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# Electricity Capacity Upgrade from 450 to 900 VA and Life Satisfaction of BPBL Recipients

**Andika Nugraha Putra***
Universitas Indonesia, Indonesia

**Muhammad Halley Yudhistira**
Universitas Indonesia, Indonesia

***Corresponding author:**
Andika Nugraha Putra, Universitas Indonesia, Indonesia. ✉ andinuputra@gmail.com

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**Abstract**

**Background:** Electricity is a basic necessity that supports household welfare. Through the New Electricity Connection Assistance Program (*Bantuan Pasang Baru Listrik*, BPBL), the Indonesian Ministry of Energy and Mineral Resources provides free electricity connections to underprivileged households. In 2023, the electricity capacity provided to BPBL recipients was increased from 450 volt-amperes (VA) to 900 VA.
**Objective:** This study examines whether the increase in electricity capacity is associated with differences in personal and social life satisfaction among BPBL recipients.
**Methods:** The study used primary survey data from 615 BPBL recipient households across the 2022 and 2023 cohorts. Propensity score matching (PSM) was performed using three methods: nearest-neighbor matching, radius caliper matching, and kernel matching. Matching quality was assessed based on covariate balance and common support.
**Results:** The increase in electricity capacity was consistently associated with higher social life satisfaction across all three matching methods, with estimated effects ranging from approximately 9% to 17%. For personal life satisfaction, a statistically significant effect was identified only using radius caliper matching, with an estimated effect of 7.5%; the estimates from nearest-neighbor and kernel matching were not statistically significant.
**Conclusion:** The increase in electricity capacity from 450 VA to 900 VA showed a more robust association with social life satisfaction than with personal life satisfaction. Future evaluations should consider longer observation periods to assess whether benefits in the personal domain emerge over time.

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## INTRODUCTION

Electricity is a basic necessity for communities and can serve as a means of improving living standards. Access to electricity enables people to engage in economic activities, obtain information, and support children's learning. The government also pays special attention to the provision of electricity. Law Number 30 of 2009 concerning Electricity mandates that electricity development aims to ensure the availability of an adequate electricity supply of good quality at reasonable prices to improve the welfare and prosperity of the people fairly and equitably and to promote sustainable development. However, government efforts to provide electricity have not yet reached all segments of the population, particularly disadvantaged households that face financial constraints in becoming customers of the state-owned electricity utility, Perusahaan

Listrik Negara (PLN). According to data from the 2023 National Socioeconomic Survey (*Survei Sosial Ekonomi Nasional*, Susenas), 3.2 million households had access to electricity but were not PLN customers. In response, the government has implemented the Electricity New Installation Assistance Program (*Bantuan Pasang Baru Listrik*, BPBL) using state budget funds since 2022. The BPBL Program provides assistance with electrical installations, electrical installation inspections, and connections to PLN's electricity network, enabling beneficiaries to become PLN customers. However, beneficiaries are responsible for paying their own electricity consumption costs. In addition to expanding access to electricity and enabling greater electricity consumption, the government expects this assistance to improve the living standards and independence of recipient households. According to the Ministry of Energy and Mineral Resources (2023), "The Electricity New Installation Assistance Program (BPBL) from the Ministry of Energy and Mineral Resources (ESDM) helps people who cannot afford to install electricity for free. This program is also one of the many efforts to equalize access to electricity throughout the archipelago to increase the electrification ratio which is expected to improve people's living standards and independence." To further support the objectives of the BPBL Program, the electricity connection capacity provided to recipient households was increased from 450 volt-amperes (VA) to 900 VA in 2023.

The increased electricity connection capacity is expected to enable beneficiary households to make greater use of electrical appliances for domestic, social, and educational purposes, as well as for economic activities, ultimately improving their welfare. Statistics Indonesia (*Statistik*, BPS) uses happiness indicators to measure population welfare. BPS employs happiness as an indicator for assessing the impact of public policies on well-being (Forgeard et al., 2011; Gordon, 2024). This approach is based on the premise that the Happiness Index encompasses the components that constitute well-being: (1) ten major life domains, based on the life satisfaction domain framework developed by Cummins (1996) and Bühler et al. (2026) ; (2) feelings or emotional states, measured using the positive and negative affect scales developed by Diener et al. (2010) and Burns and Crisp (2026); and (3) meaning in life, consistent with the concept of meaningfulness in Seligman (2011) and Lomas et al. (2023) theory of well-being. The theoretical basis for using happiness indicators as a measure of well-being draws on hedonic psychology (Ananda et al., 2023; Kahneman et al., 1999) .

This study examines the association between differences in electricity connection capacity received by BPBL Program beneficiaries in 2022 and 2023 and their life satisfaction. The primary data were obtained from the 2024 Program Evaluation and Impact Analysis Survey of the Electricity New Installation Assistance Program, conducted by the Ministry of Energy and Mineral Resources. The survey was designed with reference to the provisions of Ministerial Regulation No. 14 of 2017 concerning Guidelines for the Preparation of Community Satisfaction Surveys for Public Service Provider Units (*Peraturan Menteri Pendayagunaan Aparatur Negara dan Reformasi Birokrasi Nomor 14 Tahun 2017*). The survey questions covered ten domains constituting the life satisfaction dimension. To reduce observable selection bias when comparing recipients with different electricity connection capacities, the study employed the Propensity Score Matching (PSM) method.

Numerous studies have demonstrated the need for government intervention to expand electricity access among disadvantaged communities and have examined the effects of electricity access on well-being. A meta-analysis of rural electrification studies in developing countries found that household electrification has significant positive effects on education, employment, income, time use, and women's empowerment. The findings suggest that financial support remains necessary to ensure that disadvantaged communities can continue to access electricity, which, in the long term, may encourage the development of small-scale economic activities and improve community well-being (Ayana & Degaga, 2022). From a policy perspective, access to electricity plays an important role in improving living conditions. Poor households should have the freedom to determine their level of electricity consumption according to their basic needs. Consistent with the framework of basic household energy needs for achieving a decent quality of life, electricity is considered an essential service that should be accessible, adequate, affordable, reliable, and sustainable to meet basic needs related to health, education, and mobility. Thus, expanding electricity access for disadvantaged groups not only improves living conditions but also enhances their capabilities to escape poverty (Shyu, 2024). Empirical evidence from developing countries

further supports this relationship: household electrification has been shown to alter beneficiaries' time allocation, enabling them to devote more time to productive activities such as studying and working (Grogan, 2018; Gupta et al., 2025). In Indonesia, electrification has also been found to significantly reduce rural poverty and increase household nonfood expenditure (Ikhsan & Amri, 2022). The Electricity New Installation Assistance Program represents an effort to expand electricity access among people in disadvantaged areas. Such access may influence poverty-related outcomes through several channels, including household expenditure, occupational choices, household income, and overall household welfare (Salac et al., 2024; Wirawan & Gultom, 2021).

Providing access to electricity may enable people to allocate more time to productive activities, such as children's learning and parents' income-generating activities. At the aggregate level, these changes may contribute to improvements in regional economic performance.

Regarding the relationship between electricity supply and subjective well-being, previous studies have reported mixed findings. Research in Indonesia using the 2017 Happiness Index and electricity access data found an association between electricity access and happiness, particularly in disadvantaged areas (Nasrudin et al., 2022). In contrast, Okulicz-Kozaryn and Altman (2020) and Renanita and Rembulan (2025), using per capita electricity consumption data from countries in Europe and the Americas for the period 2000–2009, found no direct relationship between electricity consumption and happiness. These studies generally examined populations with heterogeneous economic and regional characteristics and primarily focused on differences in electricity access or consumption. The present study differs by examining households that had already received electricity through the same BPBL assistance program but had been provided with different connection capacities, namely 450 VA and 900 VA. It therefore focuses specifically on whether an increase in electricity connection capacity is associated with differences in life satisfaction.

Although these studies establish a link between electricity access and well-being, they largely compare electrified and nonelectrified households drawn from populations with heterogeneous economic and regional backgrounds. An important question remains unanswered: among households that already have electricity access through a single assistance program, does a further increase in electricity connection capacity from 450 VA to 900 VA yield measurable gains in life satisfaction? This intensive-margin question is the focus of the present study, which examines beneficiaries of the BPBL Program.

The demographic characteristics of recipients are also considered in the study's analytical model. The literature indicates that gender is associated with life satisfaction, although the direction of this relationship varies across age groups and regions (Hong et al., 2025; Joshanloo & Jovanović, 2020). Research on subjective well-being in Indonesia has likewise identified differences in patterns across age groups (Khoirunnisa & Nurchayati, 2023; Tomo & Pierewan, 2018). Accordingly, gender and age are included as covariates in the probit regression model used in this study.

## METHOD

This study used primary data from the survey conducted as part of the Study Survey Activities and Preparation of the Roadmap for the Electricity New Installation Assistance Program. The survey was conducted in the provinces where the BPBL Program was implemented in 2022 and 2023. The study employed a multistage sampling approach involving simple random sampling at the regency/municipality and village levels, followed by simple random sampling at the household level. A total of 615 households were randomly selected for the survey.

In this evaluation, treatment status was defined according to the electricity connection capacity received under the BPBL Program. Households that received the increased connection capacity of 900 VA (the 2023 cohort) were assigned to the treatment group, whereas households that received 450 VA (the 2022 cohort) served as the control group. Because the connection capacity was determined administratively at the time of installation, before the measurement of life satisfaction in the 2024 survey, treatment status was established before the outcomes were observed. This temporal ordering supported the counterfactual interpretation of the matching estimates, although it did not, by itself, establish that treatment assignment was independent of

potential outcomes or eliminate unobserved confounding.

**Table 1**
*Sampling Distribution Data Per Provision of Implementation Study Surveys and BPBL Roadmap*

| NO | PROVINCE | Number of Samples | | | NO | PROVINCE | Number of Samples | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2022 | 2023 | TOTAL | | | 2022 | 2023 | TOTAL |
| 1 | ACEH | 7 | 15 | 22 | 18 | MALUKU | 10 | 5 | 15 |
| 2 | BANTEN | 7 | 8 | 15 | 19 | NORTH | | 8 | 8 |
| 3 | BENGKULU | 0 | 9 | 9 | 20 | WEST NUSA | | | |
| 4 | SPECIAL | | | | | TENGGARA | 0 | 8 | 8 |
| | DISTRICTS | 2 | 9 | 11 | 21 | EAST NUSA | 10 | 7 | 17 |
| 5 | GORONTALO | 0 | 9 | 9 | 22 | PAPUA | 8 | 3 | 11 |
| 6 | JAMBI | 0 | 6 | 6 | 23 | PA | 2 | 8 | 10 |
| 7 | WEST JAVA | 10 | 71 | 81 | 24 | RIAU | 9 | 6 | 15 |
| 8 | CENTRAL JAVA | 33 | 25 | 58 | 25 | WEST | 0 | 8 | 8 |
| 9 | EAST JAVA | 37 | 41 | 78 | 26 | SOUTH | 10 | 17 | 27 |
| 10 | WEST | 8 | 32 | 40 | 27 | CENTRAL | | 8 | 8 |
| 11 | SOUTH | 12 | 6 | 18 | 28 | SOUTHEAST | 4 | 10 | 14 |
| 12 | CENTRAL | 7 | 13 | 20 | 29 | NORTH | 0 | 8 | 8 |
| 13 | EAST | 4 | 4 | 8 | 30 | WEST | 0 | 8 | 8 |
| 14 | NORTH | 5 | 4 | 9 | 31 | SOUTH | 6 | 11 | 17 |
| 15 | BANGKA | | | | 32 | NORTH | 12 | 12 | 24 |
| | ISLANDS | 1 | 6 | 7 | TOTAL | | 204 | 411 | 615 |
| 16 | RIAU ISLANDS | 0 | 15 | 15 | | | | | |
| 17 | LAMPUNG | 0 | 11 | 11 | | | | | |

The conceptual framework of this study was based on the research conducted by Nasrudin et al. (2022), which found an association between access to electricity and happiness, particularly among people living in disadvantaged areas. Their conceptual framework suggested that happiness was associated with electricity access, individual and household characteristics, and regional characteristics. Accordingly, the analytical framework for the present study considered the following variables: the happiness or life satisfaction outcome, electricity connection status or capacity, individual and household characteristics, and regional characteristics. In the framework of Nasrudin et al. (2022), the outcome variable (Yj) represented the happiness index, measured on a scale ranging from 0 to 10; electricity status (Ei) indicated whether a household had access to electricity; individual and household covariates (Xi) included age, gender, educational attainment, and income; and regional covariates (Rj) included urban or rural residence, island or regional location, and the Gini index.

The principal difference between the present study and that of Nasrudin et al. (2022) was the study population and the treatment of electricity access. Whereas the earlier study examined differences in electricity access and happiness, the present study focused exclusively on households that had obtained electricity through the BPBL Program but had received different connection capacities: 450 VA or 900 VA. Using responses to the questionnaire administered through the Study Survey Activities and Preparation of the Roadmap for the Electricity New Installation Assistance Program, the study examined differences in personal and social life satisfaction associated with the increase in electricity connection capacity. The Propensity Score Matching (PSM) method was used to match households in the treatment and control groups based on their estimated propensity scores. Three matching algorithms were employed: nearest-neighbor matching, kernel matching, and radius matching with a caliper.

The two outcome variables were personal life satisfaction and social life satisfaction, which constituted components of the Life Satisfaction Index used by Statistik (2021) and Bühler et al. (2026). Personal life satisfaction captured individuals' assessments of predominantly private life domains, including education and skills, employment, household income, health, and housing

and asset conditions. Social life satisfaction captured assessments of socially oriented domains, including harmony in family relationships, availability of leisure time, social relationships within the community, environmental conditions, and personal security. Each of the ten domains was measured on a scale ranging from 1 (very dissatisfied) to 10 (very satisfied), following the BPS Happiness Index instrument. The domain scores were averaged to obtain the personal and social life satisfaction subindices, which were then normalized to a range of 0–1, with higher values indicating greater satisfaction. The survey instrument was developed with reference to the Community Satisfaction Survey guidelines established under Ministerial Regulation No. 14 of 2017 (*Peraturan Menteri Pendayagunaan Aparatur Negara dan Reformasi Birokrasi Nomor 14 Tahun 2017*) and applied by the Ministry of Energy and Mineral Resources (ESDM) in the 2024 survey.

Based on the conceptual framework and the research objectives, the hypotheses were formulated as follows: (1) H0: Personal and social life satisfaction did not differ significantly between BPBL recipients who received a 450-VA electricity connection and those who received a 900-VA electricity connection; (2) H1: Personal and social life satisfaction was higher among BPBL recipients who received a 900-VA electricity connection than among those who received a 450-VA electricity connection.

## RESULTS AND DISCUSSION

The propensity score matching (PSM) method was used in this study to examine whether the increase in electricity connection capacity received by BPBL recipient households was associated with higher levels of life satisfaction. Life satisfaction was assessed in two dimensions: personal life satisfaction and social life satisfaction. In the first step, a preliminary test of differences between variables was conducted to examine whether there was an initial indication of an association between electricity connection capacity and life satisfaction. The results are presented below.

**Table 2**
*Results of Different Tests of Variables Relationship between Electrical Power and Life Satisfaction*

| No | Variable Test | Diff | t-stat |
|---|---|---|---|
| 1 | Electric Power and Social Life Satisfaction | 0.0940** | 2.77 |
| 2 | Electric Power and Personal Life Satisfaction | 0.0749 | 1.90 |

Based on the preliminary tests of differences, electricity connection capacity was significantly associated with social life satisfaction at the 1% significance level, with a t-statistic of 2.77. Therefore, the null hypothesis ($H_0$) could be rejected for this outcome. In contrast, the association between electricity connection capacity and personal life satisfaction was not statistically significant at the 5% level; therefore, the null hypothesis could not be rejected. The next step was to compare the numbers of households in the control and treatment groups.

**Table 3**
*Comparison of Control and Treatment Groups*

| Treatment | Electric Power and Life Satisfaction |
|---|---|
| Control Group | 204 |
| Treatment Group | 411 |

After the numbers of households in the control and treatment groups were established, propensity scores were estimated to facilitate the construction of a counterfactual comparison. This step involved estimating a probit regression model in which treatment assignment was the dependent variable and the observed covariates were the independent variables. The resulting propensity scores represented the estimated probabilities of households receiving the treatment, conditional on their observed characteristics. The results are presented below.

After data cleaning, the analysis included 615 households: 204 in the 450 VA control group and 411 in the 900 VA treatment group. This total is consistent across the abstract, the sampling distribution presented in Table 1, and the group comparison presented in Table 3.

**Table 4**
*Probit Regression Results*

| Electric Power | Coefficient | z | P>\|z\| | [G5% conf interfal] | |
|---|---|---|---|---|---|
| Sex | .1222 | 1.10 | 0.273 | -.0964 | .3410 |
| Age | .0117 | 0.10 | 0.920 | -.2174 | .2409 |
| Education | .0001 | 0.00 | 0.998 | -.1364 | .1368 |
| Revenue | .3095 | 2.84 | 0.004** | .0960 | .5230 |
| Village | .1903 | 1.15 | 0.250 | -.1340 | .5146 |
| IndexGini | .0023 | 0.02 | 0.986 | -.2720 | .2767 |
| DummyIsland1 | -.0985 | -0.51 | 0.608 | -.4750 | .2778 |
| DummyIsland2 | -.3860 | -2.27 | 0.023* | -.7199 | -.0521 |
| DummyIsland3 | -.5736 | -2.38 | 0.017* | -1046 | -.1010 |
| DummyIsland4 | 0 | Omitted | | | |
| _cons | .2858 | 0.91 | 0.362 | -.3288 | .9004 |

*p <0.05 **p <0.01

The same set of observed covariates was used to estimate propensity scores for comparing the 450 VA control group with the 900 VA treatment group. Personal life satisfaction and social life satisfaction were analyzed as separate outcome variables. The probit regression results indicate that treatment assignment was significantly associated with household income and two regional dummy variables, whereas the remaining covariates were not statistically significant. The purpose of the propensity score model was not to explain the outcome variables directly but to estimate the probability of receiving the treatment conditional on observed demographic, economic, and regional characteristics. The subsequent covariate balance assessment was therefore conducted to determine whether matching reduced differences in the distributions of these observed covariates between the treatment and control groups. Improved covariate balance increases the comparability of the two groups and reduces observable selection bias, although it does not transform the observational design into a randomized experiment.

Two key identifying assumptions underlie the PSM design. First, the conditional independence assumption, also known as unconfoundedness, requires that the potential outcomes be independent of treatment assignment conditional on the observed covariates. In this study, this assumption was approximated by matching households on propensity scores estimated from demographic, economic, and regional covariates. Second, the common support (overlap) assumption requires sufficient overlap between the propensity score distributions of the treatment and control groups so that treated households can be matched to comparable control households. Matching quality was therefore assessed using t-tests, standardized bias (standardized mean differences) before and after matching, and an examination of the common support region. The mean standardized bias decreased from 38.3% before matching to 18.3% after matching, falling below the 25% threshold and indicating a substantial improvement in covariate balance (Kurz et al., 2024; Zhang et al., 2019).

**Table 5**
*Balancing Test Results*

| Variable | p>\|t\| | |
|---|---|---|
| | Unmatched | Matched |
| Sex | 0.260 | 0.648 |
| Age | 0.729 | 0.432 |
| Education | 0.616 | 0.964 |
| Revenue | 0.012** | 0.671 |
| Village | 0.500 | 0.577 |
| Gini | 0.445 | 0.922 |
| Island Dummy 1 | 0.110 | 0.910 |
| Island Dummy 2 | 0.072* | 0.669 |
| Island Dummy 3 | 0.115 | 0.539 |

| Variable | p>\|t\| | |
|---|---|---|
| | Unmatched | Matched |
| Dummy Island 4 | 0.074* | 0.864 |

The balance test results show that the mean standardized bias between the treatment and control groups decreased from 38.3% before matching to 18.3% after matching, below the maximum threshold of 25%. Furthermore, the t-tests conducted before and after matching indicate that none of the observed covariates differed significantly between the treatment and control groups after matching. This improvement suggests that matching reduced observable differences between the groups and helped mitigate potential selection bias in the PSM estimates. However, nonsignificant t-test results alone do not establish adequate covariate balance; the standardized mean differences and common support diagnostics should also be considered.

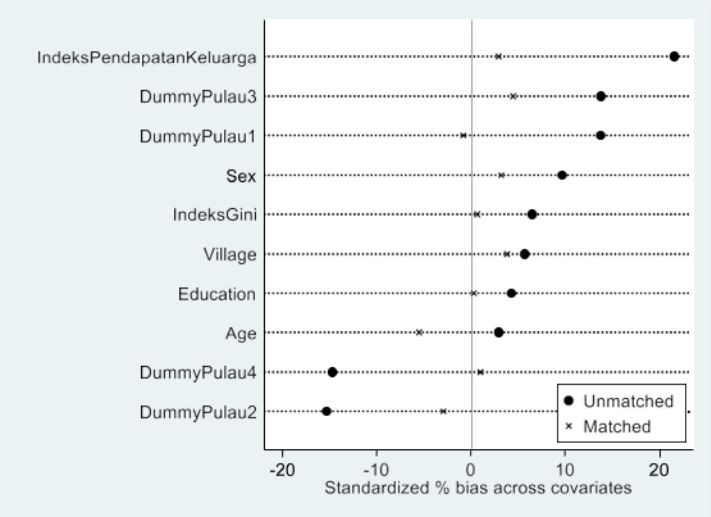


**Figure 1.** Covariate Balance Test Results

The final step involved matching households using their estimated propensity scores. Three commonly used matching methods were considered: nearest neighbor, radius caliper, and kernel matching. These methods differ in how control households are selected or weighted when constructing the counterfactual for treated households. The estimated treatment effects are presented in the following table.

**Table 6**
*Matching Results with Nearest Neighbor, Radius Caliper and Kernel Methods*

| Variable | Sample | Treated | Control | Difference | S.E.t-stat |
|---|---|---|---|---|---|
| Nearest Neighbor | | | | | |
| SatisfactionSocial Life | Unmatched | 0.834 | 0.740 | 0.093 | 0.0342.77 |
| | ATT | 0.834 | 0.663 | 0.170 | 0.0672.54 |
| SatisfactionPersonal Life | Unmatched | 0.722 | 0.647 | 0.075 | 0.0391.90 |
| | ATT | 0.722 | 0.712 | 0.009 | 0.0790.12 |
| Radius Caliper | | | | | |
| SatisfactionSocial Life | Unmatched | 0.834 | 0.740 | 0.093 | 0.0342.77 |
| | ATT | 0.834 | 0.740 | 0.093 | 0.0214.46 |
| SatisfactionPersonal Life | Unmatched | 0.722 | 0.647 | 0.075 | 0.0391.90 |
| | ATT | 0.722 | 0.647 | 0.075 | 0.0243.02 |
| Kernel | | | | | |
| SatisfactionSocial Life | Unmatched | 0.834 | 0.740 | 0.093 | 0.0342.77 |
| | ATT | 0.834 | 0.740 | 0.089 | 0.0372.38 |
| SatisfactionPersonal Life | Unmatched | 0.722 | 0.647 | 0.075 | 0.0391.90 |

| Variable | Sample | Treated | Control | Difference | S.E.t-stat |
|---|---|---|---|---|---|
| | ATT | 0.723 | 0.709 | 0.014 | 0.0420.33 |

Based on the matching results for social life satisfaction, all three methods yielded statistically significant estimates of the average treatment effect on the treated (ATT). The Radius Caliper method produced the largest t-statistic, at 4.46, with an estimated difference of 0.093, or approximately 9.3 percentage points. For personal life satisfaction, only the Radius Caliper method yielded a statistically significant estimate, with a reported t-statistic of 3.02 and an estimated difference of 0.075, or 7.5 percentage points. The Nearest Neighbor and Kernel estimates for personal life satisfaction were not statistically significant, with reported t-statistics of 0.12 and 0.33, respectively. Both values are well below the approximate two-sided 5% critical value of 1.96 for a standard normal test. If the results are evaluated against the initial hypothesis, the following interpretation applies.

The pattern of results should be interpreted in terms of sensitivity to the choice of matching method rather than by simply selecting the method that produces the largest estimated effect. For social life satisfaction, the estimated effect was statistically significant under all three methods (Nearest Neighbor, Radius Caliper, and Kernel) indicating that this finding was robust to the matching specification. For personal life satisfaction, by contrast, the estimated effect was significant only under Radius Caliper matching, suggesting that the result was sensitive to the choice of method and should therefore be interpreted with caution. The Radius Caliper estimate may be reported as the primary estimate if the caliper specification was justified a priori and its matching quality was satisfactory. However, radius matching does not necessarily produce lower variance in every application, and the method should not be selected solely because it yields the largest t-statistic. The estimates in Table 6 should also be checked against the original statistical output to ensure internal consistency among the estimated differences, standard errors, and t-statistics.

These results suggest that the increase in electricity connection capacity under the BPBL Program was more consistently associated with social life satisfaction than with personal life satisfaction. The estimated effect on social life satisfaction remained statistically significant across the Nearest Neighbor, Radius Caliper, and Kernel matching methods, whereas the estimated effect on personal life satisfaction was statistically significant only under the Radius Caliper specification. Therefore, the evidence does not support a strong conclusion that the increase in electricity connection capacity consistently improved personal life satisfaction. Because the analysis evaluated aggregate indices of personal and social life satisfaction, the findings should not be interpreted as demonstrating statistically significant improvements in individual domains such as education, health, employment, income, family relationships, or security unless those domains are analyzed separately.

This finding is consistent with those of other studies, including Han et al. (2020) and Watema et al. (2025), who examined Cambodia and reported that household electricity consumption was associated with improvements in children's health and increases in the number of hours spent studying. Regarding education, BPBL recipients are predominantly low-income households. Massagony et al. (2026), in their study of Indonesia, found that educational attainment and household income were significant socioeconomic factors associated with household electricity consumption. Households with higher educational attainment and income tended to use electricity more extensively through the ownership and use of electronic devices, which may ultimately contribute to improvements in quality of life.

It is important to distinguish between the empirical findings and their interpretation. Empirically, the increase in electricity connection capacity was associated with a larger and more robust improvement in social life satisfaction than in personal life satisfaction. One plausible interpretation, rather than a direct empirical finding, is that low-income BPBL recipients initially allocate the additional electricity capacity to basic and shared uses, such as lighting, household security, and family activities, which may contribute to satisfaction with social aspects of life. By contrast, improvements in personal domains associated with employment and income may materialize more gradually and require a longer period of exposure before they become observable.

After obtaining the matching estimates, the final analytical step was to conduct a sensitivity analysis to assess how vulnerable the estimated treatment effects were to potential unobserved confounding factors. Such factors cannot be measured directly in the available data but may influence both treatment assignment and the outcomes. The analysis used the sensitivity parameter Γ (Gamma) to assess how the conclusions might change under different assumptions about the influence of unobserved factors on treatment assignment.

**Table 7**
*Sensitivity Test Results*

| Gamma | sig+ | sig- | t-hat+ | t-hat- | CI+CI- |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 1 | 1 | 11 |
| 1.5 | 0 | 0 | 1 | 1 | 11 |
| 2 | 0 | 0 | .5 | 1 | .51 |
| 2.5 | 0 | 0 | .5 | 1 | .51 |
| 3 | 0 | 0 | .5 | 1 | .51 |
| 3.5 | 0 | 0 | .5 | 1 | .51 |
| 4 | 0 | 0 | .5 | 1 | .51 |
| 4.5 | 0 | 0 | .5 | 1 | .51 |
| 5 | 0 | 0 | .5 | 1 | .51 |

Based on the reported sensitivity analysis results, the displayed statistics remained unchanged for several measures as Γ increased to 5, while other measures changed at Γ = 2. These results should be interpreted in accordance with the definitions of the reported sensitivity statistics and the specific implementation of the sensitivity analysis. In particular, the stability of selected values does not, by itself, establish that the model maintained covariate balance or that the estimated treatment effects were unaffected by unobserved confounding. The sensitivity results should therefore be used to assess the robustness of the estimated effects to departures from the assumption of no unobserved confounding, subject to verification of the original output and the definitions of the reported statistics.

## CONCLUSION

This study evaluated the association between the increase in electricity connection capacity under the BPBL Program, from 450 VA to 900 VA, and recipient households' life satisfaction using propensity score matching (PSM) with the Nearest Neighbor, Radius Caliper, and Kernel methods. The findings indicate that higher electricity connection capacity was consistently associated with greater social life satisfaction across all three matching methods, with estimated effects ranging from approximately 9% to 17%. The consistency of this finding across the matching specifications suggests that the association between increased electricity connection capacity and social life satisfaction was relatively robust within the analytical framework used in this study.

In contrast, the association between increased electricity connection capacity and personal life satisfaction was less consistent. A statistically significant estimated effect of 7.5 percentage points was identified only under the Radius Caliper method, whereas the Nearest Neighbor and Kernel estimates were not statistically significant. Accordingly, the findings provide stronger evidence of an association between increased electricity connection capacity and social life satisfaction than between increased capacity and personal life satisfaction. Because the outcomes were measured in a 2024 survey of households that received BPBL installations in 2022 and 2023, future research could use longitudinal data to determine whether changes in personal life satisfaction become more evident over a longer period.

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## AUTHOR CONTRIBUTION STATEMENT

Andika Nugraha Putra and Muhammad Halley Yudhistira contributed to the preparation of this manuscript, including the development of the research, interpretation of the findings, and manuscript preparation. Both authors participated in reviewing and refining the manuscript and approved the final version for publication. Both authors are responsible for the integrity and accuracy of the published work.

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