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Green Energy Transformation in Sumatera: The Influence of Government Expenditure on the Achievement of Sdg 7 (Clean and Affordable Energy)

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ABSTRACT: This research aims to explore government expenditure's impact on achieving SDG 7 (Affordable and Clean Energy) in Sumatera. The primary focus of this study is on green energy transformation as a strategic effort to enhance economic growth and societal well-being in the region. Using quantitative methods, this research analyzes secondary data from various sources, including government expenditure reports and statistical data related to the achievement of SDG 7. The findings indicate that government spending in the energy sector, particularly in infrastructure and services, significantly impacts achieving clean and affordable energy targets. However, challenges such as insufficient infrastructure and suboptimal regulations remain major obstacles. This study provides critical insights for policymakers in designing more effective strategies to accelerate green energy transformation in Sumatera and support the national achievement of SDG 7 targets.

Keywords: Government Expenditure, SDG 7, Renewable Energy, Green Energy Transformation.

INTRODUCTION

In 2023, Sumatera's economic growth was recorded at 4.69%, which was lower than the national economic growth of 5.05%. However, Sumatera's inflation reached 2.72%, higher than the national inflation rate of 2.61% (BPS, 2024). Despite these relatively favorable macroeconomic indicators, Sumatera's economic potential can still be enhanced through effective policy synergies, especially amidst increasingly complex global challenges.

Green energy transformation is one of the strategic efforts to boost economic growth and improve the welfare of the people in Sumatera. Focusing on clean and affordable energy is expected to lead to sustainable and inclusive economic growth. The goal of clean and affordable energy is enshrined in Sustainable Development Goal (SDG) 7: Affordable and Clean Energy (SDG, 2015).

The government is vital in driving this transformation through appropriate expenditures and policies. Therefore, it is essential to assess how government spending impacts the achievement of SDG 7 in Sumatera. With significant potential for renewable energy development and government policy support, Sumatera could play a key role in the national energy transition.

Figure 1 Economic Growth Map for 2023

Green energy has become a priority in global development agendas, particularly in supporting the achievement of SDG 7. Sumatera has immense potential for green energy development, including solar, wind, and biomass energy. However, this potential has not been fully exploited, and an in-depth analysis is required to understand the impact of government spending on green energy development in this region.

The primary motivation of this research is to identify factors that can strengthen green energy transformation efforts in Sumatera. The study aims to provide valuable insights for the government and stakeholders in designing more effective policies to achieve SDG 7 targets.

Although many studies have been conducted on green energy development in general, there are limitations in the research focusing on the impact of government spending on achieving SDG 7 in Sumatera. Furthermore, previous studies often do not account for the specific conditions of Sumatera, which has challenges and opportunities in the context of energy transformation.

Green energy transformation in Sumatera faces several challenges, including insufficient infrastructure, suboptimal regulations, and limited financial resources. Ineffective government spending can hinder the development of green energy in this region. Therefore, it is important to understand the extent to which government spending influences the achievement of SDG 7 targets in Sumatera and what factors can strengthen its impact.

The objective of this research is to explore the influence of government spending on achieving SDG 7 in Sumatera, focusing on clean and affordable energy. This study also aims to identify factors that affect the effectiveness of government spending and provide policy recommendations that could enhance green energy transformation in Sumatera.

This research is expected to contribute to the literature on the influence of government spending in the context of green energy transformation and the achievement of SDG 7 in Indonesia, particularly in Sumatera. Additionally, this study hopes to provide useful insights for policymakers in designing more effective strategies to promote clean and affordable energy in Sumatera, while supporting efforts to improve the people's welfare through sustainable and inclusive green energy development.

LITERATURE REVIEW

Concept and Definition of SDG 7: Affordable and Clean Energy

Sustainable Development Goal 7 (SDG 7) is one of the 17 Sustainable Development Goals adopted by the United Nations in 2015. SDG 7 aims to ensure access to affordable, reliable, sustainable, and modern energy for all by 2030. Energy is considered a fundamental component in supporting various economic and social development aspects, including education, health, and poverty alleviation (United Nation, 2015). Access to reliable and modern energy is crucial in improving healthcare and education services. Without adequate energy access, hospitals and clinics cannot operate efficiently, and children cannot learn effectively in poorly lit schools. SDG 7 seeks to address this gap by providing reliable and modern energy for all levels of society (Jagger, Bailis, Dermawan, Kittner, & McCord, 2019).

Clean energy refers to energy sources that do not pollute the air, water, or soil and do not contribute to climate change. Examples of clean energy sources include renewable energy such as solar, wind, and hydro power. Renewable energy is considered more environmentally friendly than fossil fuels like oil and coal, which produce greenhouse gases and other atmospheric pollutants (IEA, 2021). Using clean energy also has the potential to reduce dependence on fossil fuel imports, which are often a source of economic and political instability. Clean energy has demonstrated higher efficiency and lower long-term costs in many countries. Moreover, investments in clean energy technology can create new jobs and support sustainable technological innovation (Chovancová & Vavrek, 2022).

Affordable energy means that the cost of obtaining and using energy should be within the financial reach of all societal levels. This includes policies and initiatives to lower the cost of clean energy technologies and provide subsidies or financial support to low-income communities so they can access clean energy. When energy costs are high, poor communities often sacrifice other basic needs to pay their energy bills (World Bank, 2020). Governments and international institutions play a vital role in ensuring energy remains affordable for all. This can be achieved through various means, including fair tariff regulation, energy subsidies, and support for renewable energy projects that reduce energy production costs. Policies that encourage energy efficiency are also crucial in helping to reduce overall energy costs (Franco, Power, & which, 2020).

Installed Capacity

The installed capacity of renewable energy power plants used as an indicator to measure the achievement of SDG 7 refers to the maximum electricity generation capacity of power plants based on the capacity stated on the nameplate capacity of the factory. Nameplate capacity is the maximum output generated by generators or other power generation equipment under conditions set by the manufacturer, usually displayed on the generator's nameplate.

Renewable energy is derived from renewable sources such as geothermal, wind, bioenergy, sunlight, streams, and waterfalls, and movement and temperature differences in ocean layers. This is crucial for supporting the achievement of SDG 7, which targets access to affordable, reliable, sustainable, and modern energy for all. The basic formula for calculating installed capacity from renewable energy is:

$$Installed\ Capacity\ per\ capita\ =\ \frac{Total\ Installed\ Capacity\ from\ Renewable\ Energy}{Total\ Population}$$

This formula calculates the percentage of renewable energy contributions to the total energy produced. It is a key indicator for monitoring progress and determining priorities in renewable energy utilization to meet society's energy needs for one year as part of the sustainable energy transition aligned with SDG targets.

METHOD

This study employs a quantitative research design. The quantitative approach is a research method that emphasizes collecting and analyzing numerical data to understand specific phenomena (Creswell, 2014). This approach was chosen to analyze the relationship between government expenditure and the achievement of SDG 7 in Sumatera. The primary objective of this research is to examine the impact of government expenditure, particularly capital and service spending in the energy sector, on the indicators of SDG 7 achievement(Verduzco Villaseñor, Cornejo Ortega, & Espinoza Sánchez, 2023; Wang, Zhao, & Yang, 2024; Zhou, Ho, & Mieiro, 2024).

The population of this study consists of all provinces in the Sumatera region, and the entire population is included in the analysis. The data collection technique used in this study relies entirely on secondary data. These secondary data sources include government expenditure reports containing information on budget allocation and spending in the energy sector at the regional level, statistical data from BPS (Statistics Indonesia), which covers the indicators of SDG 7 achievement, and reports from the Ministry of Energy and Mineral Resources (ESDM), which provide information on energy policies, renewable energy program implementation, and progress related to SDG 7 in Sumatera (Sani, Khatiwada, Harahap, & Silveira, 2021). Policy documents related to green energy will also be used as secondary data sources.

In this study, the validity and reliability of the quantitative data used will be tested by examining the data sources, year of publication, and relevance of the data to the research objectives. The data analysis technique to be applied is multiple linear regression to measure the impact of government expenditure, particularly capital and service spending, on the achievement of SDG 7(Bousrih, 2024; Sun, Wang, Liu, & Sun, 2023). This regression model will also control other variables, such as infrastructure and policies, that may influence the research outcomes. Before the regression analysis, classical assumption tests will be performed to ensure the regression model is valid and reliable (Salfina, Nurtati, Meidona, Elvina, & Yadewani, 2023).

Descriptive analysis will also provide a general overview of government expenditure and the achievement of SDG 7 in Sumatera. The data obtained will be systematically analyzed to identify significant patterns and relationships between the variables under study (Suparjo, Darma, Kurniadin, Kasuma, & Priyagus, 2021).

Theoretical Framework

This research explores the relationship between government spending in the energy sector and achieving renewable energy capacity per capita as an indicator of SDG 7 accomplishment in

Sumatera. The study focuses on two main independent variables: capital and goods/services. Capital expenditure includes investments in energy infrastructure, while goods/services expenditure involves operational and maintenance spending related to the energy sector.

Meanwhile, the dependent variable used is renewable energy capacity per capita. This variable was chosen as a key indicator to measure the achievement of SDG 7, which focuses on access to clean and affordable energy. Renewable energy capacity per capita reflects the extent to which the government has succeeded in enhancing infrastructure and using renewable energy resources in Sumatera. This indicator is important as it enables a concrete assessment of the impact of government spending in the energy sector.

This research hypothesizes that capital expenditure and goods/services expenditure significantly influence Sumatera's renewable energy capacity per capita. Renewable energy capacity per capita serves as the dependent variable, representing the extent of government efforts in supporting the transition to clean and affordable energy, in line with SDG 7 targets. Within this framework, capital expenditure is expected to enhance energy infrastructure that facilitates increased renewable energy capacity, while goods/services expenditure is expected to support the efficiency and operationalization of such infrastructure.

RESULT AND DISCUSSION

Descriptive Analysis

In this study, the achievement of SDG 7 in Sumatera is measured using the installed capacity of renewable energy power plants per capita, which is calculated by dividing the installed capacity by the population of a region.

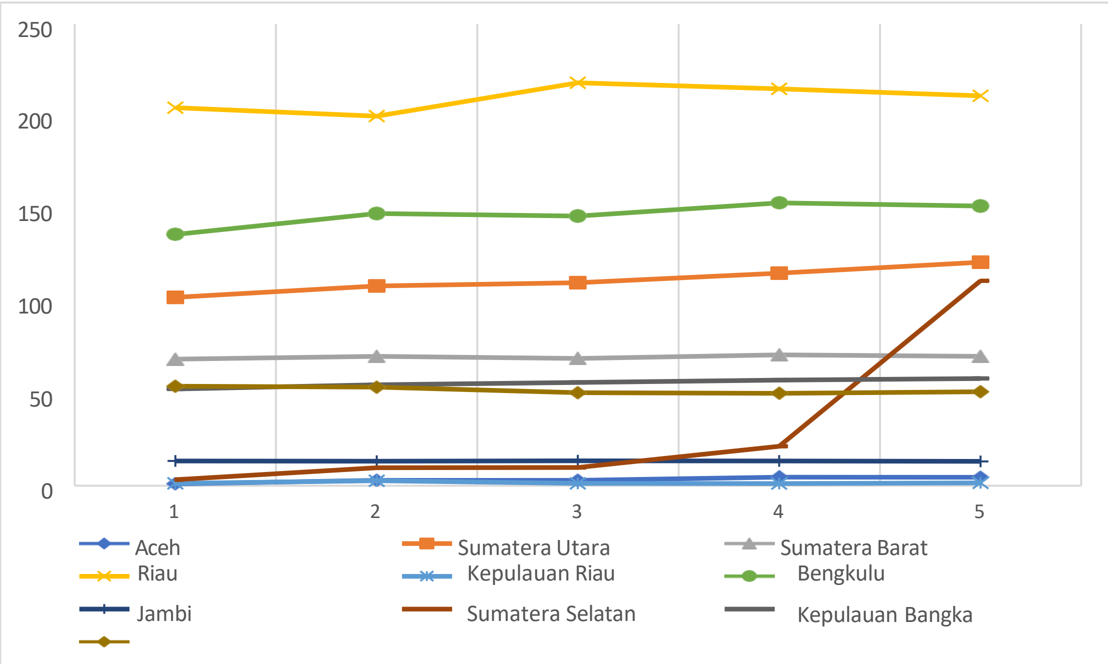

Figure 2 Installed Capacity of Renewable Energy Power Plants Per Capita per Province

General Trends

The general trend of installed capacity of renewable energy power plants per capita across all provinces in Sumatera shows significant variation. The provinces of North Sumatera and South Sumatera display consistent growth in the installed capacity of renewable energy power plants per capita over the observed period. This suggests an increase in access or efficiency in energy utilization in these regions, likely due to infrastructure development or more progressive energy policies. South Sumatera even shows a sharp spike at the last point, which may reflect a major change in policy or newly implemented energy capacity.

Meanwhile, the Riau Islands continue to lead in installed capacity of renewable energy power plants per capita, with values consistently higher than other provinces, despite slight fluctuations. The dominance of the Riau Islands could be attributed to geographical advantages, industrialization, or a more abundant availability of energy resources. This trend, identified through census methods, provides a comprehensive picture of the distribution and use of energy in Sumatera, highlighting significant disparities in energy development across provinces. It underscores the importance of further analysis to understand the specific factors driving changes in each region's installed capacity of renewable energy power plants per capita.

Stability and Variation

The stability and variation in the installed capacity of renewable energy power plants per capita across Sumatera's provinces reveal distinct patterns. Provinces such as Aceh, Riau, Jambi, and Lampung show relatively high stability, with the installed capacity of renewable energy power plants per capita remaining fairly constant over the observed period. This stability indicates that there have been no major changes in energy infrastructure, policies, or consumption in these provinces during the period. It could mean that these provinces have an established and consistently functioning energy system, although it may also suggest a lack of new investment or innovation in the energy sector.

On the other hand, provinces like West Sumatera, Bengkulu, and the Bangka Belitung Islands exhibit some variation in the installed capacity of renewable energy power plants per capita, although not significantly. These provinces have experienced slight increases in their installed capacity values, indicating improvements or increases in access to or usage of energy, but not large enough to suggest profound changes. The limited variation may reflect new initiatives in energy development, but they are not yet strong enough to produce major short-term impacts. Using census methods, this analysis provides a comprehensive overview of how stable or varied the energy distribution is across different provinces in Sumatera. It identifies areas that may require more attention in energy policy development.

Provincial Analysis

Riau is the province with the highest installed capacity of renewable energy power plants. In Riau, renewable energy development shows significant potential, particularly in the solar and bioenergy sectors. According to recent reports and studies, several major projects have been launched to increase renewable energy capacity in the region. For instance, Sunseap Group has signed a Memorandum of Understanding (MoU) with the Riau Islands provincial government to develop large-scale solar power plants with a capacity of 1,380-megawatt peak (MWp) on Combol Island and

1,682 MWp on Citlim Island. Additionally, the project includes constructing an energy storage system that supports the stability of electricity supply in the area (Sunseap, 2022).

Moreover, Riau has significant potential for solar energy development. For example, large solar power projects in Riau are expected to significantly increase renewable energy capacity, given the region's optimal sunlight exposure throughout the year. The solar energy potential in Riau is estimated to reach hundreds of megawatts, although utilization is still in the development stage (Sedai et al., 2023).

Based on an article from Antara News, the Riau Provincial Government and the Chinese government have agreed to build a solar power plant (PLTS) worth IDR 19 trillion. This project demonstrates Riau's great potential in renewable energy development, especially solar energy. The strategic geographic location and optimal year-round sunlight exposure make Riau ideal for solar power plants. With this significant investment, Riau is expected to considerably increase its renewable energy capacity, supporting a transition to more environmentally friendly energy sources and reducing reliance on fossil fuels. Additionally, this project reflects strong international cooperation in advancing green energy in Indonesia, particularly in the Riau region.

In addition to solar power plants, Riau also has several community-based renewable energy management locations. The Batu Songgan Micro-hydro Power Plant (PLTMH) in Riau serves as a model for community-based electricity management. This PLTMH highlights Riau's potential in developing water-based renewable energy, especially in remote areas that are difficult to reach by the main electricity grid. This potential comes from the many small rivers that can be harnessed to produce environmentally friendly and sustainable electricity (Budiman, 2023).

However, despite its great potential, the development of PLTMH and other renewable energy sources in Riau still faces several challenges. One of the main obstacles is the lack of adequate infrastructure support and financial challenges. Additionally, issues related to maintenance and operation require specific technical expertise that is sometimes difficult to find in local communities. Nevertheless, initiatives like the Batu Songgan PLTMH demonstrate that local communities can actively manage and utilize renewable energy resources with the right support.

Other potentials in Riau include bioenergy sources, wind energy, and micro-hydro, which still have room for further development. Renewable energy development in Riau is essential for reducing reliance on fossil fuels and supporting the transition to cleaner and more sustainable energy sources.

The second-highest installed capacity of renewable energy power plants belongs to Bengkulu Province. Bengkulu Province has several renewable energy power plants (EBT) with significant potential. One of the largest is the Geothermal Power Plant (PLTP) at Hulu Lais Bukit Daun and Bukit Kaba, with a capacity that has not yet been fully explored but is estimated to generate hundreds of megawatts of electricity (Ant, 2017). Additionally, there are several micro-hydro power plants in areas such as Sungai Lisai Village and Air Kuro Trans Village, which have smaller capacities but are essential in meeting local energy needs. The renewable energy potential in Bengkulu is part of the efforts to support sustainability and reduce dependence on fossil fuels (Firmansyah, 2014).

Statistical Analysis Pooled OLS Regression

Pooled Ordinary Least Squares (Pooled OLS) is a basic method in panel data analysis that assumes the relationship between the dependent and independent variables is homogeneous across all cross-sectional units and over time (Pesaran & Smith, 1995). This means that all observations from different individuals and periods are considered to come from a single population without accounting for specific differences between units or periods. Pooled OLS is often used to provide an initial estimate before transitioning to more complex models, such as Fixed Effects or Random Effects, which allow for heterogeneity across individuals or time.

Source	SS	df	MS		
				Number of obs =	50
				F(2, 47) =	4.80
Model	36687.5024	2	18343.7512	Prob > F =	0.0127
Residual	179752.527	47	3824.52184	R-squared =	0.1695
				Adj R-squared =	0.1342
Total	216440.029	49	4417.14345	Root MSE =	61.843

kap	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
modal	-2.03e-11	7.17e-12	-2.83	0.007	-3.47e-11	-5.89e-12
jasa	1.65e-11	5.33e-12	3.09	0.003	5.76e-12	2.72e-11
_cons	49.56074	19.28003	2.57	0.013	10.77433	88.34715

Figure 3 Results of Pooled OLS Regression in STATA Application

The regression results indicate that the capital and services variables significantly impact the dependent variable but in opposite directions. While capital has a negative effect, services exert a positive influence. Although the model is statistically significant, the low R-squared value suggests that it may not fully explain the variation in the dependent variable. This implies that additional variables or alternative models might need to be considered to improve the explanatory power of the analysis.

Breusch-Pagan Lagrange Multiplier (LM) test

The Breusch-Pagan Lagrange Multiplier (LM) test is a statistical tool used to determine the appropriate model in panel data analysis, specifically to differentiate between the random effects model and the OLS model (Baltagi & Li, 1990). This test evaluates whether there are random effects in the regression model by examining variation among cross-sectional units. In this context, the Breusch-Pagan LM test is used to decide whether the random effects model is more appropriate than a simple Ordinary Least Squares (OLS) model. If the LM test results indicate significant random effects, the random effects model is preferred over the basic OLS model.

```
Breusch and Pagan Lagrangian multiplier test for random effects

        kap[id,t] = Xb + u[id] + e[id,t]

        Estimated results:
                         |       Var     SD = sqrt(Var)
                ---------+-----------------------------
                     kap |   4417.143       66.46159
                       e |   207.1568       14.39294
                       u |   4383.832       66.21051

        Test: Var(u) = 0
                             chibar2(01) =    76.22
                          Prob > chibar2 =   0.0000
```

Figure 4 Results of Breusch-Pagan Lagrange Multiplier (LM) test in STATA Application

The Breusch-Pagan Lagrange Multiplier (LM) test is a statistical tool used to determine the appropriate model in panel data analysis, specifically to differentiate between the random effects model and the OLS model (Baltagi & Li, 1990). This test evaluates whether there are random effects in the regression model by examining variation among cross-sectional units. In this context, the Breusch-Pagan LM test is used to decide whether the random effects model is more appropriate than a simple Ordinary Least Squares (OLS) model. If the LM test results indicate significant random effects, the random effects model is preferred over the basic OLS model.

Hausman Test

The Hausman test is a statistical test used to determine whether the fixed or random effects models are more appropriate for panel data analysis (Verbeek & Nijman, 1992). This test compares two estimators: the fixed effects estimator, which assumes a correlation between individual effects and the independent variables, and the random effects estimator, which assumes no such correlation. If the Hausman test results show a significant difference between the two estimators, the fixed effects model is more suitable, as the assumptions of the random effects model are not met. Conversely, if there is no significant difference, the random effects model can be used, as it is more efficient.

```
             |      ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference       Std. err.
-------------+----------------------------------------------------------------
       modal |   -5.13e-13    -1.21e-12       7.02e-13        6.16e-13
        jasa |    5.43e-12     5.35e-12       7.57e-14        7.94e-13
------------------------------------------------------------------------------
                          b = Consistent under H0 and Ha; obtained from xtreg.
           B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

    chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            =   2.59
Prob > chi2 = 0.2734
```

Figure 5 Results of the Hausman test in the STATA Application

The Hausman test results show a chi2(2) value of 2.59 with a p-value of 0.2734. Since the p-value is greater than 0.05, the null hypothesis—that the difference in coefficients between the Fixed Effects (FE) and Random Effects (RE) models is not significant—cannot be rejected. This suggests that the Random Effects model is more appropriate for this analysis, as the assumption that the differences across cross-sectional units are not correlated with the independent variables holds. Therefore, the Random Effects model is considered more efficient and consistent for use with this data.

Regression with the Random Effects Model

The Random Effects model in panel data regression is used when individual variables have a random influence on the dependent variable and are assumed to be uncorrelated with the independent variables in the model. Unlike the Fixed Effects model, which assumes that each unit has a constant effect, the Random Effects model allows variation across individuals or time to be treated as a random component in the regression (Bell & Jones, 2015). This method is often chosen when there is reason to believe that the differences between observational units are random and not caused by the measured variables. The Random Effects model is more efficient in parameter estimation than the Fixed Effects model when the underlying assumptions are met, such as the lack of correlation between the random effects and the independent variables.

```
Random-effects GLS regression                   Number of obs     =         50
Group variable: id                              Number of groups  =         10

R-squared:                                      Obs per group:
     Within  = 0.1046                                         min =          5
     Between = 0.0372                                         avg =        5.0
     Overall = 0.0398                                         max =          5

                                                Wald chi2(0)      =          .
corr(u_i, X) = 0 (assumed)                      Prob > chi2       =          .

------------------------------------------------------------------------------
         kap | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
       modal |  -1.21e-12   2.87e-12    -0.42   0.672    -6.83e-12    4.40e-12
        jasa |   5.35e-12   2.51e-12     2.13   0.033     4.28e-13    1.03e-11
       _cons |   37.29088   27.45608     1.36   0.174    -16.52205    91.10382
-------------+----------------------------------------------------------------
     sigma_u |  66.210513
     sigma_e |  14.392941
         rho |  .95487753   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Figure 6 Results of Random Test Regression in STATA Application

The results of the Random Effects regression show that the "capital" variable is not significant, with a p-value of 0.672, indicating that "capital" does not have a significant effect on the dependent variable. On the other hand, the "services" variable is significant at the 5% level with a p-value of 0.033, suggesting that "services" has a positive and significant impact on the dependent variable. This means that an increase in "services" will enhance the value of the dependent variable.

In the Random Effects model, one of the key classical assumption tests must be fulfilled is the multicollinearity test (Septianingsih, 2022). The multicollinearity test is conducted by measuring the Variance Inflation Factor (VIF), and the results show that all independent variables have VIF values below 10, indicating no multicollinearity issues.

Multicollinearity Test

Multicollinearity is a phenomenon in regression analysis where two or more predictor variables exhibit a high degree of linear correlation (Kim, 2019). The presence of multicollinearity can lead to difficulties in accurately estimating regression coefficients, which may result in the misinterpretation of the analysis outcomes. When multicollinearity occurs, the variability in coefficient estimates increases, rendering the probability values and confidence intervals unreliable.

Variable	VIF	1/VIF
jasa	4.84	0.206754
modal	4.84	0.206754
Mean VIF	4.84	

Figure 7 Results of Multicollinearity test in STATA Application

The results of the multicollinearity test show that the Variance Inflation Factor (VIF) for both the "service" and "capital" variables is 4.84. This VIF value is below the common threshold of 10, indicating that multicollinearity is not a significant issue in this model. Generally, a VIF below 5 is still considered acceptable and suggests that the correlation between independent variables is insufficient to raise concerns. Therefore, both variables can be retained in the regression model without excessive worry about multicollinearity.

CONCLUSION

This research shows that government spending plays a significant role in supporting the achievement of SDG 7 in Sumatera, particularly through the enhancement of renewable energy capacity such as hydropower plants (PLTA), geothermal power plants (PLTP), and solar power plants (PLTS). Sumatera has great renewable energy potential, but its utilization is still not optimal. The government has implemented various policies to accelerate the green energy transition. However, challenges such as inadequate infrastructure, suboptimal regulations, and limited financial resources continue to hinder renewable energy development in the region. The use of regression models in this study also highlights that spending in the services sector significantly impacts achieving clean and affordable energy targets in Sumatera, whereas spending in capital expenditure does not significantly affect the achievement of SDG indicator values in the Sumatera.

This research has several important implications regarding the development of renewable energy and the role of government spending in supporting the achievement of SDG 7 in Sumatera. First, the findings indicate that the allocation of government spending in the energy sector, particularly on infrastructure and services, significantly impacts the expansion of access to and the use of renewable energy. Therefore, the government needs to consider increasing the budget in this sector to accelerate the green energy transformation, which will contribute to achieving SDG 7 and support more inclusive and sustainable economic growth in the Sumatera region.

Second, the study emphasizes the importance of strengthening local capacity to ensure the sustainability of renewable energy projects. Through adequate training and education, local communities can play a more active role in maintaining and operating green energy infrastructure, ultimately enhancing the effectiveness and efficiency of government programs in the renewable energy sector.

Finally, the research underlines the importance of collaboration among various stakeholders, including the government, the private sector, and non-governmental organizations (NGOs), to drive innovation and investment in the renewable energy sector. Strong cooperation and supportive policies will accelerate the energy transition and ensure that Sumatera's renewable energy potential is optimally utilized for society's and the environment's well-being.

Suggestion and Recommendations

Based on the research findings, capital expenditure does not significantly affect SDG 7 indicators. To optimize Sumatera's renewable energy potential, the government needs to increase targeted investments in green energy infrastructure, especially in the hydropower, geothermal, and solar energy sectors. These investments can be facilitated through public-private partnerships and more attractive fiscal incentives.

Meanwhile, this study reveals a sharp disparity in SDG indicator achievements across provinces. This highlights the need for stronger and more integrated policies to support equitable renewable energy development in that is evenly distributed in each province. Measures such as streamlining licensing procedures, increasing feed-in tariffs, and supporting renewable energy technology innovation are crucial.

According to the regression results, spending on goods and services significantly impacts achieving clean and affordable energy targets. Therefore, local education and training must be reinforced by regional governments to ensure the sustainability of renewable energy projects. This will enable local communities to actively participate in developing and maintaining green energy infrastructure in their areas. By addressing these challenges, Sumatera can contribute more significantly to national targets for installed renewable energy capacity and support sustainable and inclusive economic growth in the region.

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