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Research article

Energy Poverty and Subjective Wellbeing: Empirical Analysis in Indonesia

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Abstract: As stated in the Sustainable Development Goals, energy poverty is a severe problem that is a priority for the United Nations to eradicate. In general, the study on energy poverty is concerned with objective indicators. More study still needs to evaluate energy poverty with subjective indicators, especially in Indonesia. This study aims to analyze the relationship between energy poverty as measured by the Multidimensional Energy Poverty Index which is proxied by happiness. Based on consumer theory that an individual's utility in meeting their needs will influence their satisfaction, where satisfaction is closely related to happiness, it is hypothesized that there is a relationship between energy poverty, where someone has limited access to energy, which will harm their happiness—estimated using the panel fixed effect method using 17,918 individual data obtained from IFLS4 (2007) and IFLS5 (2014) survey data. These findings suggest that energy poverty is detrimental to personal happiness. Using firewood for cooking, not having access to electricity, and not having a refrigerator or TV are signs of low energy and significantly impact happiness. Access to energy is very influential in making everyday life easier, increasing productivity and quality of life for individuals.

Keywords: energy poverty, subjective wellbeing, happiness

JEL Classification: I31, I32

Abstrak: Kemiskinan energi sudah menjadi masalah serius yang merupakan agenda utama dalam Sustainable Development Goals untuk mengatasinya dengan menjamin ketersediaan energi terjangkau, berkelanjutan dan modern bagi semua. Secara umum, penelitian mengenai kemiskinan energi lebih banyak berfokus pada indikator objektif. Namun, diperlukan penelitian lebih lanjut untuk mengevaluasi kemiskinan energi dengan menggunakan indikator subjektif, terutama di Indonesia. Penelitian ini bertujuan untuk menganalisis keterkaitan antara kemiskinan energi, yang diukur dengan Indeks Kemiskinan Energi Multidimensi yang diwakili oleh tingkat kebahagiaan. Berdasarkan teori konsumen yang menyatakan bahwa kepuasan individu dalam memenuhi kebutuhan mereka mempengaruhi tingkat kebahagiaan, hipotesisnya adalah bahwa ada hubungan antara kemiskinan energi dan kebahagiaan, di mana keterbatasan akses terhadap energi dapat merugikan kebahagiaan seseorang. Penelitian ini menggunakan metode panel fixed effect dengan menggunakan data dari 17.918 individu yang diambil dari survei IFLS4 (2007) dan IFLS5 (2014). Hasil penelitian menunjukkan bahwa kemiskinan energi memiliki dampak negatif terhadap kebahagiaan pribadi. Penggunaan kayu bakar untuk memasak, ketidakmampuan memiliki akses listrik, dan tidak memiliki lemari es atau TV diidentifikasi sebagai tanda-tanda rendahnya energi, yang secara signifikan mempengaruhi tingkat kebahagiaan. Akses terhadap energi sangat berpengaruh dalam mempermudah kehidupan sehari-hari, meningkatkan produktivitas dan kualitas hidup individu.

Kata Kunci: kemiskinan energi, kesejahteraan subjektif, kebahagiaan

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1. INTRODUCTION

Energy poverty is defined as a lack of access to quality energy sources, such as electricity and gas, needed to meet basic household and individual needs (Nussbaumer et al., 2012). The consequences of energy poverty are significant, as it impedes efforts to eradicate absolute poverty, acting as a barrier to economic development indicators such as productivity and education (Casillas & Kammen, 2010). The primary factors contributing to energy poverty include the quality of energy sources, energy supply, and energy costs (González-Eguino, 2015). Moreover, energy poverty, in terms of the quality of energy sources, has adverse effects on health, leading to issues such as poor eyesight, malnutrition, respiratory disorders, and increased mortality during winter (Kimemia & Van Niekerk, 2017; Sambodo & Novandra, 2019; Teariki et al., 2020).

Energy poverty has become a severe problem, and the main agenda of the Sustainable Development Goals (SDGs) is to eradicate it by ensuring the availability of affordable, sustainable, and modern energy for all. This condition has become a global problem because every country is finding solutions to alleviate energy poverty. In Indonesia, energy poverty remains a pressing issue. It can be seen from Indonesia's per capita energy consumption in 2021 that it is only 909.24 million barrels of oil equivalent (BOE) or less than half the world's average consumption (Kementerian ESDM, 2022). According to the International Energy Agency (IEA) report, in Indonesia, there are still 23 million people who cannot access electricity, and 14 million people still depend on solid fuels, such as wood and kerosene, for cooking.

The Indonesian Government has made many efforts so that people can access modern energy. One of the efforts involves providing energy subsidies to impoverished communities. Based on a report by the Directorate General of Treasury, Ministry of Finance of the Republic of Indonesia (DJPB Kemenkeu RI, 2022), the Government has allocated subsidy funds for electricity and LPG amounting to IDR 115.44 trillion in 2021 and it increases annually. However, these efforts should be further optimized given the prevalent issue of energy poverty in Indonesia that many people still experience. Considering the high level of energy poverty, despite the efforts made, it is necessary to analyze the relationship between energy poverty and people's perceptions of welfare, also known as subjective well-being (SWB) (Diener, 1984). How society assesses the condition of energy poverty needs to be understood so that poverty alleviation policies are right on target. People's perceptions are closely tied to assessing their satisfaction with the living conditions they experience. Therefore, if people believe that energy poverty diminishes life satisfaction, they will perceive their living conditions as lacking prosperity. Conversely, if people believe that conditions of energy poverty do not diminish their perception of prosperity, then energy poverty will persist, considering that Indonesia is an archipelago with diverse characteristics that significantly influence how satisfaction or happiness is assessed.

Study on energy poverty often associates its detrimental effects with objective indicators such as health (Awaworyi Churchill et al., 2020; Utami & Hartono, 2022; Zhang & Awaworyi Churchill, 2020), education (Acharya & Sadath, 2019; Koomson & Danquah, 2021) and income (Acharya & Sadath, 2019). On the other hand, in recent years, study has developed into how various factors correlate with SWB. For example, SWB is influenced by income (Diener & Oishi, 2000), trust and social capital (Awaworyi Churchill & Mishra, 2017), religion, and culture (Diener et al., 2011; Frankel & Hewitt, 1994). While there are numerous studies on both SWB and energy poverty, there remains a scarcity of study linking these two aspects. Analyzing energy poverty from society's subjective perspective can provide valuable insights for policymakers, enabling them to target their implementations more effectively. It is essential because, according to study by Forgeard (2011), population life satisfaction (SWB) significantly influences societal and social development. Therefore, the study is needed to analyze the relationship between the two and whether energy poverty negatively affects people's SWB.

This study is intriguing, because in Indonesia, there is still a need for additional studies linking energy poverty with SWB. In addition, the characteristics of Indonesia as an archipelagic country are unique, as the standard of life satisfaction can vary between islands, particularly concerning energy. Meanwhile, previous study linking energy poverty and SWB was conducted in Ghana (Lin & Okyere,

2021) Australia (Awaworyi Churchill et al., 2020), and China (Li et al., 2022; Zhang et al., 2021). The country's characteristics are land and tend to be homogeneous (Awaworyi Churchill & Mishra, 2017).

Based on consumer theory, which often uses utility functions to represent individual preferences, it is formed from a collection of goods chosen by individuals to fulfill their basic needs and optimize their satisfaction. It is assumed that satisfaction equates to happiness, in line with the theory of need and goal satisfaction (Ed & Katherine, 2009; Sheldon & Houser-Marko, 2001), which posits that meeting an individual's basic needs leads to happiness. Assuming modern energy is a basic need, when an individual cannot fulfill the need for sufficient and high-quality energy, their happiness is likely to decrease. Energy poverty is conditions where individuals cannot consume energy according to their needs and reasonable quality. So, conditions of poor energy will have a negative impact on individual happiness. This study analyzes the level of happiness of individuals in society who experience energy poverty and those who do not.

Several previous studies have tried to analyze the relationship between energy poverty and SWB, including study by Churchill et al. (2020), who examined the impact of energy poverty on subjective well-being (SBW) in Australia using a panel data survey. Subjective well-being (SWB) was assessed using the question, 'All things considered, how satisfied are you with your life?' with responses ranging from 1 to 10. Energy poverty is measured using five approaches to obtain an energy poverty score, using the energy price variable instrument. The results are that energy poverty using both ordinary least squares (OLS) and panel fixed effects has a negative impact on SWB/life satisfaction. Li et al. (2022) examined the effect of energy poverty on the SWB of elderly residents in China using a 4-wave panel data survey. SWB was measured based on indicators of life satisfaction and depression levels, which were decomposed using the principal component analysis (PCA) method to produce a SWB score. Using the instrument variables energy price, water access, and IV-lewbel, it was found that energy poverty worsens the SWB of the elderly population, and the degree is higher in groups from low-income families living alone and in urban areas.

Zhang et al. (2021) examine the effect of energy poverty on children's SWB in China; SWB is proxied by a happiness level score of 1-10, using panel data and variable instruments of energy prices, water access and IV-lewbel found that educational performance is an essential channel through which energy poverty deteriorates children's SWB. Lastly, in contrast to previous studies utilizing energy poverty variables, Nasrudin et al.'s study (2022) investigated the impact of access to electricity on happiness in Indonesia. They employed instrumental variables, specifically the distance to the nearest power plant, to estimate this relationship. SWB was measured using a happiness level scale from 1 to 10. The study revealed a positive correlation, indicating that access to electricity had a beneficial effect on happiness, assessed through an individual assessment index of housing conditions.

This study is intriguing because additional studies are needed to establish the link between energy poverty and SWB, especially in Indonesia. Apart from that, the characteristics of Indonesia as an archipelagic country are unique because the standard of life satisfaction between islands can vary regarding energy. Meanwhile, a previous study linking energy poverty and SWB was conducted in the countries of Ghana (Lin & Okyere, 2021), Australia (Awaworyi Churchill et al., 2020), and China (Li et al., 2022; Zhang et al., 2021) whose country characteristics in the form of land and tends to be homogeneous (Churchill & Mishra, 2017).

Based on the background, problems related to energy poverty and the importance of subjective welfare measures. This study analyzes the relationship between energy poverty and happiness in Indonesia. Based on the theoretical framework and previous empirical studies, it can be hypothesized that energy poverty is negatively related to individual happiness in society, or in other words, individuals who are energy-poor are less happy than individuals who are not energy-poor. We hope this study will help complete the literature regarding the relationship between energy poverty and social indicators, incredibly subjective measurements, which were still limited in Indonesia at the time of this writing. It also provides input to policymakers from different perspectives by taking the subjective side of society as material for policy evaluation.

2. RESEARCH METHODS

2.1. Data

The fourth and fifth batches of the Indonesian Family Life Survey (IFLS), performed by RAND Corporation in 2007 and 2015, provided the data for this study. The extensive household survey covered over 30 thousand individuals, representing approximately 83% of Indonesia's population (Strauss et al., 2016). This study only used two waves because the survey before the fourth wave did not accommodate the main independent variables. One advantage of existing household surveys is the ability to track respondents as they move from one group to another. For instance, if household members leave the community, efforts are made to trace the respondent in their new environment. As a result, of the households contacted in the first wave, 87.8 percent of the households were also interviewed in the fifth wave. For the record, the existing data represents 23 provinces in Indonesia, excluding provinces in Papua, the Maluku Islands, and most of the provinces in Sulawesi.

2.1.1 Happiness

Subjective Well-being (SWB) is a broad category of phenomena that includes people's emotional responses, satisfaction domains, and global assessments of life satisfaction (Diener et al., 1999). Furthermore (Diener et al., 2011) define SWB as a person's cognitive and affective evaluation of his life. People generally interpret happiness more broadly than just subjective well-being. Helliwell et al. (2015) understand happiness as a synonym for SWB. The scientific literature also uses the preference for using happiness as SWB (Kopsov, 2019; Lyubomirsky & Dickerhoof, 2005). Based on these considerations, this study applies a happiness proxy to interpret SWB. Happiness theories are categorized into three groups (Diener et al., 2011): needs and goal satisfaction theories, process or activity theory, and theories of genetic predisposition and personality. The need satisfaction theory assumes that satisfying an individual's basic needs will make him happy. It is supported by the study by Sheldon & Houser-Marko (2001). Activity theory argues that involvement in an interesting activity that follows the skills mastered will bring happiness (Csikszentmihalyi, 2000). Both theories argue that SWB will change as individuals approach goals or engage in interesting activities.

Energy poverty occurs when a person cannot meet the required energy consumption; in other words, consumers can only access a limited amount of energy or energy of poor quality. It is related to the economic theory that when individuals cannot meet the required level of consumption, the individual's utility will decrease. Energy consumption is an individual's need to support daily activities. If an individual's needs are not met, they cannot experience true happiness. Therefore, a person's satisfaction can be seen from the level of happiness (Biswas-Diener & Diener, 2009), and one way to obtain this information is through subjective assessments from individuals who experience conditions of energy poverty or non-energy poverty. Community satisfaction surveys regarding living conditions are commonly used to measure subjective well-being, such as the IFLS survey data used in this study. The outcome variable in this study, SWB, uses individual perceptions of their happiness through the question, "Considering the current situation, do you /Mr/Mr. feel that Mrs./ Mr./Mr. very happy = 1, happy = 2, unhappy = 3, or very unhappy = 4 ?".

Issues related to variables obtained through perception or self-reported variables may introduce biases related to the respondent's state of mind at the time of assessment, especially when the questions pertain to their happiness. The potential for bias arises from the fact that during the interview, respondents may have recently encountered events or circumstances that could influence their answers (Schwarz & Strack, 1999). For instance, if an individual has just experienced something distressing, such as a conflict with a partner or job loss, this may lead to an underestimation of their reported level of happiness. Furthermore, subjective perceptions of satisfaction and happiness often depend on individuals comparing their own situation to that of others around them or reflecting on their own past experiences (Lama, 2009).

Based on the first issue, the bias of the answers tends to reduce the level of happiness, whereas the second issue is related to the condition of energy poverty. Generally, the surrounding conditions

do not differ much in terms of the level of energy poverty, so the answer to the level of happiness tends to be higher because the individual does not know the actual condition of energy poverty (Churchill & Smyth, 2020). To reduce the impact of this bias, this study changed the four categorical answers to only two categories: happy = 1 and unhappy = 0. Happy combines answers 1, "very happy," and 2, "happy." While unhappy combines answers 3, "unhappy," and 4, "very unhappy."

Responses "very" or "very not" are paired with responses that discriminate between yes and no, which often do not give many of these responses or are included in particular categories, may reflect an individual's momentary optimism (Mohanty, 2009). Wang (2015) also adopted a similar approach due to a limited number of responses in the 'very unhappy' and 'very happy' categories, constituting only about 3% of the total responses. As a result, the responses were aggregated, assigning a value of 1 if the respondent answered as 'very happy' or 'happy', and a value of 0 if the respondent answered as 'very unhappy' or 'not happy'. A similar approach is also employed by Welsch & Biermann (2017) when addressing the issue of SWB. This approach implies that a decrease in SWB cannot be observed if it is already in the lowest category in the previous period, nor can an increase be observed if it is in the highest category. Although used as a robustness test, they overcome this by breaking the SWB variable information into two high (1) and low (0) categories. Whereas in this study, the answer "very unhappy" was only about 0.75% of the total answers.

It should be noted that individuals who underestimate their energy poverty condition feel better or do not feel worse because of energy poverty. Given that happiness is a subjective measure, individuals tend to report higher states of happiness, and this could be different if they accurately knew their actual state of energy poverty. Even if this assumption is correct, this is fine for the analysis of this study. This study aims to capture SWB aspects that are influenced by energy poverty, which is subjective, and responses to individual perceptions can be different from reality. Therefore, the behavior of the relationship between the two will lead to a downward bias, thus indicating that If someone is aware that the condition of energy poverty is harmful to them, the effect of genuine energy poverty should be more significant than the estimate in this study.

Another critical issue is that responses to SWB questions were not precisely measured due to survey restrictions. SWB directly related to energy poverty can be achieved if the question is asked following the question concerning energy poverty. However, in the IFLS survey, this did not occur since the SWB questionnaire was asked individually within a home. In contrast, the head of the household represented the energy poverty questionnaire, and the two items were in distinct areas of the questionnaire.

2.1.2. Energy Poverty

In this study, the primary variable was determined using the MEPI (Multidimensional Energy Poverty Index) developed by Nussbaumer et al. (2012). This index measures the lack of access to modern energy services and is an independent variable. Table 1 presents the various dimensions and indicators of the conceptual framework that has been established.

Table 1. Dimensions and indicators of the Multidimensional Energy Poverty Index

Dimensions	Indicator (weight)	Variables	Deprivation cutoff (Poor if)
Cooking	Access to modern cooking fuel (0.2)	Firewood or charcoal as fuel for cooking.	True
	Indoor air pollution (0.2)	Household uses biomass fuel in an enclosed environment without windows or chimneys	True
Lightning	Electricity Access (0.2)	Have access to electricity	False
Household appliances	Household appliances ownership (0.13)	owns a deep freezer or refrigerator	False
Entertainment & Education	Ownership of entertainment or education appliances (0.13)	owns a radio or TV	False
Communications	Telecommunications equipment (0.13)	owns a telephone or mobile phone	False

Source: Adopted from Nussbaumer et al. (2012)

Based on the dimensions and indicators in Table 1, the energy deprivation score can be calculated to determine energy poverty status as follows:

$$d_{i\,energi} = w_1 I_1 + w_2 I_2 + w_3 I_3 + w_4 I_4 + w_5 I_5 + w_6 I_6 \quad (1)$$

where, I_k is the k indicator of multidimensional energy poverty measurement and w_k is the weight for each indicator, provided that $\sum_1^k wk$ = 1; I_k=1 if the household experiences deprivation in the k indicator and I_k=0 if not deprived. Meanwhile, $d_{i\,energi}$ represents the energy deprivation score of the household. the energy deprivation score ($d_{i\,energi}$) for each household will range from 0 to 1.

A certain threshold or deprivation cut-off is set to determine whether a household is in the energy-poor category. No explicit criteria are used to determine the energy poverty deprivation cut-off. The determination of the threshold value is normative, following the goals and priorities of the policy. Several studies have determined the deprivation cut-off for energy poverty at 0.3 (Mahmood & Shah, 2017), a cut-off of 0.33 (Koomson & Danquah, 2021; Nussbaumer et al., 2012; Sadath & Acharya, 2017), cut -off of 0.5 (Mendoza et al., 2019), cut-off of 0.6 (Ogwumike & Ozughalu, 2016). Then, the study by Abbas et al. (2020) stated that there are three cut-off sizes to measure the Multidimensional Energy Poverty Index proposed in the UNDP report, namely Severe (0.5), Acute (0.33), and Vulnerability (0.2). This study uses a cut-off that refers to the study of Nussbaumer et al. (2012), namely k = 0.33 (Acute Energy Poverty). Thus, if > 0.33, household i is categorized as energy poor, and if < 0.33, household i is categorized as not poor in energy.

2.1.3 Control Variables

Consistent with the study on happiness (Diener et al., 2009; Helliwell et al., 2015; Li et al., 2022), We account for household and respondent factors such as age, age squared, education, marital status, gender of head of household, property ownership, income, and health status (see Table 2). Additionally, this study considers the differences in population density between urban and rural areas.

2.1.4 Endogeneity Issues

In this study, the endogeneity issue is that much-unobserved heterogeneity can affect happiness; if not addressed, it will result in omitted variable bias (Ferrer-i-Carbonell & Frijters, 2004). One effort to overcome endogeneity caused by time-invariant unobserved variables is using individual fixed effect panel data. Using the fixed effect method on panel survey data, such as IFLS in Indonesia or HILDA in Australia, can reduce the possibility of unobserved heterogeneity in all individuals, including personality characteristics (Churchill et al., 2020). Another endogeneity issue related to the relationship between energy poverty and happiness is a reversed causality relationship. Energy poverty can affect a person's happiness because a lack of access to sufficient energy can lead to financial, health, and comfort problems. Conversely, happiness can also affect energy poverty because people who feel happy tend to be more productive and able to find better sources of income, thereby reducing the level of energy poverty. However, regarding the effects of happiness on energy poverty, previous studies have yet to address much because happiness is the goal of life for every human being, much influenced by various factors rather than being a particular factor. Therefore, following similar studies that analyze the relationship between energy poverty and happiness, this study assumes that there is no reversed causality.

2.1.5 Empirical Strategy

Comparing the happiness of energy-poor and non-energy-poor individuals from observable data may not have a causal interpretation due to not being energy-poor rather than a perfect counterfactual of energy-poor-related happiness (Nasrudin et al., 2022). It is because many factors can impact a person's happiness, one of which is energy poverty, as expected in this study. Based on previous studies, individual personal characteristics and socio-economic factors influence happiness. To ensure accuracy, this study considered control variables that could impact the relationship between the primary study variables. These included factors such as age, age squared,

health status, income, years of education, marital status, gender of the head of the household, and home ownership.

Using control helps sort out the problem or eliminate the disturbing effect of the control variable on the relationship between energy poverty and happiness. For example, the use of income and education controls based on empirical study, having higher income and education will make individuals happier and able to gain access to more modern energy or not energy-poor. Meanwhile, when having lower income and education, individuals will tend to be unhappy and more likely to be in an energy-poor state. Thus, the effect of energy poverty on happiness with the inclusion of the control will correct the upward bias, or in other words, the negative effect of energy poverty on happiness will be corrected lower than without control.

However, the endogeneity issue can only be resolved partially if the existing controls sufficiently remove the interference from the relationship between the two main variables. If not resolved, the estimation results will contain omitted bias variables because unobserved variables have yet to be included in the compiled model. To overcome unobserved heterogeneity, the method that can be used is the fixed effect or the instrument variable. This method allows unobserved differences between individuals to be correlated with the energy poverty variable and can adjust the estimates accordingly.

Finding external variable instruments that fulfill the exogenous elements in surveys, such as the IFLS, is difficult. Therefore, this study will use fixed effects at the individual and survey wave levels to overcome unobserved heterogeneity, which can cause estimation bias even though only time-invariant variables can be overcome.

2.2. Model specification

The following is the basic estimation equation to analyze the relationship between energy poverty and happiness:

$$Y_{it} = \beta_0 + \beta_1 EP_{it} + \sum_n \beta_n X_{n,it} + \vartheta_i + \alpha_t + \mu_t + \varepsilon_{ijt} \quad (2)$$

Y_{it} is the binary variable of subjective wellbeing or happiness; EP_{it} is the binary variable based on the cut-off of energy poverty; X is a vector of individual characteristics that can affect SWB; ϑ_i is an individual fixed effect to control for unobserved factors from individuals that do not vary over time which can interfere with the relationship between happiness and energy poverty; α_t is the fixed effect of the density of rural-urban areas to absorb the heterogeneity of differences in the two regions between years/waves; μ_t is the fixed effect of survey waves to account for possible changes between waves; ε_{it} is the error term.

Most psychology studies has not predicted psychological or behavioral results but instead explained the causal mechanisms leading to these outcomes (Yarkoni & Westfall, 2017). Because of this, the question of whether or not to use linear regression when outcomes are binary becomes, for most psychologists, how much do estimates of causal influence get affected by out-of-bound predictions from linear regression? In general, the response to this issue is that out-of-bound forecasts are not a concern for psychologists (Gomila, 2021).

There are several reasons to prefer linear regression over nonlinear models like logit and probit when dealing with binary outcomes. Linear regression is a safer choice, enabling coefficients to be easily interpreted as probabilities, particularly in models with fixed effects or interaction terms (Beck, 2018; Rodriguez & Goldman, 1995). In contrast, logit and probit coefficients require more intricate interpretation. Techniques like marginal standardization, prediction at the means, or prediction at the modes are necessary to convert them into probabilities (Angrist & Pischke, 2009; Freedman, 2008; Muller & MacLehose, 2014). Moreover, nonlinear models like logit and probit prove unsuitable when dealing with interaction terms or fixed effects, as in nested models (Beck, 2018; Freedman, 2008).

In a study conducted by Robin Gomila Gomila (2021), using the same data, comparing the results of linear and logistic regression, it produces the same P-value value up to 2 decimal places with fixed effects or not. The only difference is that the coefficient value in the logistic value needs

to be derived using the predict function. This aligns with previous study by Hellevik (2009), finding that the correlation between two sets of P-values was 0.9998, and in 90% of cases, the difference between P-values was less than 0.005. Overall, choosing linear regression over logit or probit does not involve any trade-offs in terms of statistical significance. Considering the ease of interpretation, the results are similar, and arguments related to the binary outcome in this study are variables related to psychology, namely, the individual's subjective condition related to happiness. This study used OLS to estimate the relationship between energy poverty and happiness rather than logistic regression.

In estimating equation (2), the author will estimate the relationship between energy poverty and happiness directly with or without control to see the relationship between the two without considering the resulting bias. Previous studies have found that energy poverty is negatively related to happiness (Churchill et al., 2020; Li et al., 2022; Zhang et al., 2021). Based on the estimation results, it is hoped that the relationship between the two will not differ from the previous study, where energy-poor individuals are more unhappy than non-energy-poor individuals. However, as previously discussed, there is an issue of endogeneity caused by unobserved heterogeneity, and the fixed effect method is used to correct the resulting bias (Kilburn et al., 2016). Based on the study background and empirical results of several similar studies. This study hypothesizes that energy poverty in individuals is negatively related to happiness; in other words, energy-poor individuals tend to be unhappy.

3. RESULTS AND DISCUSSION

The happiness variable is binary. As seen from Table 2, the average happiness is 0.913, or 91.3% of the individuals surveyed felt happy. Like the happiness variable, the energy poverty variable is also a binary variable with an average of 0.315 or 31.5% of the individuals surveyed are in an energy-poor condition.

The distribution of energy poverty conditions using the Multidimensional Energy Poverty Index (MEPI) approach from 2007 to 2014 has changed. Based on IFLS data waves 4 (2007) and 5 (2014), there is a decrease in energy poverty conditions in society.

Table 2. Summary of Research Variable Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Happiness	35836	0.913	0.282	0	1
Energy Poverty Status	35836	0.315	0.465	0	1
Years of schooling	35836	8.146	4.4	0	22
Age	35836	39.203	13.999	14	101
Age Squared	35836	1732.864	1227.909	196	10201
Marital Status	35836	0.78	0.414	0	1
Gender Head of Household	35836	0.123	0.329	0	1
Homeownership	35836	0.772	0.42	0	1
Income (log)	35836	13.302	0.76	10.814	16.815
Health Status	35836	0.821	0.383	0	1
Urban	35836	0.541	0.498	0	1

Source: IFLS-4 and IFLS-5 processed

Table 3 shows that in 2007, 42.84% of individuals surveyed were energy-poor, and in 2014, this changed to 20.16%. As a note, the energy poverty conditions in Table 3 use a cut-off of 0.33 from the MEPI index in both years. This illustrates that society is starting to experience changes in conditions and use more modern energy in everyday life.

Table 3. Energy Poor Conditions (MEPI) in 2007 and 2014 based on IFLS data

Year	Energy Poor Conditions (MEPI)		Total	% Energy Poor
	Yes	No		
2007	7.676	10.242	17.918	42.84%
2014	3.612	14.306	17.918	20.16%

Source: IFLS-4 and IFLS-5 processed

Based on Table 4, individuals who are not energy-poor tend to be happier. However, if we look at the composition of an energy-poor society, the number of happy individuals is not small. Therefore, the results of this comparison still need to be tested because many factors influence individual well-being, and the survey did not specifically link the questions to the conditions of energy poverty experienced by individuals.

Table 4. Comparison of Individual SWB

SWB	Energy Poor	Not Energy Poor	Total
Happy	9.822	22.899	32.725
Unhappy	1.466	1.649	3.115
Total	11.288	24.548	35.836

Source: IFLS4 and IFLS5 processed

Table 5 shows the estimation results using the common effect (CE) method to analyze the relationship between energy poverty and happiness. The relationship between energy poverty and happiness is observed with different controls. Column (1) is the result of estimating the relationship between energy poverty and happiness without a control variable to focus on seeing the relationship. Column (2) is the result of estimation by including control variables to ensure that other factors do not distort the relationship between energy poverty and happiness. Column (3) is the result of the estimation by controlling for individual effects, year effects, density effects, and observed control variables.

Table 5. Common and Fixed Effects results

Dependent variable = Happiness			
Variables	**Common effect without control**	**Common effect with control**	**Fixed Effect**
	(1)	**(2)**	**(3)**
Energy Poverty Status	-0.0627***	-0.0425***	-0.0142**
	(0.00354)	(0.00377)	(0.00601)
Years of schooling		0.00518***	-0.0000531
		(0.000405)	(0.00162)
Age		-0.00533***	0.00364
		(0.000607)	(0.00359)
Age Squared		0.00004***	-0.00004**
		(0.000008)	(0.0000174)
Marital Status		0.0733***	0.0716***
		(0.00435)	(0.00850)
Gender Head of Household		-0.0138***	-0.0273***
		(0.00489)	(0.00910)
Homeownership		0.0215***	0.00776
		(0.00363)	(0.00553)
Income (Log)		0.0201***	0.0147***
		(0.00249)	(0.00439)
Health Status		0.0937***	0.0523***
		(0.00385)	(0.00628)
Individual Effect	No	No	Yes
Year Effect	No	Yes	Yes
Density Effect	No	Yes	Yes
Observations	35,836	35,836	35,836
R-squared	0.011	0.060	17,918
Prob F-test	0.0000	0.0000	0.018

Note: *, ** and *** represent significance at 1%, 5% and 10% levels respectively
Source: Authors' calculations

Table 5 reports the estimation results from the three columns, energy poverty is negatively related to happiness. Column (1) shows that individuals in energy-poor conditions reduce their chances of being happy by 6.27% and are significant at 1%. When including control variables as in column (2), individuals with poor energy reduce their chances of being happy by 4.25% and are significant at 1%. In column (3), when controlling for individual, year, and density effects, individuals in energy-poor conditions reduce their happiness chances by 1.42% and are significant at 5%. The results, by including control and individual effects, can reduce the negative influence of energy poverty on happiness. These results confirm that the relationship between energy poverty and happiness contains unobserved heterogeneity. When using the fixed effect to handle unobserved variables that do not vary over time, the coefficient decreases from 4.25% to 1.42%.

Based on these findings, the association between energy poverty and subjective well-being, as evaluated by happiness level, is statistically significantly negative. In other words, those who are energy-poor are less happy than people who are not energy-poor or have access to contemporary energy. This finding is consistent with previous studies in Australia (Churchill et al., 2020) and China ((Li et al., 2022; Zhang et al., 2021)), this study concluded that energy poverty has a negative effect on happiness. With a coefficient that is not much different from the study in Australia of 1.68% and China around 0.4% - 7%. However, a previous study was conducted in developed countries; while Indonesia is a developing country, the coefficient of 1.42 is quite large, with high energy poverty in Indonesia.

The estimation results for the independent variables using the fixed effect for the variables of length of school, age, and home ownership have no significant effect on happiness. The direction of the education and home ownership coefficient is similar to previous studies, namely positive for happiness. However, in the context of this study, the higher one's education and home ownership do not make one's happiness increase. The results of the education variable align with previous studies that education does not directly affect one's happiness (Michalos, 2008). Indirect effects of education are seen in higher employment opportunities, better jobs, higher expected salaries, and better health (Cuñado & de Gracia, 2012).

The age variable has a positive relationship to happiness but is insignificant. In comparison, the age-squared variable has a significant negative relationship with happiness. This indicates that the relationship between age and happiness in this study is in the form of an inverted U, where when the age variable has a positive slope, that is, the older someone gets, the happier the individual tends to be, and at a certain age point it will decrease again based on the results of the squared age variable. These results are different from studies in general that look at the relationship between age and happiness. However, these results align with the study conducted by Alesina et al. (2004) and van Praag et al. (2000).

Marital status has a significant positive relationship to happiness with a coefficient of 0.0716, which means that individuals who are married have a 7.16% greater chance of being happy than individuals who are not (Arampatzi et al., 2018; Rodríguez-Pose & von Berlepsch, 2014; Sohn, 2013). The gender variable of the head of the household has a significant negative relationship with a coefficient of -0.0273. It means that someone with a female household head has a 2.73% lower chance of being happy than having a male household head. Generally, when a woman becomes the head of the household, it is caused by a divorce or the death of her husband. Thus, the family will be relatively deprived of attention from parents, and women must work to help the family economy.

The income as measured by per capita expenditure, has a significant positive relationship to happiness with a coefficient of 0.0147, which means that the higher the individual's income level, the greater the chance to be happy. This result aligns with the findings of Diener et al. (1985), Hori & Kamo (2018) and (Hardini & Wasiaturrahma, 2020) that the higher the income, the happier the individual is because higher income makes it easier to fulfill needs. Referring to the Easterlin Paradox, this study proves that in the short term, an increase in income will make a person happier, and besides that, it also proves that Indonesia is still a developing country; according to this theory, it will only apply to countries with low-income levels.

The health status variable has a significant positive relationship to happiness with a coefficient of 0.0523. This means that healthy individuals have a 5.23% greater chance of being happy than

unhealthy individuals, or in other words, healthy individuals are happier than unhealthy individuals. These results align with the study by Gerstenblüth & Rossi (2013) that perceptions of health are positively related to happiness.

Table 6. Estimating the Relationship between each indicator of Energy Poverty and Happiness

Dependent variable = Happiness						
Variables	**Cooking fuel**	**Indoor Pollution**	**Electricity Access**	**Refrigerator**	**TV/Radio**	**Phone/HP**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Energy poverty	-0.0160***	0.00575	-0.0246	-0.00936**	-0.0178***	-0.00190
	(0.00616)	(0.0211)	(0.0162)	(0.00448)	(0.00688)	(0.00542)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Density effect	Yes	Yes	Yes	Yes	Yes	Yes
Number of energy-poor individuals	11,154 (31.13%)	482 (1.35%)	756 (2.11%)	23,779 (66.36%)	5,552 (15.41%)	10,035 (28%)
Observations	35,836	35,836	35,836	35,836	35,836	35,836
R-squared	0.018	0.018	0.018	0.018	0.018	0.018
Number of ID	17,918	17,918	17,918	17,918	17,918	17,918

Note: *, ** and *** represent significance at 1%, 5% and 10% levels respectively
Source: Authors calculations

Table 6 shows the results of the fixed effect method estimation for each indicator of energy poverty with varying numbers of individuals. Only three indicators have a significant negative effect on happiness: individuals who still use wood fuel for cooking, do not have a refrigerator to store food and do not have a TV/Radio as a source of information. Meanwhile, the indicators, namely access to electricity, indoor pollution, individuals who cook at home using firewood, and those who do not have a landline or cell phone to communicate, do not significantly reduce happiness. This indicates that not all conditions of energy poverty make individuals unhappy, just as a study in Ghana (Lin & Okyere, 2021) found that not all energy poverty indicators harm a person's perception of their social status. In this study, it has no effect on happiness with indoor pollution and has a TV/Radio.

The results in Table 6 for the indicators in column 2 indicate that the activity of cooking with firewood indoors for some people is believed to make the food tastier (Akpalu et al., 2011; Tamire et al., 2018). Column 3 shows that not having access to electricity does not harm a person's happiness. This finding aligns with the study by Nasrudin et al. (2022) who examined the relationship between electricity access and happiness, where the direct effect of electricity access on happiness was negative and insignificant. However, the indirect influence of access to electricity on happiness by mediating the condition and facilities of the house has a positive influence on happiness. It can be concluded that most people feel unhappy if they do not have a refrigerator to store food and a TV to obtain information and entertainment.

Based on the heterogeneity test in rural and urban areas to investigate the relationship between energy poverty and SWB happiness, the results shown in Table 5 indicate that the negative effects of energy poverty on happiness are more pronounced in rural areas, where individuals experiencing energy poverty reduce their probability of happiness by 1.73%. While for urban areas, the negative effect is smaller but not statistically significant. That is, people with conditions far from adequate infrastructure development, which is generally felt in rural areas, tend to be unhappy compared to people who live in urban areas where infrastructure development and access to modern energy are easier to achieve (Utami & Hartono, 2022). This also indicates that policies on access to modern energy by providing subsidies must pay attention to the distribution process again so that people in rural areas can also feel the effects of these policies.

Table 7. Heterogeneity Estimation Results for Urban and Rural Areas

Dependent variable = Happiness		
Variables	**Urban**	**Rural**
	(1)	**(2)**
Energy poverty	-0.00366	-0.0173**
	(0.0112)	(0.00830)
Control variables	Yes	Yes
Year effect	Yes	Yes
Individual effect	Yes	Yes
Number of energy poverty	2,742	8,546
	(14.15%)	(51.93%)
Observations	19,379	16,457
R-squared	0.016	0.020
Number of ID	10,865	9,404

Note: *, ** and *** represent significance at 1%, 5% and 10% levels respectively
Source: Authors' calculations

The robustness test results in Table 8 show that the models at the cut-off of 0.33 and 0.2 had significant negative results at 5% and 1%, respectively. If using a cut-off of 0.4, which makes the poverty measure tight or makes fewer individuals categorized as energy-poor, then the results are the opposite of positive but not statistically significant.

Table 8. The results of the Robustness Estimation change the MEPI cut-off

Dependent variable = Happiness			
Variables	**Cut-off 0,33**	**Cut-off 0,2**	**Cut-off 0,4**
	(1)	**(2)**	**(3)**
Energy Poverty Status	-0.0142**	-0.0152***	0.00285
	(0.00601)	(0.00542)	(0.00653)
Control Variables	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Individual Effect	Yes	Yes	Yes
Density Effect	Yes	Yes	Yes
Number of Energy Poverty	11.288	14.930	7.235
	(31.50%)	(41.66%)	(20.19%)
Observations	35,836	35,836	35,836
R-squared	0.018	0.018	0.018
Number of id	17,918	17,918	17,918

Note: *, ** and *** represent significance at 1%, 5% and 10% levels respectively
Source: Authors' calculations

The consequence of using the Cut-off 0.4 is that individuals categorized as energy poor must at least fulfill 3 of the six deprivation score indicators. For example, individuals who use firewood for cooking, indoor pollution, and do not have a TV can be considered energy-poor. Meanwhile, if only two indicators, such as only using firewood and indoor pollution but having access to electricity and its derivatives, they are not included in the energy-poor category. In other words, the deeper a person's energy poverty level, the less it affects their happiness. This indicates that if the individual has adapted to the conditions of energy poverty experienced, the reported degree of happiness tends to be higher if the individual knows the bad condition. The factor of reluctance to switch to modern energy also occurs in several countries, such as in New Zealand, where people are more respectable if they use firewood for space heating compared to using heating units in winter (Cupples et al., 2007). Similarly, in Indonesia, Ethiopia, and Ghana, people believe that cooking using firewood makes food much tastier than cooking using LPG (Akpalu et al., 2011; Tamire et al., 2018).

To effectively address energy poverty, it is essential to understand the societal factors at play. Given that many individuals rely on traditional energy sources, it is necessary to implement strategic policies that encourage a transition to more sustainable options. Based on a previous study conducted by Dartanto (2013), the reallocation of subsidies to maintain fiscal stability has an impact

on increasing the absolute poverty rate in Indonesia and also highlights that energy subsidies, in general, are still not well targeted at groups in need in line with the study conducted by Khalid & Salman (2020) in Pakistan who recommend that subsidy distribution be more targeted at poor groups to improve community welfare and maintain fiscal space. Furthermore, providing subsidies to make modern energy accessible and affordable to all community members is crucial. These findings underscore the importance of a comprehensive approach to combat energy poverty.

4. CONCLUSIONS

This study reveals that the adverse impact of energy poverty on happiness is more pronounced in rural areas than in urban areas. While urban areas exhibit a statistically significant negative effect, it is less prominent than rural areas. This suggests that rural communities experiencing energy poverty are generally less content due to constraints in accessing modern energy. The primary issue in alleviating this poverty is the unequal distribution, particularly in rural areas. Thus, addressing energy poverty at hard-to-reach locations becomes imperative, especially considering the exclusion of eastern parts of Indonesia, such as the Maluku Islands and provinces on the island of Papua, from the survey sample. The study delves into the subjective aspect of society concerning energy poverty, finding a negative correlation with people's happiness. Consequently, strategic government efforts are essential to eradicate energy poverty evenly, enhancing overall quality of life (Nussbaumer et al., 2012; Welsch & Biermann, 2017).

Results from specific tests offer a foundation for policies prioritizing alleviating energy poverty. These include initiatives to enhance access to modern cooking fuels like LPG or electric stoves and affordable electricity for household utilities. The distribution poses a challenge, primarily affecting groups in need. Notably, prevalent energy poverty in Indonesia signals the necessity for targeted subsidy evaluations, acknowledging distribution challenges. Study indicates that more than government energy prices are needed to prompt a transition to modern energy sources, particularly in rural areas. Thus, improving access and affordability of modern energy remains imperative. In differentiating between rural and urban areas, the study identifies that rural areas experience more pronounced adverse effects of energy poverty on happiness. This disparity can be attributed to challenging distribution dynamics in Indonesia's archipelagic geography, where development is uneven. Urgent diversification of policies is crucial, involving regional and village governments and communities to ensure equitable distribution and alleviate energy poverty in hard-to-reach areas. This study underscores that efforts to eradicate energy poverty are tantamount to enhancing people's quality of life and achieving their life goals, particularly in attaining happiness.

Notably, the study needs to be more robust in fully addressing the endogeneity of the energy poverty variable due to challenges in finding suitable instrumental variables (IV) with the survey data. Although several studies use energy prices as IV, this approach is not applicable in Indonesia, where energy prices remain constant across years and regions. Consequently, the study can only analyze the directional relationship between energy poverty and happiness without conclusively establishing causation. Additionally, the dataset is based on 2-wave panel data from the IFLS4 (2007) and IFLS5 (2014) surveys, reflecting conditions up to 2014, as the latest survey data had yet to be published.

REFERENCES

Abbas, K., Li, S., Xu, D., Baz, K., & Rakhmetova, A. (2020). Do socioeconomic factors determine household multidimensional energy poverty? Empirical evidence from South Asia. *Energy Policy*, *146*, 111754. https://doi.org/10.1016/j.enpol.2020.111754

Acharya, R. H., & Sadath, A. C. (2019). Energy poverty and economic development: Household-level evidence from India. *Energy and Buildings*, *183*, 785–791. https://doi.org/10.1016/j.enbuild.2018.11.047

Akpalu, W., Dasmani, I., & Aglobitse, P. B. (2011). Demand for cooking fuels in a developing country: To what extent do taste and preferences matter? *Energy Policy*, *39*(10), 6525–6531. https://doi.org/10.1016/j.enpol.2011.07.054

Alesina, A., Di Tella, R., & MacCulloch, R. (2004). Inequality and happiness: are Europeans and Americans different? *Journal of Public Economics*, *88 (9–10)*, 2009–2042.

Arampatzi, E., Burger, M. J., & Novik, N. (2018). Social Network Sites, Individual Social Capital and Happiness. *Journal of Happiness Studies*, *19*(1), 99–122. https://doi.org/10.1007/s10902-016-9808-z

Awaworyi Churchill, S., & Mishra, V. (2017). Trust, Social Networks and Subjective Wellbeing in China. *Social Indicators Research*, *132*(1), 313–339. https://doi.org/10.1007/s11205-015-1220-2

Awaworyi Churchill, S., & Smyth, R. (2020). Ethnic diversity, energy poverty and the mediating role of trust: Evidence from household panel data for Australia1. *Energy Economics*, *86*. https://doi.org/10.1016/j.eneco.2020.104663

Awaworyi Churchill, S., Smyth, R., & Farrell, L. (2020). Fuel poverty and subjective wellbeing. *Energy Economics*, *86*. https://doi.org/10.1016/j.eneco.2019.104650

Biswas-Diener, R., & Diener, E. (2009). *Making the Best of a Bad Situation: Satisfaction in the Slums of Calcutta* (pp. 261–278). https://doi.org/10.1007/978-90-481-2352-0_13

Csikszentmihalyi, M. (2000). Happiness, flow, and economic equality. *American Psychologist*, *55*(10), 1163–1164. https://doi.org/10.1037/0003-066X.55.10.1163

Cuñado, J., & de Gracia, F. P. (2012). Does Education Affect Happiness? Evidence for Spain. *Social Indicators Research*, *108*(1), 185–196. https://doi.org/10.1007/s11205-011-9874-x

Cupples, J., Guyatt, V., & Pearce, J. (2007). "Put on a jacket, you wuss": cultural identities, home heating, and air pollution in Christchurch, New Zealand. *Environment and Planning A*, *39*(12), 2883–2898.

Dartanto, T. (2013). Reducing fuel subsidies and the implication on fiscal balance and poverty in Indonesia: A simulation analysis. *Energy Policy*, *58*, 117–134. https://doi.org/10.1016/j.enpol.2013.02.040

Diener, E. (1984). Subjective well-being. *Psychological Bulletin*, *95*(3), 542–575. https://doi.org/10.1037/0033-2909.95.3.542

Diener, E., Horwitz, J., & Emmons, R. A. (1985). Happiness of the very wealthy. *Social Indicators Research*, *16*(3), 263–274. https://doi.org/10.1007/BF00415126

Diener, E., Lucas, R. E., & Scollon, C. N. (2009). *Beyond the Hedonic Treadmill: Revising the Adaptation Theory of Well-Being* (pp. 103–118). https://doi.org/10.1007/978-90-481-2350-6_5

Diener, E., & Oishi, S. (2000). Money and happiness: Income and subjective well-being across nations. *Culture and Subjective Well-Being*, 185–218.

Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, *125*(2), 276–302. https://doi.org/10.1037/0033-2909.125.2.276

Diener, E., Tay, L., & Myers, D. G. (2011). The religion paradox: If religion makes people happy, why are so many dropping out? *Journal of Personality and Social Psychology*, *101*(6), 1278.

DJPB Kemenkeu RI. (2022). *Laporan Keuangan Pemerintah Pusat Tahun 2021 Audited*.

Ed, D., & Katherine, R. (2009). Subjective well-being : a general overview. *South African Journal of Psychology*, *39*(4), 391–406. https://doi.org/10.10520/EJC98561

Ferrer-i-Carbonell, A., & Frijters, P. (2004). How Important is Methodology for the Estimates of the Determinants of Happiness? *The Economic Journal*, *114*(497), 641–659. https://doi.org/10.1111/j.1468-0297.2004.00235.x

Forgeard, M. J. C. (2011). Happy people thrive on adversity: Pre-existing mood moderates the effect of emotion inductions on creative thinking. *Personality and Individual Differences*, *51*(8), 904–909. https://doi.org/10.1016/j.paid.2011.07.015

Frankel, B. G., & Hewitt, W. E. (1994). Religion and well-being among Canadian university students: The role of faith groups on campus. *Journal for the Scientific Study of Religion*, 62–73.

Gomila, R. (2021). Logistic or linear? Estimating causal effects of experimental treatments on binary outcomes using regression analysis. *Journal of Experimental Psychology: General*, *150*(4), 700–709. https://doi.org/10.1037/xge0000920

Hardini, M., & Wasiaturrahma, W. (2020). Social capital dimensions and individual happiness in Indonesia: The micro-level study. *Jurnal Ekonomi Pembangunan*, *18*(2), 147–162. https://doi.org/10.29259/jep.v18i2.12753

Hellevik, O. (2009). Linear versus logistic regression when the dependent variable is a dichotomy. *Quality & Quantity*, *43*(1), 59–74. https://doi.org/10.1007/s11135-007-9077-3

Helliwell, J. F., Huang, H., & Wang, S. (2015). The geography of world happiness. *World Happiness Report*, *2015*, 12–41.

Hori, M., & Kamo, Y. (2018). Gender Differences in Happiness: the Effects of Marriage, Social Roles, and Social Support in East Asia. *Applied Research in Quality of Life*, *13*(4), 839–857. https://doi.org/10.1007/s11482-017-9559-y

Kementerian ESDM. (2022). *HANDBOOK OF ENERGY & ECONOMIC STATISTICS OF INDONESIA 2021*. Https://Www.Esdm.Go.Id/Assets/Media/Content/Content-Handbook-of-Energy-and-Economic-Statistics-of-Indonesia-2021.Pdf.

Khalid, S. A., & Salman, V. (2020). "Welfare impact of electricity subsidy reforms in Pakistan: A micro model study." *Energy Policy*, *137*, 111097. https://doi.org/10.1016/j.enpol.2019.111097

Kilburn, K., Handa, S., Angeles, G., Mvula, P., & Tsoka, M. (2016). *Happiness and alleviation of income poverty: Impacts of an unconditional cash transfer programme using a subjective well-being approach*.

Kimemia, D., & Van Niekerk, A. (2017). Cookstove options for safety and health: Comparative analysis of technological and usability attributes. *Energy Policy*, *105*, 451–457. https://doi.org/10.1016/j.enpol.2017.03.022

Koomson, I., & Danquah, M. (2021). Financial inclusion and energy poverty: Empirical evidence from Ghana. *Energy Economics*, *94*, 105085.

Kopsov, I. (2019). A New Model of Subjective Well-Being. *The Open Psychology Journal*, *12*(1), 102–115. https://doi.org/10.2174/1874350101912010102

Lama, D. (2009). *The art of happiness: A handbook for living*. Penguin.

Li, Y., Ning, X., Wang, Z., Cheng, J., Li, F., & Hao, Y. (2022). Would energy poverty affect the wellbeing of senior citizens? Evidence from China. *Ecological Economics*, *200*. https://doi.org/10.1016/j.ecolecon.2022.107515

Lin, B., & Okyere, M. A. (2021). Does energy poverty affect the well-being of people: Evidence from Ghana. In *Sustainable Production and Consumption* (Vol. 28, pp. 675–685). Elsevier B.V. https://doi.org/10.1016/j.spc.2021.06.031

Lyubomirsky, S., & Dickerhoof, R. (2005). Subjective well-being. *Handbook of Girls' and Women's Psychological Health: Gender and Wellbeing across the Life Span*, 166–174.

Mahmood, R., & Shah, A. (2017). Deprivation counts: An assessment of energy poverty in Pakistan. *The Lahore Journal of Economics*, *22*(1), 109.

Mendoza, C. B., Cayonte, D. D. D., Leabres, M. S., & Manaligod, L. R. A. (2019). Understanding multidimensional energy poverty in the Philippines. *Energy Policy*, *133*, 110886. https://doi.org/10.1016/j.enpol.2019.110886

Michalos, A. C. (2008). Education, Happiness and Wellbeing. *Social Indicators Research*, *87*(3), 347–366. https://doi.org/10.1007/s11205-007-9144-0

Mohanty, M. S. (2009). Effects of positive attitude on happiness and wage: Evidence from the US data. *Journal of Economic Psychology*, *30*(6), 884–897. https://doi.org/10.1016/j.joep.2009.08.010

Nasrudin, R., Quarina, Q., & Dartanto, T. (2022). Revisiting the Energy-Happiness Paradox: A Quasi-Experimental Evidence of Electricity Access in Indonesia. *Journal of Happiness Studies*, *23*(7), 3549–3576. https://doi.org/10.1007/s10902-022-00567-6

Nussbaumer, P., Bazilian, M., & Modi, V. (2012). Measuring energy poverty: Focusing on what matters. *Renewable and Sustainable Energy Reviews*, *16*(1), 231–243. https://doi.org/10.1016/j.rser.2011.07.150

Ogwumike, F. O., & Ozughalu, U. M. (2016). Analysis of energy poverty and its implications for sustainable development in Nigeria. *Environment and Development Economics*, *21*(3), 273–

290.
Rodríguez-Pose, A., & von Berlepsch, V. (2014). Social Capital and Individual Happiness in Europe. *Journal of Happiness Studies*, *15*(2), 357–386. https://doi.org/10.1007/s10902-013-9426-y
Sadath, A. C., & Acharya, R. H. (2017). Assessing the extent and intensity of energy poverty using Multidimensional Energy Poverty Index: Empirical evidence from households in India. *Energy Policy*, *102*, 540–550.
Sambodo, M. T., & Novandra, R. (2019). The state of energy poverty in Indonesia and its impact on welfare. *Energy Policy*, *132*, 113–121. https://doi.org/10.1016/j.enpol.2019.05.029
Schwarz, N., & Strack, F. (1999). Reports of subjective well-being: Judgmental processes and their methodological implications. In *Well-being: The foundations of hedonic psychology.* (pp. 61–84). Russell Sage Foundation.
Sheldon, K. M., & Houser-Marko, L. (2001). Self-concordance, goal attainment, and the pursuit of happiness: Can there be an upward spiral? *Journal of Personality and Social Psychology*, *80*(1), 152.
SOHN, K. (2013). SOURCES OF HAPPINESS IN INDONESIA. *The Singapore Economic Review*, *58*(02), 1350014. https://doi.org/10.1142/S0217590813500148
Strauss, J., Witoelar, F., & Sikoki, B. (2016). *The fifth wave of the Indonesia family life survey: overview and field report* (Vol. 1). Rand Santa Monica, CA, USA.
Tamire, M., Addissie, A., Skovbjerg, S., Andersson, R., & Lärstad, M. (2018). Socio-Cultural Reasons and Community Perceptions Regarding Indoor Cooking Using Biomass Fuel and Traditional Stoves in Rural Ethiopia: A Qualitative Study. *International Journal of Environmental Research and Public Health*, *15*(9), 2035. https://doi.org/10.3390/ijerph15092035
Teariki, M. A., Tiatia, R., O'Sullivan, K., Puloka, V., Signal, L., Shearer, I., & Howden-Chapman, P. (2020). Beyond home: Exploring energy poverty among youth in four diverse Pacific island states. *Energy Research & Social Science*, *70*, 101638. https://doi.org/10.1016/j.erss.2020.101638
Utami, C. N., & Hartono, D. (2022). A multidimensional energy poverty in Indonesia and its impact on health. *International Energy Journal*, *22*(2), 147–156.
Van Praag, B. M. S., Frijters, P., & Ferrer-i-Carbonell, A. (2000). A structural model of well-being: With an application to German data. *FEE, Universiteit Van Amsterdam Working Paper*.
Wang, J.-H. (2015). Happiness and Social Exclusion of Indigenous Peoples in Taiwan - A Social Sustainability Perspective. *PLOS ONE*, *10*(2), e0118305. https://doi.org/10.1371/journal.pone.0118305
Welsch, H., & Biermann, P. (2017). Energy Affordability and Subjective Well-Being: Evidence for European Countries. *The Energy Journal*, *38*(3). https://doi.org/10.5547/01956574.38.3.hwel
Yarkoni, T., & Westfall, J. (2017). Choosing Prediction Over Explanation in Psychology: Lessons From Machine Learning. *Perspectives on Psychological Science*, *12*(6), 1100–1122. https://doi.org/10.1177/1745691617693393
Zhang, Q., Appau, S., & Kodom, P. L. (2021). Energy poverty, children's wellbeing and the mediating role of academic performance: Evidence from China. *Energy Economics*, *97*. https://doi.org/10.1016/j.eneco.2021.105206
Zhang, Q., & Awaworyi Churchill, S. (2020). Income inequality and subjective wellbeing: Panel data evidence from China. *China Economic Review*, *60*. https://doi.org/10.1016/j.chieco.2019.101392