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Urban-Rural Differences in Sustainable Energy Consumption Behavior: Evidence from Indonesia

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ABSTRACT

Research Originality: This study offers a novel contribution by integrating micro-level spatial comparison and behavioral analysis. Unlike previous studies that highlight income or education as key drivers, this research finds that structural factors have a stronger influence on energy-saving behavior.

Research Objectives: This study aims to examine household energy consumption patterns and identify the socioeconomic and structural determinants of energy-saving behavior in urban and rural settings.

Research Methods: A mixed-methods approach is employed. Qualitative analysis using ATLAS.ti explores household energy-use practices and perceptions, while binary logit regression is applied to identify factors influencing energy-efficient behavior.

Empirical Results: The results indicate significant differences in energy consumption between urban and rural households. Urban households tend to consume more energy due to lifestyle characteristics and appliance ownership. Regression results show that household size, dwelling area, installed electrical capacity, and residential location significantly affect the likelihood of adopting energy-saving behavior. Rural households exhibit a higher propensity for energy-efficient practices, mainly due to limited electricity access and reliance on traditional energy sources.

Implications: Energy policies should incorporate spatial and socioeconomic dimensions, reduce subsidy-induced price distortions, and promote incentives for energy-efficient behavior and renewable energy adoption.

Keywords:

Energy; consumption; behavior; residential setting; energy accessibility

How to Cite:

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INTRODUCTION

Energy is one of the inputs in industrial, service, transportation, and household activities. Stable and affordable energy availability is a key pillar for driving economic growth, maintaining industrial competitiveness, and ensuring public welfare. However, Indonesia faces serious challenges to energy security due to its high dependence on fossil fuels, as its oil and natural gas reserves are dwindling (Li et al., 2024). The depletion of petroleum reserves and other energy sources, coupled with the continuing rise in energy consumption, means Indonesia must begin conserving energy. Energy subsidies in Indonesia remain substantial. In 2025, the government will continue to provide subsidies of 19.41 million kiloliters (KL) for fuel, while for LPG, it will be 8.2 million metric tons. Additionally, the government will allocate IDR 90.22 trillion in electricity subsidies, higher than the 2024 level. If this situation persists, the Indonesian government will face difficulties in maintaining its foreign exchange reserves, which could threaten national energy security.

Household energy consumption accounts for a significant share of total energy consumption worldwide (Zhou & Yang, 2016). Household energy consumption in Indonesia accounted for approximately 42% of total electricity consumption in 2023 (Ministry of Energy and Mineral Resources, Republic of Indonesia, 2023), underscoring its significant impact on environmental issues. Indonesian households contribute 3.8% of direct carbon emissions and 20.7% of indirect carbon emissions (Pangestu & Ayuningsasi, 2024). Several factors influence household energy consumption patterns, and there is potential for savings. Based on research, household energy use can be reduced by up to 27% (Lesic et al., 2018). Households can save energy through a combination of technological advances and changes in energy consumption behavior (Frederiks et al., 2015).

High levels of urbanization have led to increased energy demand (Dong et al., 2018) due to lifestyle changes (Novianto et al., 2022). The standard of living in cities, which offer more opportunities, affects income, leading to increased use of household appliances and, consequently, higher energy demand (Olatunde & Okwandu, 2024). Energy consumption among rural residents is lower than in urban areas, as they rely more on straw, biogas, solar energy, and wood (G. Li et al., 2016). Unfortunately, energy sources in rural areas are only sufficient to meet basic needs but are not yet able to improve their standard of living.

Increased household income is associated with higher energy consumption (Nazer & Handra, 2016). Increased income also reduces traditional energy consumption as people shift to modern energy sources. The positive relationship between income and modern energy consumption indicates that modern energy is a normal good (Marzban et al., 2023). The energy ladder theory holds that households will increase their energy consumption and seek higher-quality energy as their income rises (Van Der Kroon et al., 2013; Waleed & Mirza, 2023). The theory of increased energy consumption up to the last rung of the energy ladder is more commonly found in urban areas than in rural areas. In addition to income, wealth also affects energy consumption, which, in turn, impacts the environment and health (Xiong & Xu, 2021; Piao & Managi, 2023).

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In addition to income, other economic variables influence energy consumption, including energy prices and the prices of household appliances that use energy (Zhang & Tao, 2020). In addition to economic factors, there are non-economic factors that influence shifts in energy consumption, namely household size (Romero-Jordán & del Río, 2022), urbanization (Zhao & Zhang, 2018), household demographic characteristics (Soltani et al., 2020; Chavda et al., 2023), access to energy (Gashaye et al., 2025; Zhang & Khan, 2024), sociocultural factors (Ravindra et al., 2019; Bhattacharjee & Reichard, 2011), and education (Benlaria, 2025; Endriana et al., 2025).

Several international studies emphasize the importance of a multidimensional approach to energy consumption behavior, including the influence of demographics, energy literacy, and social norms (Van Der Kroon et al., 2013; Frederiks et al., 2015). These studies also show that although there is potential for energy savings of up to 27% from household use (Lesic et al., 2018), its implementation is highly dependent on the local context and non-economic factors, which have not been widely discussed in Indonesia-based studies.

The development of renewable energy shows a gap between urban and rural areas. Cities play a crucial role in reducing greenhouse gas emissions and leading the transition to renewable energy that can be used across all sectors; however, they are not yet able to generate as much renewable energy as rural areas. Urban residents are becoming increasingly aware of the benefits of using more energy-efficient technologies, while rural residents are playing a greater role in generating renewable energy. Therefore, this study will examine differences in people's energy consumption behavior patterns.

This study is novel in that it uses a comparative spatial approach at the micro level to examine energy consumption patterns between urban and rural households. It also integrates mixed methods, combining quantitative and qualitative approaches. ATLAS.ti was used to map the determinants of energy behavior based on interviews and FGDs, while logit regression analysis empirically tested the influence of socioeconomic variables on energy-saving behavior.

Despite extensive international studies on multidimensional energy behavior, a significant research gap remains in the Indonesian context. Most local studies focus on macro-level energy demand or purely economic determinants, often overlooking how spatial disparities and psychological perceptions simultaneously shape energy-saving propensity. There is a lack of integrated evidence on how structural constraints across different residential settings, ranging from high-capacity urban hubs to resource-limited areas, shape behavioral adoption. Furthermore, the interplay between qualitative household perceptions and quantitative socioeconomic indicators remains underexplored.

To address this gap, this study aims to examine household energy consumption patterns and identify the socioeconomic and structural determinants of energy-saving behavior across diverse spatial contexts. This research is novel in its application of a micro-level comparative spatial approach, integrating a mixed-methods design. By combining qualitative mapping using ATLAS.ti to capture lived experiences of energy with binary logit regression to test socioeconomic variables empirically, this study provides a holistic framework for understanding energy behavior that is often overlooked by single-method approaches.

METHODS

This study was conducted in two regions with distinct characteristics: Surakarta City, representing urban areas, and Magelang Regency, representing resource-dependent peripheral areas. The research employed a mixed-methods approach, combining quantitative and qualitative methodologies. Primary data were collected through a survey of 120 households. Respondents were selected using a proportional sampling method, with the sample size determined by the Slovin formula to ensure representativeness and statistical validity. Data were collected through structured questionnaires, in-depth interviews, and focus group discussions (FGDs). The questionnaires focused on socioeconomic characteristics, energy use patterns, and behavioral aspects of energy conservation. Secondary data were collected from the Central Bureau of Statistics (BPS) for demographic and economic indicators; the Ministry of Energy and Mineral Resources (ESDM) for national energy consumption, pricing, and subsidy trends; and Official reports and policy documents related to Indonesia's energy sector.

Table 1. Operational Variables

Variable	Definition	Measurement	Source	References
Energy Consumption Patterns	Household energy consumption patterns refer to the form, type, and amount of various energy sources used by households in their daily activities to meet their needs, such as cooking, lighting, cooling, entertainment, and personal transportation.	0 = Households have not yet made any savings in their energy consumption. 1 = Households have already made savings in their energy consumption.	Interview	(Shim & Song, 2025)
Income (Inc)	An amount of money or income obtained by respondents from various sources	Rupiah	Interview	(Zhou & Yang, 2016) (Marzban et al., 2023) (Van Der Kroon et al., 2013)
Education (Edu)	Highest level of education completed by respondents	Years	Interview	(Endriana et al., 2025)
House area (House_area)	Total floor area of the building used as a residence by households	Total square meters (m^2) of all rooms used	Interview	(Stephan & Crawford, 2016)
Installed electrical power (Elec_power)	The maximum electrical capacity connected to the household as stated in the contract or on the electricity meter.	Power rating in Volt-Amperes (VA) – for example, 450 VA, 900 VA, 1300 VA, 2200 VA, 3500 VA, etc.	Interview	(Spunei & Martin, 2024) (Permana et al., 2015)
Number of electrical appliances (Home_tech)	Total number of electrical appliances owned and used in households	Unit	Interview	(Firth et al., 2018)
Location (Loc)	Respondents' place of residence	0 = respondents living in urban areas 1 = respondents living in rural areas	Interview	(Zhou & Yang, 2016) (Chimbo, 2020) (Guo et al., 2023)

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This study has two main objectives. First, to map and analyze energy consumption patterns using ATLAS.ti software to assist in organizing and mapping data based on the results of literature studies, documentation, focus group discussions, and in-depth interviews. ATLAS.ti facilitates an understanding of the meaning and motivation behind consumption behavior. Second, to analyze the influence of socioeconomic variables on energy consumption patterns across rural and urban communities using logit regression. This model enables researchers to estimate the likelihood that a household will adopt energy-efficient practices, based on various socioeconomic and environmental factors (e.g., income, education, household size, dwelling area, electricity capacity, number of appliances, and residential location).

The model used in this research is as follows:

$$L_i = L_n = \frac{P_i}{(1 - P_i)} = \alpha_0 + \alpha_1\, Inc + \alpha_2\, Edu + \alpha_3\, Fam_{number} + \alpha_4\, House_{area} + \alpha_5\, Elec_{power} + \alpha_6\, Home_{tech} + \alpha_7\, Loc + \varepsilon_i$$

This study uses binary logit regression to analyze the factors influencing household energy conservation behavior. Logit regression is used because the dependent variable is dichotomous. The α_n coefficient is estimated using the Maximum Likelihood Estimation (MLE) method. The coefficient indicates the direction of each variable's influence on the logarithm of households' energy-saving probability. To facilitate interpretation, the coefficient can be converted to an odds ratio (eβk), which describes the likelihood of a change in saving behavior for a one-unit change in the independent variable.

RESULTS AND DISCUSSION

The results of this study indicate that household energy-saving behavior differs significantly between urban and rural areas. Based on the mixed-method analysis, both structural and behavioral factors play a decisive role in shaping household energy consumption patterns. Qualitative findings from ATLAS.ti highlight variations in daily energy-use practices, transportation choices, and perceptions of renewable energy, while the binary logit regression results show that household size, dwelling area, installed electrical capacity, and residential location significantly influence the likelihood of adopting energy-saving behavior. Notably, rural households exhibit a higher propensity for energy-saving practices than urban households.

To provide a clearer context for these findings, Table 2 presents descriptive statistics summarizing the socioeconomic characteristics and energy-use profiles of respondents in both urban and rural areas. Demographic characteristics also differed substantially between locations. Rural respondents were predominantly aged 60–69 years, while urban respondents were mainly in the 40–59 age group. Previous studies suggest that age influences energy consumption through lifestyle and activity patterns, with productive-age households tending to consume more energy, while younger cohorts show greater awareness of energy conservation (Mills & Schleich, 2012; Khulaemi, 2022). Household size varied across respondents and was found to affect energy use by increasing demand for electricity, cooking fuel, and transportation, supporting earlier findings on the relationship between household composition and energy consumption (Dupont, 2004).

Table 2. Descriptive Statistic

No	Descriptive	Mean
1	Income	
	Urban	3.466.666,167
	Rural	1.533.333
2	Age	
	Urban	40 – 59
	Rural	60 – 69
3	Family Members	
	Urban	7
	Rural	8
4	House Size	
	Urban	30 – 79 m2
	Rural	30 – 79 m2
5	Installed Electrical Power	
	Urban	900 VA
	Rural	450 VA
6	Elecreical Bills	
	Urban	150.000 – 299.000
	Rural	0 – 149.000
7	Vehicle Owned	
	Urban	Motorcycle
	Rural	Motorcycle

Source: Data Processed (2025)

Housing characteristics further explain variations in energy consumption. Larger dwelling areas and higher installed electrical capacity were more prevalent in urban households, leading to greater electricity demand for lighting and cooling. This result aligns with prior research indicating that building size and appliance ownership significantly influence household energy use (Oh et al., 2021; Peng et al., 2024). Most respondents consumed electricity in the range of 100–300 VA per month, although urban households exhibited higher consumption levels and more diverse appliance use, including air conditioners and washing machines.

Electricity expenditure patterns also differed spatially. Rural households generally paid less than IDR 149,000 per month, while urban households showed higher and more varied electricity bills, reflecting differences in installed power and appliance intensity. Despite these differences, respondents in both areas demonstrated relatively high awareness of electricity conservation, particularly in switching off unused appliances, which is consistent with findings on household energy management behavior (Permana et al., 2015; Shrestha et al., 2021).

In terms of cooking energy, urban households predominantly relied on LPG, whereas rural households continued to use firewood either exclusively or in combination

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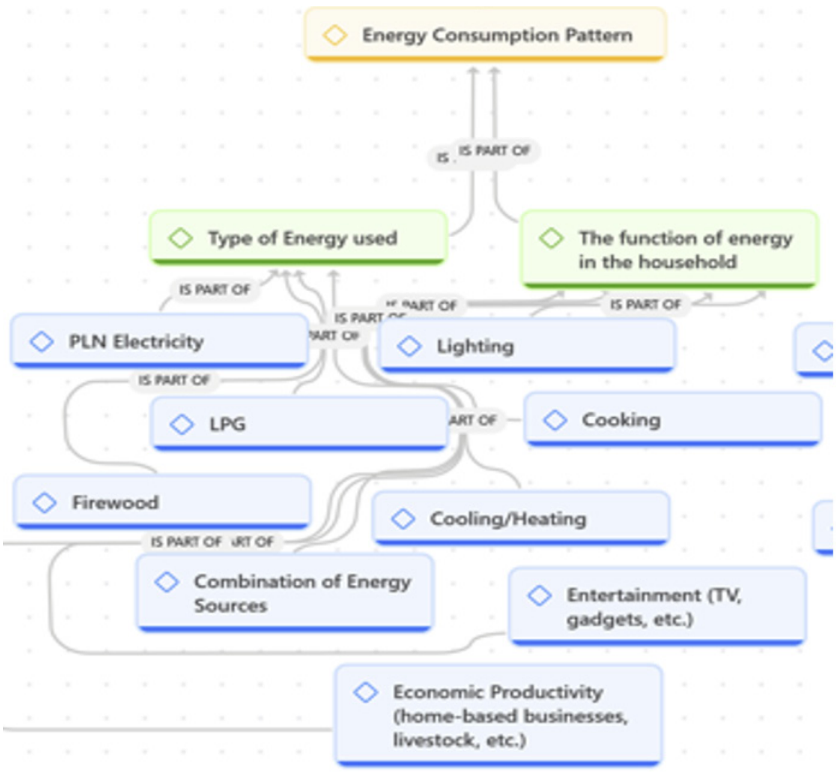
with LPG. This pattern supports the Energy Ladder Theory, which explains the gradual transition from traditional to modern fuels as income and access to modern fuels improve. Finally, energy consumption related to mobility was higher in urban areas, where vehicle ownership was more diverse, while motorcycles dominated rural transportation. Limited public transportation in both areas highlights structural constraints on promoting low-carbon mobility (Brown et al., 2016).

Energy conservation at the household level is crucial to supporting sustainable development. The ATLAS.ti analysis shows that household energy consumption behavior is shaped by socioeconomic conditions, education, infrastructure availability, and energy conservation awareness. These behaviors are reflected in several key dimensions, including energy consumption patterns, energy-saving practices, transportation-related energy use, knowledge and acceptance of renewable energy, and public expectations and recommendations. Figure 1 presents findings related to household energy consumption patterns.

Figure 1. Energy Consumption Patterns



Households primarily rely on three energy sources: PLN electricity for electronic appliances, LPG for cooking, and firewood, mainly in rural areas, for large-scale or alternative uses (see Figure 1). Differences in LPG and firewood utilization indicate a clear urban–rural energy transition gap, where rural households remain more dependent on traditional energy sources. These findings highlight the importance of promoting energy-saving behavior in daily household activities.

Figure 2. Energy-Saving Behavior

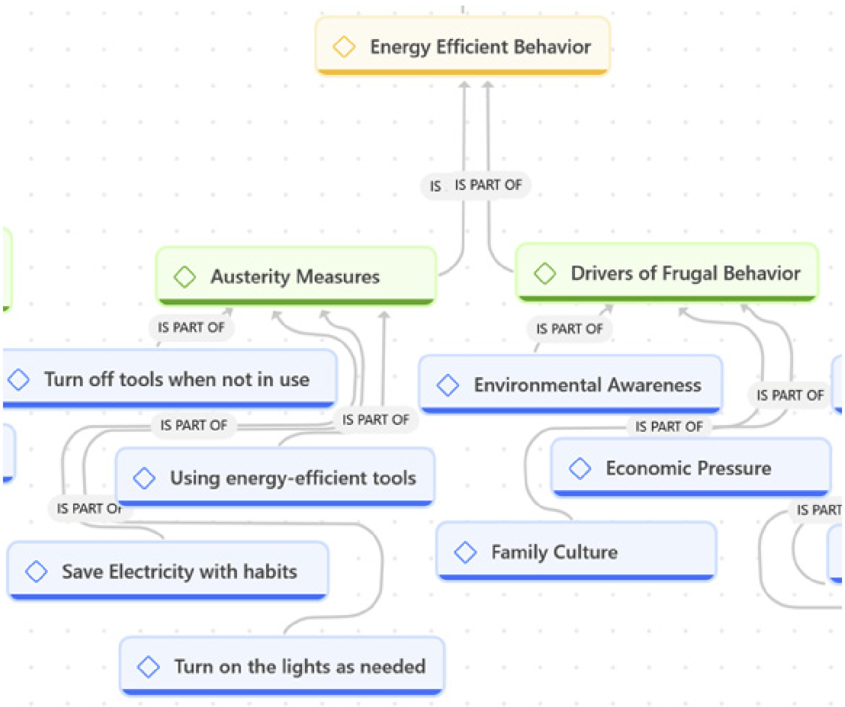
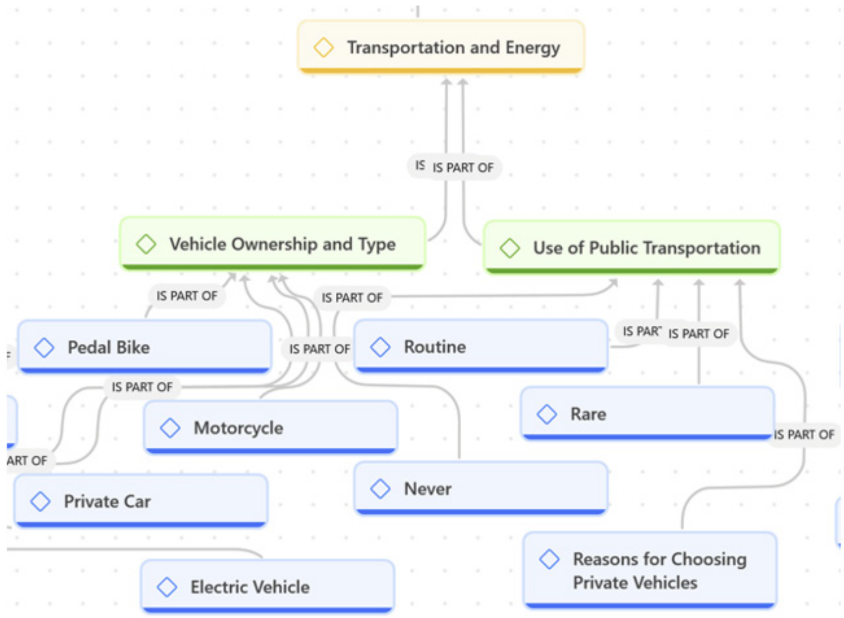


Figure 3. Transportation and Energy



Energy-saving behavior is mainly reflected in habits such as turning off unused appliances, limiting lighting use, and adopting energy-efficient devices. These practices are influenced by environmental awareness, economic considerations, education, and family values (see Figure 2). Education and household role models emerge as important drivers in shaping sustainable energy-saving habits. Transportation-related energy use is also identified as a key area for household-level energy conservation, as illustrated in the ATLAS.ti coding results.

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Transportation patterns reflect household economic conditions and significantly contribute to energy consumption. Motorcycles and cars dominate daily mobility, while electric vehicles are increasingly appearing in urban areas. In contrast, limited access to public transportation remains a major challenge in rural areas. Low public transport utilization increases fuel consumption, suggesting that improvements in transportation services and supportive energy transition policies are necessary to encourage behavioral change (see Figure 3).

Figure 4. Knowledge and Acceptance of Renewable Energy

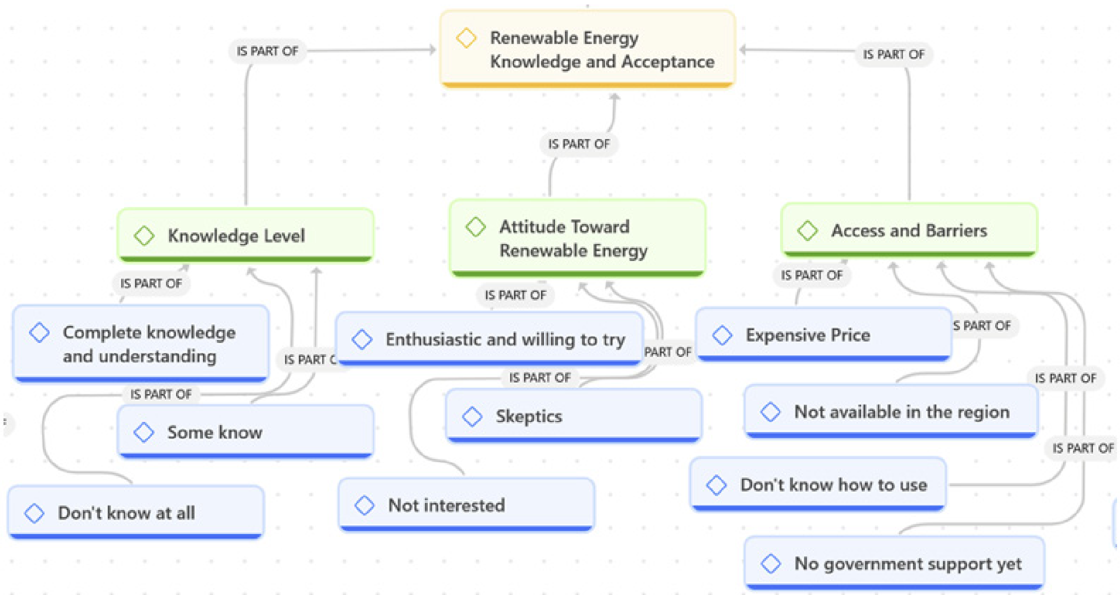
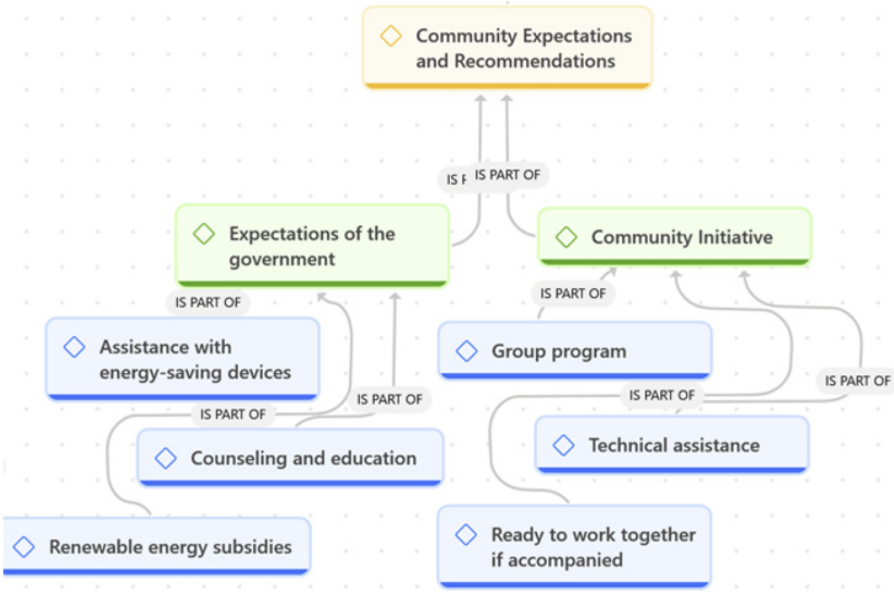


Figure 4 describes public knowledge and acceptance of renewable energy. Knowledge of renewable energy varies substantially, ranging from full understanding to complete lack of awareness. Renewable energy literacy is notably higher in urban areas, where 57% of respondents recognize the concept, compared to 27% in rural areas. In rural areas, 32% of respondents are unaware of renewable energy, and 17% have never heard of it. Willingness to adopt renewable energy is also higher among urban households (59%) than rural households (17%), reflecting disparities in information access and infrastructure. Barriers to adoption include high technology costs, limited infrastructure, and uneven policy support. Indonesia's continued dependence on fossil fuels, reinforced by rising fuel, LPG, and electricity subsidies, further constrains the adoption of renewable energy despite growing public awareness.

Public enthusiasm for energy conservation is relatively high, as reflected in expectations for stronger government involvement through education, technical assistance, and support programs for energy-saving technologies such as LED lighting. Energy-saving behavior is expressed through daily habits and decisions to adopt energy-efficient technologies, both of which are influenced by psychological motivations, economic considerations, and the availability of incentives and accessible information (see Figure 5).

Figure 5. Public Expectations and Recommendations



An analysis of energy consumption patterns is explained in the data processing output in Table 3. The binary logistic regression analysis reveals that socioeconomic variables do not uniformly influence household energy-saving behavior. Specifically, income level is not a statistically significant predictor of energy conservation. This result suggests that higher financial capacity does not automatically translate into a stronger commitment to sustainable energy practices. One major contributing factor to this phenomenon in Indonesia is the extensive energy subsidy system, which significantly reduces the actual cost of electricity and fuel. As a result, financial incentives to conserve energy are diminished, particularly for higher-income households, who may not perceive energy costs as a substantial burden.

Table 3. Binary Logistic Regression Test

Variable	Coefficient	z-stat	Prob	Odd ratio
C	-3,0239	-0,5705	0,5684	0,0486
Inc	0,8087	0,8512	0,3947	2,2450
Edu	-0,0083	-0.1093	0,9129	0,9917
Fam_number	-0,3571	-2,3922	0,0167	0,6997
House_area	-0,0097	-2,4484	0,0143	0,9903
Elec_power	0,0012	2,2178	0,026	1,0012
Home_tech	-0,1190	-0,8012	0,423	0,8878
Loc	1,1115	2,2428	0,0249	3,0389
McFadden R-squared	0,1254			
LR Statistic	20,0415			
Prob(LR Statistic)	0,0055			

Sources: Data Processed (2025)

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This result aligns with Ameli and Brandt (2015), who found that in markets where energy prices are heavily subsidized or regulated, income elasticity of energy efficiency behavior tends to weaken. Households across income levels may exhibit similar patterns of energy use. Likewise, Romero-Jordán et al. (2022) demonstrated that in low-price environments, non-economic factors such as housing characteristics and appliance usage patterns often play a more prominent role than income in determining energy efficiency outcomes. Additionally, higher-income households may prioritize comfort and convenience, leading to increased energy consumption regardless of cost. In contrast, lower-income groups, although potentially more financially constrained, may also lack access to the information, technology, or infrastructure needed to adopt energy-efficient practices (González-González & Moro, 2020).

Similarly, formal education shows no significant relationship with energy-efficient consumption. This finding aligns with prior research suggesting that formal education alone does not guarantee more sustainable energy behavior (Endriana et al., 2025). The presence of a rebound effect may explain this, as individuals with higher levels of education often have higher appliance ownership, potentially offsetting their environmental awareness. These results support the argument that household habits and social environments play a more critical role than formal education in shaping energy-saving actions (Grilli & Curtis, 2021), especially when reinforced by community norms and collective motivation (Abrahamse et al., 2005).

In contrast, household size emerged as a significant determinant, where an increase in the number of family members reduces the likelihood of practicing energy-efficient behavior. Larger households face structural challenges, such as intensified daily activities and more frequent use of shared appliances, making systemic conservation harder to maintain. This finding is consistent with previous studies emphasizing household composition as a key driver of residential energy consumption. Physical housing characteristics also play a crucial role; larger dwelling areas are associated with a lower probability of energy efficiency. Larger homes inherently demand more energy for lighting and cooling. However, prior studies note that lifestyle choices, adequate ventilation, and access to natural lighting can mitigate energy consumption even in larger homes (Sardianou, 2007).

Interestingly, installed electrical capacity has a positive and significant effect on energy-efficient behavior. Households with higher capacity are more likely to adopt energy-saving practices, reflecting a technological transition in which higher-capacity homes tend to use newer, more efficient appliances. Similar patterns have been observed in previous studies, which emphasize the role of appliance efficiency and technological upgrading in reducing energy intensity (Romero-Jordán & del Río, 2022).

Although the number of electronic appliances owned by a household is often assumed to increase energy consumption, this study finds that appliance ownership is not a statistically significant determinant of energy efficiency behavior. This result suggests that energy-saving behavior is influenced more by usage patterns and behavioral selfregulation than by the mere quantity of appliances. In other words, households with many appliances may still exhibit efficient energy use if they maintain strong behavioral control, awareness, or apply usage restrictions. This finding is consistent with recent studies that emphasize the importance of behavioral factors over structural ownership. For instance, Qiao et al. (2024) found that the energy-saving potential of appliances depends more on user behavior than on the number or technical specifications of the devices themselves. Similarly, Sardianou (2020) highlights that attitudes, perceived behavioral control, and routine practices are better predictors of household energy use than asset ownership alone.

Ultimately, residential location remains a primary determinant of energy behavior. Households in resource-dependent peripheral settings are significantly more likely to practice energy-efficient consumption compared to those in high-density spatial contexts. This disparity is attributed to increased appliance ownership and lifestyle modernization in developed areas (IEA, 2022). In contrast, higher efficiency in peripheral areas is often a result of structural and environmental constraints, such as reliance on traditional energy sources (Our World in Data, 2023) and better access to natural cooling and daylighting (OECD, 2021), which differ significantly from developed contexts.

CONCLUSIONS

This study reveals that household energy consumption behavior is strongly influenced by spatial disparities, where structural and behavioral factors outweigh conventional economic determinants. Empirical findings indicate that household size, dwelling area, installed electrical capacity, and residential location significantly affect the likelihood of adopting energy-saving practices. In contrast, income and education have a limited statistical influence. These outcomes suggest that Indonesia's long-standing energy subsidy policies have weakened price signals, reducing the role of economic motivation in promoting conservation. Instead, housing characteristics, access to electricity, and appliance usage patterns emerge as key drivers of energy behavior.

Several policy recommendations based on these findings concern subsidy reform, namely, readjusting subsidies to minimize price distortions and align them with energy conservation goals. One such recommendation is conditional subsidies for those who practice energy conservation. Strengthening public programs that focus on energy literacy, behavioral change, and awareness campaigns, especially in urban areas with high energy consumption. In addition, providing incentives in the form of financial assistance, tax rebates, or microfinance for households to adopt energy-efficient appliances and small-scale renewable energy systems can motivate them to improve energy efficiency or begin adopting renewable energy use.

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REFERENCES

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A Review of Intervention Studies Aimed at Household Energy Conservation. *Journal of Environmental Psychology*, *25*(3), 273–291. https://doi.org/10.1016/j.jenvp.2005.08.002.

Ameli, N., & Brandt, N. (2015). What Impedes Household Investment in Energy Efficiency and Renewable Energy? *International Review of Environmental and Resource Economics*, *8*(1), 101–138. https://doi.org/10.1561/101.00000067.

Benlaria, H. (2025). Does Education Spending Affect Energy Consumption in Saudi Arabia? A Bootstrap Causality Test. *International Journal of Energy Economics and Policy*, *15*(1), 36–46. https://doi.org/10.32479/ijeep.17481.

Bhattacharjee, S., & Reichard, G. (2011). Socio-Economic Factors Affecting Individual Household Energy Consumption: A Systematic Review. *ASME 2011 5th International Conference on Energy Sustainability.*

Brown, A. E., Blumenberg, E., Taylor, B. D., Ralph, K., & Voulgaris, C. T. (2016). A Taste for Transit? Analyzing Public Transit Use Trends Among Youth. *Journal of Public Transportation*, *19*(1), 49–67. https://doi.org/10.5038/2375-0901.19.1.4.

Chavda, R., Pandya, S., & Kotwal, C. (2023). Influence of Demographic-Household Features on Electricity Consumption to generate Consumption Patterns and Profiles. *Indian Journal of Science and Technology*, 16(35), 2879–2888. https://doi.org/10.17485/ijst/v16i35.685.

Chica-Olmo, J., Gachs-Sánchez, H., & Lizarraga, C. (2018). Route Effect on the Perception of Public Transport Services Quality. *Transport Policy*, *67*, 40–48. https://doi.org/10.1016/j.tranpol.2017.03.024.

Chung, Y. M., Chung, B. J., & Kim, D. S. (2024). Electricity Bill Savings from Reduced Household Energy Consumption in Apartment Complexes. *Energies*, *17*(21), 1–19. https://doi.org/10.3390/en17215488.

Dong, F., Yu, B., Hua, Y., Zhang, S., & Wang, Y. (2018). A Comparative Analysis of Residential Energy Consumption in Urban and Rural China: Determinants and Regional Disparities. *International Journal of Environmental Research and Public Health*, *15*(11), 2507. https://doi.org/10.3390/ijerph15112507.

Dupont, D. P. (2004). Do Children Matter? An Examination of Gender Differences in Environmental Valuation. *Ecological Economics*, *49*(3), 273–286. https://doi.org/10.1016/j.ecolecon.2004.01.013.

Endriana, L., Hartono, D., Khoirunurrofik, & Muzayanah, I. F. U. (2025). Does Education Affect Energy Behavior? Investigating The Influence of Educational Attainment in Indonesia. *Social Sciences and Humanities Open*, *11*, 101612. https://doi.org/10.1016/j.ssaho.2025.101612.

Frederiks, E. R., Stenner, K., & Hobman, E. V. (2015). Household Energy Use: Applying Behavioural Economics to Understand Consumer Decision-Making and Behaviour. *Renewable and Sustainable Energy Reviews*, *41*, 1385–1394. https://doi.org/10.1016/j.rser.2014.09.026.

Gashaye, A. T., Liu, H., & Li, J. (2025). The Effect of Access to Electricity on Rural Households of Underdeveloped Countries: Evidence from Ethiopia. *Energy Policy*, *199*, 114531. https://doi.org/10.1016/j.enpol.2025.114531.

Grilli, G., & Curtis, J. (2021). Encouraging Pro-Environmental Behaviours: A Review of Methods and Approaches. *Renewable and Sustainable Energy Reviews*, *135*, 110039. https://doi.org/10.1016/j.rser.2020.110039.

Guo, J., Xu, Y., Qu, Y., Wang, Y., & Wu, X. (2023). Exploring Factors Affecting Household Energy Consumption in the Internet Era: Empirical Evidence from Chinese households. *Energy Policy*, *183*, 113810. https://doi.org/10.1016/j.enpol.2023.113810.

Haque, A. N., Lemanski, C., & de Groot, J. (2021). Why Do Low-Income Urban Dwellers Reject Energy Technologies? Exploring the Socio-Cultural Acceptance of Solar Adoption in Mumbai and Cape Town. *Energy Research and Social Science*, *74*, 101954. https://doi.org/10.1016/j.erss.2021.101954.

Harnphattananusorn, S., & Puttitanun, T. (2022). Energy Consumption and Generation Diversity. *International Journal of Energy Economics and Policy*, *12*(6), 481–485. https://doi.org/10.32479/ijeep.13523.

Khulaemi, A. (2022). Perilaku Hemat Energi pada Generasi Milenial. *Jurnal Widyaiswara Indonesia*, *3*(2), 107–118. https://doi.org/10.56259/jwi.v3i2.111.

Lesic, V., De Bruin, W. B., Davis, M. C., Krishnamurti, T., & Azevedo, I. M. L. (2018). Consumers' Perceptions of Energy Use and Energy Savings: A Literature Review. *Environmental Research Letters*, *13*(3). https://doi.org/10.1088/1748-9326/aaab92.

Li, G., Sun, J., & Dai, A. (2016). Village Differences in Rural Household Energy Consumption within The Loess Hilly Region of China. *Energy, Sustainability and Society*, *6*, 33. https://doi.org/10.1186/s13705-016-0099-3.

Li, Z., Zhao, Q., Guo, H., & Huang, R. (2024). Impact of Fossil Fuel Subsidies on Energy-Saving Technological Change in China. *Energy*, *286*, 129265. https://doi.org/10.1016/j.energy.2023.129265.

Lindgren, S. (2024). Sociocultural Determinants of Electric Cooking in Rural Namibia: Recommendations for Youth and Educational Approaches to Implementation Strategy and Policy. *Energy Policy*, *187*, 114015. https://doi.org/10.1016/j.enpol.2024.114015.

Lundberg, D. C., Tang, J. A., & Attari, S. Z. (2019). Easy but not Effective: Why "Turning off the Lights" Remains a Salient Energy Conserving Behaviour in the United States. *Energy Research and Social Science*, *58*, 101257. https://doi.org/10.1016/j.erss.2019.101257.

Ly, H., & Irwin, J. D. (2017). The Relationship Between Perceptions of Discounted Public Transit and Physical Activity: Cross-Sectional Online Survey in Canada. *Case Studies on Transport Policy*, *5*(2), 279–285. https://doi.org/10.1016/j.cstp.2017.01.002.

Mahmoud, M., & Hine, J. (2016). Measuring the Influence of Bus Service Quality on the Perception of Users. *Transportation Planning and Technology*, *39*(3), 284–299. https://doi.org/10.1080/03081060.2016.1142224.

Marzban, E., Firoozpour, A., & Marzban, M. (2023). Electricity as a Common Good/Resource: a Scenario-based Approach. *International Journal of Energy Sector Management*, *17*(3), 510–530. https://doi.org/10.1108/IJESM-08-2021-0020.

Mills, B., & Schleich, J. (2012). Residential Energy-Efficient Technology Adoption, Energy Conservation, Knowledge, And Attitudes: An Analysis of European Countries. *Energy Policy*, *49*, 616–628. https://doi.org/10.1016/j.enpol.2012.07.008.

Ministry of Energy and Mineral Resources. (2023). *Handbook Of Energy & Economic Statistics Of Indonesia 2023*. Jakarta: Ministry of Energy and Mineral Resources.

Nazer, M., & Handra, H. (2016). Analisis Konsumsi Energi Rumah Tangga Perkotaan di Indonesia: Periode Tahun 2008 dan 2011. *Jurnal Ekonomi dan Pembangunan Indonesia*, *16*(2), 141–153. https://doi.org/10.21002/jepi.v16i2.04.

Novianto, D., Koerniawan, M. D., Munawir, M., & Sekartaji, D. (2022). Impact of Lifestyle Changes on Home Energy Consumption during Pandemic COVID-19 in Indonesia. *Sustainable Cities and Society*, *83*, 103930. https://doi.org/10.1016/j.scs.2022.103930.

Nugroho, S. B., Fujiwara, a, Zhang, J., Kanemoto, K., Moersidik, S. S., & Abbas, S. (2010). Development of a Household Energy Consumption. *International Sustainable Development Research Conference 2010*.

Oh, M., Jang, K. M., & Kim, Y. (2021). Empirical Analysis of Building Energy Consumption and Urban Form in a Large City: A Case of Seoul, South Korea. *Energy and Buildings*, *245*, 111046. https://doi.org/10.1016/j.enbuild.2021.111046.

Olatunde, T. M., & Okwandu, A. C. (2024). Reviewing the Impact of Energy-Efficient Appliances on Household Consumption. *International Journal of Science and Technology Research Archive*, *6*(2), 1–11. https://doi.org/10.53771/ijstra.2024.6.2.0038.

Pangestu, R. C. K., & Ayuningsasi, A. A. K. (2024). Pengaruh Konsumsi Energi Sektor Industri, Rumah Tangga, dan Transportasi terhadap Emisi Karbon di Indonesia. Inisiatif: *Jurnal Ekonomi, Akuntansi dan Manajemen*, *3*(4), 297–311.

Peng, Y., Gaspari, J., & Marchi, L. (2024). Exploring Residential Energy Behaviour of the Younger Generation for Sustainable Living: A Systematic Review. *Energies*, *17*(12), 3043. https://doi.org/10.3390/en17123043.

Permana, A. S., Aziz, N. A., & Siong, H. C. (2015). Is Mom Energy Efficient? A Study of Gender, Household Energy Consumption, and Family Decision Making in Indonesia. *Energy Research and Social Science*, *6*, 78–86. https://doi.org/10.1016/j.erss.2014.12.007.

Piao, X., & Managi, S. (2023). Household Energy-Saving Behavior, Its Consumption, and Life Satisfaction in 37 Countries. *Scientific Reports, 13*, 1382. https://doi.org/10.1038/s41598-023-28368-8.

Qiao, L., Bai, X., Liang, X., Cheng, J., & Xia, Y. (2024). User Behavior and Energy-Saving Potential of Electric Washing Machines. *Energy Informatics*, *7*, 137. https://doi.org/10.1186/s42162-024-00444-x.

Ravindra, K., Kaur-Sidhu, M., Mor, S., & John, S. (2019). Trend in Household Energy Consumption Pattern in India: A Case Study on the Influence of Socio-Cultural Factors for the Choice of Clean Fuel Use. *Journal of Cleaner Production*, *213*, 1024–1034. https://doi.org/10.1016/j.jclepro.2018.12.092.

Romero-Jordán, D., & del Río, P. (2022a). Analysing the Drivers of the Efficiency of Households in Electricity Consumption. *Energy Policy*, *164,* 112828. https://doi.org/10.1016/j.enpol.2022.112828.

Rustanto., Djati, A. P., Gymnastiar, A. A., Widiyanto, S., Putra, D. S., Aziz, M. Y. A., & Afifi, A. A. (2024). Peningkatan Efisiensi Energi pada Peralatan Rumah Tangga Berbasis Mekanik oleh Mahasiswa Universitas Negeri Semarang di Kawasan Cempaka Sari. *Jurnal Potensial*, *3*(1), 38–55.

Sardianou, E. (2007). Estimating Energy Conservation Patterns of Greek Households. *Energy Policy*, *35*(7), 3778–3791. https://doi.org/10.1016/j.enpol.2007.01.020.

Shrestha, B., Tiwari, S. R., Bajracharya, S. B., Keitsch, M. M., & Rijal, H. B. (2021). Review on the Importance of Gender Perspective in Household Energy-Saving Behavior and Energy Transition for Sustainability. *Energies*, *14*(22), 7571. https://doi.org/10.3390/en14227571.

Soltani, M., Rahmani, O., Ghasimi, D. S. M., Ghaderpour, Y., Pour, A. B., Misnan, S. H., & Ngah, I. (2020). Impact of Household Demographic Characteristics on Energy Conservation and Carbon Dioxide Emission: Case from Mahabad city, Iran. *Energy*, *194*, 116916. https://doi.org/10.1016/j.energy.2020.116916.

Sovacool, B. K. (2009). The Cultural Barriers to Renewable Energy and Energy Efficiency in the United States. *Technology in Society*, *31*(4), 365–373. https://doi.org/10.1016/j.techsoc.2009.10.009.

Sovacool, B. K., Burke, M., Baker, L., Kotikalapudi, C. K., & Wlokas, H. (2017). New Frontiers and Conceptual Frameworks for Energy Justice. *Energy Policy*, *105*, 677–691. https://doi.org/10.1016/j.enpol.2017.03.005.

Steg, L., & Vlek, C. (2009). Encouraging Pro-Environmental Behaviour: An Integrative Review and Research Agenda. *Journal of Environmental Psychology*, *29*(3), 309–317. https://doi.org/10.1016/j.jenvp.2008.10.004.

Sütterlin, B., & Siegrist, M. (2017). Public Acceptance of Renewable Energy Technologies from an Abstract Versus Concrete Perspective and the Positive Imagery of Solar Power. *Energy Policy*, *106*, 356–366. https://doi.org/10.1016/j.enpol.2017.03.061.

Taufikurahman, M. R., Holis, A., Mirdad, A. J., Wibowo, D. H., & Ahmad, T. (2023). Dampak Subsidi BBM dan LPG 3Kg Terhadap Kemiskinan Nelayan. *Indef Policy Brief*, 3, 1–9.

Van Der Kroon, B., Brouwer, R., & Van Beukering, P. J. H. (2013). The Energy Ladder: Theoretical Myth or Empirical Truth? Results from a Meta-Analysis. *Renewable and Sustainable Energy Reviews*, *20*, 504–513. https://doi.org/10.1016/j.rser.2012.11.045.

Waleed, K., & Mirza, F. M. (2023). Examining Fuel Choice Patterns Through Household Energy Transition Index: An Alternative to Traditional Energy Ladder and Stacking Models. *Environment, Development and Sustainability*, *25*, 6449–6501. https://doi.org/10.1007/s10668-022-02312-8.

Wang, B., Wang, X., Guo, D., Zhang, B., & Wang, Z. (2018). Analysis of Factors Influencing Residents' Habitual Energy-Saving Behaviour Based on NAM and TPB Models: Egoism or Altruism? *Energy Policy*, *116*, 68–77. https://doi.org/10.1016/j.enpol.2018.01.055.

Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social Acceptance of Renewable Energy Innovation: An Introduction to the Concept. *Energy Policy*, 35(5), 2683–2691. https://doi.org/10.1016/j.enpol.2006.12.001.

Xiong, J., & Xu, D. (2021). Relationship between Energy Consumption, Economic Growth, and Environmental Pollution in China. *Environmental Research*, *194*, 110718. https://doi.org/10.1016/j.envres.2021.110718.

Yu, M., Wang, C., Liu, Y., Olsson, G., & Bai, H. (2018). Water and Related Electrical Energy Use in Urban Households—Influence of Individual Attributes in Beijing, China. *Resources, Conservation and Recycling*, *130*, 190–199. https://doi.org/10.1016/j.resconrec.2017.11.004.

Yumita, F. R., Irawan, M. Z., & Malkhamah, S. (2020). Faktor Keengganan Pelajar Menggunakan Angkutan Umum dalam Perjalanan Ke Sekolah. *Jurnal Aplikasi Teknik Sipil*, *18*(2), 239–248.

Zhang, J., & Khan, I. (2024). Energy Use, Energy Access, and Oil Price Fluctuations as New Determinants of Environmental Quality in APEC Countries. *Gondwana Research*, *132*, 309–322. https://doi.org/10.1016/j.gr.2024.04.015.

Zhang, Y., & Tao, W. (2020). Will Energy Efficiency Affect Appliance Price? An Empirical Analysis of Refrigerators in China based on the Hedonic Price Model. *Energy Policy*, *147*, 111818. https://doi.org/10.1016/j.enpol.2020.111818.

Zhao, P., & Zhang, M. (2018). The Impact of Urbanisation on Energy Consumption: A 30-Year Review in China. *Urban Climate*, *24*, 940–953. https://doi.org/10.1016/j.uclim.2017.11.005.

Zhou, K., & Yang, S. (2016). Understanding Household Energy Consumption Behavior: The Contribution of Energy Big Data Analytics. *Renewable and Sustainable Energy Reviews*, *56*, 810–819. https://doi.org/10.1016/j.rser.2015.12.001.

http://journal.uinjkt.ac.id/index.php/signifikan
https://doi.org/10.15408/sjie.v15i1.46868