Analysis of New Renewable Energy Investment and Its Use in the National Capital Region Towards a Green, Smart and Beautiful City

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Abstract. The need for energy continues to increase while the supply continues to decrease, necessitating energy conservation activities, namely a form of correct and efficient energy management. The high level of greenhouse emissions and the decreasing amount of fossil energy have encouraged the world and the government to maintain energy security and independence as stated in PP No. 79 of 2014 concerning the National Energy Policy with a minimum target of a new and renewable energy mix of 23% in 2025 and 31% in 2050. PLN's scenario in electrifying IKN will carry the Green, Smart, and Beautiful concept. Later, IKN electricity will be realized through new, renewable energy (EBT)-based power generation sources that have no emissions and are equipped with Public Electric Vehicle Charging Stations (SPKLU), thereby creating a new environmentally friendly urban ecosystem. The smart concept includes Zero Downtime (ZDT), a Distribution Automation System (DAS), a Smart Grid, and a Smart Meter. Meanwhile, the beautiful concept includes distribution with underground cables and a futuristic design. This research analyzes the application of Energy Security, as well as the use of new, renewable energy in supporting a Smart, Green, Beautiful, and Sustainable national capital.

Keywords: Analysis; Investment; Renewable energy; The nation's capital.

1 Introduction

Nowadays, intense competition in business cannot be separated from the increasingly rapid development of business both locally, nationally, and internationally with various scales and targeted segments. This competition encourages business people to always be the customer's choice and be able to retain their customers. Every company is required to create a good and integrated competitive strategy because competition is the key to the success or failure of the company. The increasing intensity of competition from competitors leads companies to always pay attention to needs and desires and try to meet consumer expectations by providing more satisfying services than those provided by competitors. Thus, only quality companies can compete and dominate the market.

One of the government's efforts to conserve energy is through energy conservation measures which are cost reduction through energy management strategies. Energy conservation can be achieved through the use of energy-saving technology in the supply of both renewable and non-renewable energy sources and by implementing an energy-saving

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culture in energy utilization. The application of energy conservation includes planning, operation, and monitoring of energy utilization.

The high level of greenhouse emissions and the decreasing amount of fossil energy have encouraged the world and of course, the government to maintain energy security and independence, this is stated in PP No. 79 of 2014 concerning the National Energy Policy with a minimum target of a new and renewable energy mix of 23% in 2025 and 31% in 2050. [1] With all the potential resources that Indonesia has, this target is very likely to be realized.

The total renewable energy potential that can be utilized in Indonesia is 417.8 GW from various variations of NRE. With such a large potential, Indonesia is only able to realize the use of NRE for electricity generation of 10,467 GW or 14.69% of the total equivalent generating capacity of 71 GW in 2020. The minimal use of EBT for electricity is due to a lack of support and attention to the use of EBT, making it difficult for EBT plants to compete with fossil plants, especially coal, and hampering the development of renewable energy.[2]

The condition of fossil energy reserves such as coal, oil, and natural gas which continues to decrease is predicted to run out within the next 11 to 70 years. With all the threats to energy security, the Indonesian government should be able to anticipate them by further increasing the use of new, renewable energy (EBT). Potential new renewable energy resources that are most likely to be utilized in terms of quantity include; hydropower, Ocean Thermal Energy Conversion (OTEC), solar power, and biomass. For this reason, efforts are needed to utilize technology that can advance the use of new, renewable energy that is environmentally friendly. Solar Power Plants (PLTS) are one of the uses of solar cell technology that supports the use of new, renewable energy, with the sun as the primary energy source.[3]

The potential for utilizing solar power plants (PLTS) in Indonesia is very large considering that Indonesia is located on the equator which maximizes main factors such as intensity and angle of illumination.[4] By selecting the right system, PLTS can provide many benefits both functionally and economically. [5]

In the social sector, many people use energy inefficiently, because public understanding of the urgency of EBT is still minimal. This is reflected in the wasteful use of fossil energy every day. Another concern regarding the realization of the transfer of IKN is that it is threatened to be hampered due to the pandemic outbreak that is being experienced by all countries in the world, namely COVID-19. This resulted in delays in projects that had been designed resulting in most of the funding being diverted to dealing with the outbreak.[6]

Planning is necessary, specifically when moving to a capital city. The sooner the planning is carried out, the better and more mature the process will be. Therefore, an analysis is needed to determine energy utilization, especially in New Renewable Energy and its utilization.

Referring to the description above, the problem formulation that must be answered in this research is to examine how the analysis of investment in new, renewable energy and its use in the National Capital Region will lead to a Green, Smart, and Beautiful City.

2 Library Review

According to Gitman and Joehnk (2017), investment can be defined as a means by which funds can be placed with the hope that they will generate positive income or increase value. There are two forms of income from investment, namely:

a. Current Income (Current Income)

b. Increased Value

According to Jogiyanto (2017), investment is delaying current consumption to be used in efficient production over a predetermined period. With productive assets, postponing current consumption to invest in productive assets will increase total utility.

The steps in making an investment plan are as follows.

1. Fulfill investment prerequisites, namely the availability of sufficient funds for living needs and sufficient protection against various general risks.
2. Develop investment targets, namely the desired financial goals to be achieved with investment.
3. Adopt an investment plan, which is a written document that describes how investment funds will be invested.
4. Evaluate investment vehicles, namely by assessing potential returns and risks.
5. Choosing a suitable investment requires assessing expected returns, risks, and tax considerations. Personal tax considerations of income tax. The types of income are as follows.
    1) Active income is wages and salaries to bonuses, tips, retirement income, and allowances. This income comes from work (non-investment).
    2) Portfolio income comes from investments, such as savings accounts, shares, bonds, mutual funds, and derivatives.
    3) Passive income is a special category of income, income derived from real estate, joint ventures, and so on.
6. Construct a diversified portfolio, namely using the principle of don't put your eggs in one basket.
7. Manage the portfolio by measuring actual performance, whether it is in line with expectations.

The Eco principle of "Low Energy Design" is the focus of the discussion topic this time. The LED principle also known as Energy Saving Architecture is an architectural typology resulting from the manifestation of Energy Conscious Design. Energy-conscious design is an architectural paradigm that emphasizes the conservation of the natural global environment, primarily the conservation of energy sourced from non-renewable energy and encourages the use of renewable energy. Energy consciousness or energy saving means not reducing energy consumption, but rather being more efficient in consuming energy. Energy Efficient Architecture is based on the idea of minimizing energy use without limiting/changing the function of the building, and the comfort and productivity of its occupants by utilizing modern science and technology.

3 Method and Approach

The investment Feasibility Economic Analysis Technique is an application of technical economic principles that are not only needed in analyzing the economic feasibility of engineering projects but can also help in making decisions for personal matters that will have a financial impact in the future.[7] In this research, the method used is a qualitative method with the data obtained as descriptive qualitative data. Descriptive qualitative data was obtained from interviews conducted with sources who could provide data.[8] In this research, researchers will analyze the utilization of new, renewable energy in Indonesia's capital city using the AHP method, which is a branch of Multi Criteria Decision Making (MCDM)

developed by Prof. Thomas L. Saaty in 1985. This method is often used to determine the best alternative from several existing alternatives, based on certain criteria.

Criteria usually take the form of measures, rules, or standards used in decision-making (Saaty, 1993). The AHP method was used in the analytical calculations to obtain a choice of criteria based on sub-criteria and appropriate alternatives for EBT electricity generation to be prioritized for IKN in East Kalimantan Province. The analytical method used is the Analytical Hierarchy Process (AHP) method with criteria referring to the concepts established by Bappenas in developing IKN candidates in East Kalimantan Province. Four aspects will be used as criteria, namely Smart, Green, Beautiful, and Sustainable.

4 Result and Discussion

4.1 Research Result

Good budget absorption can be seen from the implementation of physical realization and scheduled budget realization by the work plan during one period of the budget year. The government is part of several elements that form society in the existing social system. This situation then creates a reciprocal relationship between the government and stakeholders, which means that the government must carry out its role in two directions to meet the needs of the government and other stakeholders in a social system. Therefore, everything produced and done by each part of the stakeholders will mutually influence each other.

The examination is divided into two, namely sub-criteria priority analysis and alternative priority analysis based on sub-criteria. The analysis includes calculating the vector eigenvalue and calculating the average vector eigenvalue obtained from the sum of the vector eigenvalues from each source so that sub-criteria priorities are obtained based on the average vector eigenvalue and alternatives based on the average vector eigenvalue in this study. After obtaining the priority sub-criteria, the priority criteria can be determined based on the eigenvector values obtained by each sub-criterion. The criterion with the highest number of eigenvectors becomes the priority criterion. By using the calculation steps as above, table 1 is a table of sub-criteria vector eigenvalues obtained from the sources:

Table 1. Subcriteria vector eigenvalue test

No	Sub-Criteria	Vector Eigen Value
1	Technology	
	Flexibility	0,15
	Land use	0,12
	Pollution	0,11
	Tourist	0,11
	Aesthetics	0,09
	Operation	0,16
	Maintenance	0,16

Priority criteria can be determined by calculating the number of eigenvector values obtained. Table 2 is the number of vector eigenvalues for each criterion based on sub-criteria:

Table 2. Validity Test

No	Criteria	Vector Eigenvalues
1	Smart	0,2322
2	Green	0,2206l
3	Beautiful	0,1442
	Sustainable	0,3325

From the results of the interview data obtained, observations can be made of East Kalimantan Province as a candidate for IKN in East Kalimantan Province based on the concept of Energy Security. It is by Law Number 30 of 2007 concerning energy Article 1 Number 25 regarding the realization of national energy security to increase national energy independence and security. The application of the concept of energy security in a region is crucial because energy security is a measure of a region's readiness related to the continuous availability of energy sources that can be accessed by the general public and its sustainability (IEA).

The use of renewable energy in the transformation of cities into smart, green, beautiful, and sustainable cities is a key step to achieving sustainable development goals at the city and national levels. The nation's capital is often a model and leader in adopting environmentally friendly technologies and practices, which can influence the development of other cities in Kalimantan. The following is a description of the use of renewable energy in this context:

1. Reduction of Greenhouse Gas (GHG) Emissions:
   Utilization of renewable energy, such as solar, wind, hydro, and biomass energy, can reduce dependence on fossil fuels which produce GHG emissions. By reducing these emissions, the nation's capital can become an example in efforts to mitigate global climate change.
2. Energy Efficiency:
   Smart cities utilize technology to improve energy efficiency in infrastructure, such as smart street lighting, intelligent traffic management, and monitoring of building energy consumption. Using this technology can reduce overall energy consumption.
3. Renewable Energy Network:
   National capitals can develop renewable energy networks that are integrated with city infrastructure, such as installing solar panels on buildings, wind turbines in urban areas, and energy storage systems. This will enable the city to utilize renewable energy sources efficiently.
4. Eco-Friendly Transportation:
   The promotion of sustainable transportation, such as the use of electric vehicles and the development of environmentally friendly public transportation systems, can help reduce air pollution and greenhouse gas emissions from vehicles.
5. Tree Planting and City Parks:
   Greening the city by planting trees and city parks not only increases beauty but also helps provide biomass energy sources and reduces the urban heat island effect, which can reduce energy consumption for cooling.
6. Public Education and Awareness:
   The nation's capital can play a role in educating the public about the importance of renewable energy and sustainable behavior. Educational programs and awareness

campaigns can encourage changes in consumer behavior towards more environmentally friendly energy consumption patterns.

7. Green Infrastructure Development:
   The use of environmentally friendly building materials, such as LEED (Leadership in Energy and Environmental Design) certified buildings, can help in creating green and sustainable city infrastructure.
8. Sustainable Waste Management:
   National capitals can develop sustainable waste management systems, including recycling and organic waste management, which can be used to produce biomass or compost energy.
9. International Cooperation:
   Collaboration with other countries and international organizations of renewable energy technology and sustainable practices can help the nation's capital adopt the latest innovations.
10. Long-Term Plans and Policies:
    The nation's capital must have a long-term plan that focuses on renewable energy and sustainability. This should include targets for reducing emissions, using renewable energy, and building sustainable infrastructure.

Utilizing renewable energy to support smart, green, beautiful, and sustainable cities is not only an environmental priority but can also provide major economic and social benefits. The nation's capital must lead by good example and commit to developing a city that prioritizes the environment and the well-being of its citizens.

Utilization of solar power plants is one of the main solutions in supporting the realization of smart, green, beautiful, and sustainable cities. Solar energy is a renewable energy source that is reliable, environmentally friendly, and can be used to meet various city energy needs. The following is how using solar power plants supports this goal:

1. Solar energy is a clean energy source that does not produce greenhouse gas emissions when generating electricity. By replacing fossil fuel power plants with solar plants, cities can significantly reduce Green House Gas (GHG) emissions.
2. Solar power generation systems can be integrated with the city's power grid to provide reliable electrical energy. This helps overcome power disruptions and blackouts that often occur in some cities.
3. Although the initial investment in a solar plant installation can be expensive, solar energy has low operational costs and limited maintenance costs. In the long term, this can result in significant energy cost savings for cities.
4. Solar energy can support the development of smart city infrastructure. For example, solar streetlights can be used for energy-efficient street lighting and smart sensors that control traffic.
5. Solar energy is a green energy source that can be used to power various city facilities, including government offices, schools, hospitals, and public transportation. This creates an image of an environmentally friendly city.
6. Solar panels can be aesthetically integrated into the architecture of buildings and city structures. This not only provides a source of energy but also creates a beautiful environment.
7. Cities can develop sustainable zones by using solar energy as the main resource. This includes sustainable residential and commercial developments that utilize solar energy as a primary source.

8. Solar power generation programs can involve local communities in the development and maintenance of solar systems, which can create jobs and economic empowerment.
9. Harnessing solar energy encourages research and development in renewable energy technologies, including solar energy storage, which can help cities become more sustainable.
10. Investing in solar energy is an investment in a better and sustainable future. This creates a city that is environmentally friendly, efficient, and livable for future generations.

Utilizing solar power plants is an important step in supporting the goals of a smart, green, beautiful, and sustainable city. This not only helps reduce negative environmental impacts but also creates economic opportunities and improves the quality of life for city residents. In an era increasingly impacted by climate change, solar energy is an integral part of sustainable solutions for cities around the world.

5 Conclusion

The utilization of renewable energy in the transformation of cities into smart, green, beautiful, and sustainable cities is a key step to achieving sustainable development goals at the city and national levels. The nation's capital is often a model and leader in adopting environmentally friendly technologies and practices, which in turn can influence the development of other cities in Kalimantan. Utilizing renewable energy to support smart, green, beautiful, and sustainable cities is not only an environmental priority but can also provide major economic and social benefits. The nation's capital must lead by good example and commit to developing a city that prioritizes the environment and the well-being of its citizens.

References

[1] N. R. Indonesia, *Peraturan Pemerintah Republik Indonesia No.79 Tahun 2014 Tentang Energi Nasional*. Jakarta:, 2014.

[2] D. ARIODARMA., "ANALISIS POTENSI PLTH (SURYA & ANGIN) UNTUK PENYEDIAAN ENERGI LISTRIK DI PULAU KETAPANG," Muhammadiyah Yogyakarta, 2016.

[3] A. Effendi, "Evaluasi Intensitas Konsumsi Energi Listrik Melalui Audit Awal Energi Listrik Di Rsj.Prof.Hb.Saanin Padang," *J. Tek. Elektro ITP*, vol. 5, no. 2, pp. 103–107, 2016.

[4] A. Erliansyah, A. Hiendro, and Purwoharjo, "Performansi Sistem Pembangkit Listrik Tenaga Hibrid Surya-Genset Pada Kantor Gubernur Kalimantan Barat," *J. Tek. Elektro Univ. Tanjungpura*, vol. 1, no. 3, pp. 9–17, 2018.

[5] M. G. Martínez., "MICROXARXA D'ALIMENTACIÓ HÍBRIDA, AMB SUPORT FOTOVOLTAIC I GENERACIÓ DIÈSEL, PER A INSTAL·LACIONS D'ÚS PÚBLIC AMB XARXA ELÈCTRICA FEBLE," *Treb. FI GRAU*, vol. 2, 2019, [Online]. Available:

https://upcommons.upc.edu/bitstream/handle/2117/120099/Volum II Viabilitat econòmica i annexes.pdf?sequence=2&isAllowed=y.

[6] J. Aspan Latifah, M. S. Boedoyo, and D. Yoesgiantoro, "Analisis Pemanfaatan Energi Terbarukan di Calon Ibukota Negara Provinsi Kalimantan Timur dengan Metode Analytical Hierarchy Proess untuk Ketahanan Energi," *J. Ketahanan Energi*, vol. 7, no. 2, pp. 77–84, 2021, [Online]. Available: https://jurnalprodi.idu.ac.id/index.php/KE/article/view/1079%0Ahttps://jurnalprodi.idu.ac.id/index.php/KE/article/download/1079/911.

[7] P. H. D. Prima., *Grid-Connected System: Simulation parameters*. Jakarta: PT Hexamitra Daya Prima., 2020.

[8] P. D. Sugiyono, *Metode penelitian kuantitatif*, Cet. 1. Bandung: Alfabeta, 2018.

[9] H. Umar, *Metode Penelitian untuk Skripsi dan Tesis*. Jakarta: Rajawali Press, 2013.

[10] I. Ghozali, *Aplikasi Analisis Multivariate dengan Program IBM SPSS 25.* Semarang: Badan Penerbit Universitas Diponegoro., 2018.