energy and energy efficiency create more direct and indirect jobs across the supply chain than equivalent investments in fossil fuels. These employment opportunities span across various sectors including research and development, manufacturing, installation, grid management, and maintenance of renewable energy systems, thereby contributing to broader economic resilience and social welfare.

The Role of Community Participation and Co-Ownership Literature review also reveals the importance of community participation and coownership models in renewable energy projects. Wright (2011) emphasizes that the involvement of local communities in decision-making and project ownership can increase acceptance and support for renewable energy.

In the book "Energy Transition: Financing Consumer Co-Ownership in Renewables (Pittion, 2018), various coownership models are discussed that allow consumers to participate in renewable energy projects, such as energy cooperatives and crowdsourcing financing schemes.

4. CONCLUSION

Community participation and shared ownership models in renewable energy projects have proven to play an important role in increasing public acceptance and accelerating the energy transition. The involvement of local communities in decisionmaking and project ownership can create greater support for renewable energy.

Therefore, renewable energy conversion is an effective and environmentally friendly solution to address the global energy crisis and mitigate climate change. With the right combination of policies, sufficient investment, community participation, and international cooperation, the transition to a sustainable and renewable energy system can be realized. This will not only ensure future energy security, but also contribute to efforts to protect the environment and achieve global sustainable development.

This highlights the main points from the results and discussion, including the great potential for renewable energy conversion, the challenges faced, the important role of community participation, as well as recommendations to accelerate the transition to a sustainable and environmentally friendly energy system. This conclusion also emphasizes the importance of joint efforts from various parties, including the government, industry, society, and international cooperation, in realizing environmentally friendly solutions for the global energy crisis through renewable energy conversion.

5. DECLARATION/STATEMENT

5.1. Acknowledgment

We would like to thanks to all parties who helped this research.

5.2. Author Contribution

All Authors contributed to do the research.

5.3. Conflict of Interest

Authors declare no conflict of interest.

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