Environment and Social Psychology (2026) Volume 11 Issue 2 ISSN: 2424-8975 (O)
doi: 10.59429/esp.v11i2.4446 2424-7979 (P)

RESEARCH ARTICLE

Psychological pathways from energy poverty perception to clean energy adoption intention

Junchi Du*

Faculty of Business and Communication, INTI International University, Persiaran Perdana BBN, Putra Nilai, 71800 Nilai, Negeri Sembilan

*** Corresponding author:** Junchi Du, I25036380@student.newinti.edu.my

ABSTRACT

Purpose: This study investigates how feelings of energy poverty affect Chinese residents' plans related to the adoption of clean energy by using the theory of planned behavior and conservation of resources theory. It considers how environmental concern and perceived behavioral control act as mediators for this relationship.

Methodology: Data was obtained from the Chinese General Social Survey of 2021 in collaboration with the International Social Survey Programme (ISSP) environmental module. A total of 2,187 adult participants made up the entire sample. Structural equation modeling was used to test the hypotheses. Additionally, Bootstrap mediation analysis was performed with 5,000 resamples.

Findings: Energy poverty perception had a significant negative direct influence on the adoption intention of clean energy ($\beta = -0.14$, $P < 0.01$). Environmental concern and perceived behavioral control both acted as significant partial mediators for the effect. The indirect effect via environmental concern was larger in magnitude (−0.091, 30.8% of total effect) compared to the indirect effect of perceived behavioral control (−0.064, 21.7%). The total indirect effect (52.5%) exceeded the direct effect (47.5%).

Conclusion: Energy poverty perception indirectly hinders the adoption intention of clean energy by reducing environmental prioritization and self-efficacy perceptions. The affective path was shown to have a relatively more significant effect.

Practical Implications: Policy interventions should cover the alleviation of energy poverty while also linking the benefits of clean energy in terms of health and economic gains to the shortage of resources.

Keywords: energy poverty perception; clean energy adoption intention; environmental concern; perceived behavioral control; psychological pathways

1. Introduction

The exacerbated international climate change problem and energy security problem have raised the transition to clean energy to a foremost position in the sustainable development strategies of all nations. As the world's largest energy consumer and a major greenhouse gas emitter, the adoption of clean energy in the residential sector of China Is of great importance to the realization of "dual-carbon" objectives. However,

ARTICLE INFO
Received: 11 December 2025 | Accepted: 04 January 2026 | Available online: 05 February 2026

CITATION
Du JC. Psychological pathways from energy poverty perception to clean energy adoption intention. *Environment and Social Psychology* 2026; 11(2): 4446 doi:10.59429/esp.v11i2.4446

research into the problem has shown that between 20% and 25% of Chinese households fall into the problem of energy poverty to some extent [1]. Energy poverty encompasses both objective service inadequacy and subjective experiences regarding energy affordability. Such a level of the subjective energy problem may influence the psychological attitude of individuals toward the adoption of clean energy.

The effect of energy poverty on the well-being of individuals has also been subjected to empirical verification in more than one aspect. Studies covering South Asia have established the pivotal role of socio-economic factors in determining multi-dimensional energy poverty in households[2]. A negative link between energy poverty and subjective well-being has also been established in the context of developed nations[3]. However, the relationship between energy poverty and well-being operates through complex pathways rather than direct transmission. Analysis made from the General Social Survey of China has established the foregoing effect to occur via complex paths of mediation[4]. Regarding energy poverty measurement specifically, different subjective fuel poverty indicators show varying explanatory power in predicting individual health outcomes[5]. This indicates the need for equal attention to the existing reality of energy poverty in a particular location in understanding the health effect of energy poverty. Studies gave further verification of the health effect of energy poverty in a long-term tracking analysis[6]. A significant heterogeneity of the weakening effect of energy poverty in the subjective well-being of the populace was also detected in the Chinese Household Panel survey[7].

The research subject of energy poverty has presented the trend of expanding from the objective measurement to the multi-dimensional measurement in the last years. The dual effects mechanism of the multi-dimensional energy poverty in the household to the physical and mental health has gradually become clear[8]. At the macro level, the linkage between energy poverty and the carbon emission has presented a new thought for the social equity of the energy transition[9], while the researches focusing on the middle-aged and older populations have unveiled the definite damages of the energy poverty to the cognitive function & mental health[10]. Even if the above researches have further enriched the academia's cognitions of the energy poverty consequences, the existing studies have presented the definite inadequacies in the following aspects: First of all, the research viewpoint emphasizes the objective measurement of the energy poverty more seriously, but researchers' attention to individuals' subjective perceptions of the individuals about the energy poverty is relatively low; Second point, outcome variables primarily remain in the health and social domains, but the researches about the influence of the effect of energy poverty perception on willingness of the environmental behavior remain very small. Thirdly, the research about the influence mechanism fails to carry out the overall theoretical interpretation, unable to explore the psychological transmission mechanisms between the cognitive effect of the energy poverty & the willingness of the adoption of the clean energy.

The Theory of Planned Behavior has developed a more mature analysis framework to interpret the process of forming the environmental behavioral intentions of the individual. The Theory of Planned Behavior highlights the predictive power of attitude, subjective norms, and perceived control of behavior concerning the prediction of behavioral intentions[11]. A literature analysis based on the Theory of Planned Behavior highlights the robust application of the Theory of Planned Behavior to elucidate different pro-environmental activities[12]. The Resource Conservation Theory provides a theoretical interpretation of the psychological processes of individuals experiencing stressful conditions from the perspective of the theoretical framework of gaining, conserving, and losing resources. According to the theoretical context of the Resource Conservation Theory, under stressful conditions of losing resources or merely threatened resources, individuals undergo psychological stress conditions; therefore, the conditions of conserving resources develop[13]. Cross-nation analysis research has also validated the pivotal influence of environmental concern and perceived control of behavior of the Theory of Planned Behavior concerning the

prediction of pro-environmental intentions concerning the pivotal influence pattern exhibiting significant variation in different nations under different cultural settings[14].

To build a psychological path model of how the perception of energy poverty influences the willingness to adopt clean energy in a more integrated manner, the theory of planned behavior and the theory of conservation of resources can be seamlessly integrated. Energy poverty perception, the subjective judgment of energy poverty of the individual him- or herself, may have a possible influence on the willingness to adopt clean energy in the following two psychological channels of influence: Firstly, according to the conservation of resources theory, the occurrence of resource scarcity experienced from the judgment of energy poverty would lead to the constriction of psychological channels of processing information, making the cognitive resources of the individuals more devoted to the facilitation of survival activities instead of processing information about the environment. Thus, the willingness to adopt clean energy would be weakened. Secondly, in accordance with the principles of the theory of planned behavior, the occurrence of economic constraint experienced from the energy poverty judgment would weaken the person's own belief in own capability of action to change the present energy usage behavior in order to impede the willingness to adopt clean energy. According to the theoretical analysis mentioned above, the following hypotheses of the research can be developed:

H1: Energy poverty perception has a significant negative effect on clean energy adoption intention.

H2: Environmental concern mediates the relationship between energy poverty perception and clean energy adoption intention. H3: Perceived behavioral control mediates the relationship between energy poverty perception and clean energy adoption intention.

Based on the theoretical analysis and research hypotheses outlined above, the hypothesized model of this study is illustrated in **Figure 1**. The model posits that energy poverty perception influences clean energy adoption intention through two parallel psychological pathways: environmental concern and perceived behavioral control. The direct path (H1) represents the unmediated negative effect of energy poverty perception on adoption intention, while the indirect paths represent the mediating mechanisms whereby energy poverty perception reduces environmental concern (H2a) and perceived behavioral control (H3a), which in turn diminish clean energy adoption intention (H2b, H3b).

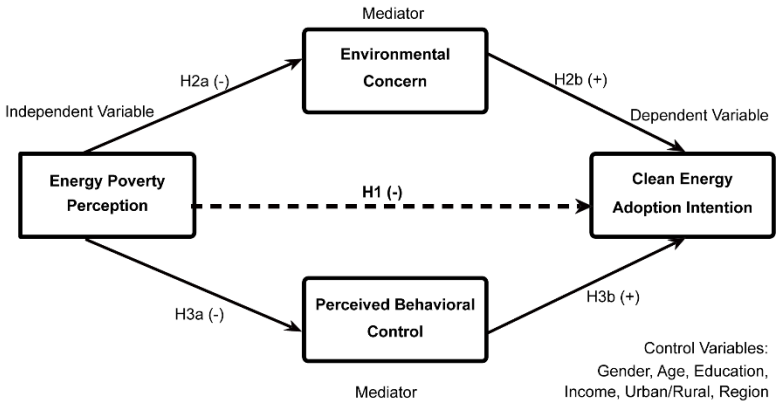

Figure 1. Hypothesized model.

2. Methodology

2.1. Data sources and samples

The data of this study is derived from the 2021 annual Survey of the Chinese General Social Survey (CGSS). This survey was hosted and implemented by the National Survey Research Center at Renmin

University of China (NSRC, http://nsrc.ruc.edu.cn) and was conducted nationwide using a multi-stage stratified sampling method. It is the earliest national, comprehensive, and continuous academic investigation project in China. The CGSS 2021 survey was officially released to the academic community on March 31, 2023, and can be obtained for free through the Chinese National Survey Data Archive (CNSDA, https://www.cnsda.org). For detailed information about the CGSS project, researchers may also visit the official project website (http://cgss.ruc.edu.cn). A total of 8,148 valid samples have been obtained in the survey. There are about 700 variables. One of the important characteristics of the CGSS 2021 Annual Survey is the inclusion of the ISSP environment module. The ISSP environment module considers about one-third of the random sample sub-units to be the survey subjects. There was a detailed gathering of information on the subjects' environmental values, intentions of environmental behavior, and environmental perceptions. All the necessary variables to gauge the main dependent variables and the mediators of the research have already been obtained. The pertinent ethics committee has already approved the original research. All the information gathered in the research has also already been anonymized. There is no need for additional ethics check in the secondary analysis of the research.

The sample screening criteria follow these: Identify participants aged 18 years old and above who have replied comprehensively to the ISSP environmental questionnaire, exclude the sample containing missing in the independent variables, dependent variables, and the mediating variables. After the processes mentioned above for screening the sample, the total number of subjects qualified for analysis was 2,187. The demographic profiles of the pool of participants are presented in more particularity in **Table 1**.

Table 1. Sample characteristics.

Variable	Category	n	%
Gender	Male	1,021	46.7
	Female	1,166	53.3
Age	18–30	347	15.9
	31–45	583	26.7
	46–60	724	33.1
	61 and above	533	24.4
Education	Primary school or below	486	22.2
	Junior high school	612	28.0
	Senior high school/Vocational	498	22.8
	College/University or above	591	27.0
Monthly Household Income	< 3,000 RMB	573	26.2
	3,000–5,999 RMB	698	31.9
	6,000–9,999 RMB	512	23.4
	≥ 10,000 RMB	404	18.5
Residence	Urban	1,247	57.0
	Rural	940	43.0
Region	Eastern	814	37.2
	Central	586	26.8
	Western	787	36.0

In terms of sample composition, the gender composition presents a slightly larger proportion of female participants (53.3%) than that of the male participants (46.7%). The composition of the sample by different ages includes all adult ages, of whom the medium- and older-aged participants (aged 46 years or more) account for the largest proportion (57.5%), representing the aging of the Chinese populace. Educational structure presents a multi-level distribution trend, embracing all educational levels from primary education and below to college or above, with junior high school being the most common category (28.0%). The composition of the sample per urban or rural regions provides a reflection of the dual-structure nature of Chinese society. The proportion of the sample residing in urban regions (57.0%) accounts for more than the proportion in rural regions (43.0%). The composition of the sample per regions also presents geographical representation. The three regions include the east region (37.2%), central regions (26.8%), followed by the west-region participants who account for (36.0%). These sample characteristics show that the demographic dimension of the data of the present study possesses a satisfactory degree of heterogeneity.

2.2. Variable measurement

The operational definition of the independent variable of energy poverty perception relies on the subjective evaluation of economic stress and resource constraint. The measuring approach mentioned refers to the traditional approach to the methodological framework of measuring multidimensional poverty[15]. Inasmuch as the CGSS questionnaire has no items measuring the energy poverty perception directly. To address this measurement gap, we adopted a proxy variable approach grounded in energy poverty theory. Unlike general economic poverty focusing solely on income insufficiency, energy poverty perception specifically captures households' subjective experiences of energy service inadequacy and affordability stress[16]. The three proxy indicators—economic status, social position, and life satisfaction—collectively reflect the psychological burden arising from energy expenditure constraints rather than overall material deprivation. Those items include Self-assessment of family economic status ("Since you know the different levels of family economic status in the local area. Which level of family economic status your family belongs to?", Scale of 5 points); social status evaluation ("But how about your own social position? Which social class you think you ought to be in?", Sub-scale of 1-10); life satisfaction evaluation ("How satisfied you feel about your life?", Scale of 5 points). All the three items mentioned have been reversed in their scoring. A higher score indicates a greater degree of energy poverty perception. While recent studies have developed dedicated energy poverty perception scales measuring fuel affordability and thermal comfort directly[5,17], these instruments are not available in CGSS. Our proxy approach aligns with established multidimensional poverty frameworks and demonstrates convergent validity through significant correlations with energy-related behaviors in robustness tests. Next was the exploratory factor analysis for factor extraction to make a standardized overall score for the energy poverty perception.

The indicators for the dependent variable clean energy adoption intention are taken from the environmental module of the CGSS 2021 ISSP survey, three indicators: "Willing to pay a higher price for environmental protection," "Willing to see a reduced living standard for environmental protection," "Willing to pay higher taxes for environmental protection," all of which have a 5-point Likert scales. The average of the three indicators is taken as the overall index of the willingness to switch to clean energy adoption intention. The indicators of the mediator "Environmental Concern" are also taken from the ISSP environmental module. They include self-assessment measures of the degree to which the participants in the survey feel concerned about different issues in the environment around them. Perceptual behavioral control measures the subjects' cognitive evaluation of the effects of their own behavior concerning the "environmental problems," including climate change or pollution. The control factors include demographic characteristics of the subjects concerning their gender, ages, education levels, per capita household incomes a

year, place of residence whether urban or rural areas, regions. These variables were controlled to eliminate confounding effects on core relationships.

2.3. Analysis strategy

The analysis of the data in the research takes place in three steps. The first step involves the application of a descriptive statistical analysis in order to determine the arithmetic mean, the standard deviation, skewness, and kurtosis of the core factors. Additionally, the analysis involves the application of a Pearson Correlation to determine the direction and strength of the relationships between the factors. The second step involves the application of a Structural Equation Modeling in the analysis to determine the validity of the research hypotheses. This approach allows for the analysis of multiple paths in a complex manner between multiple factors without the need to account for measurement errors [18]. The analysis of the structural model takes place in two steps. These include the evaluation of the structural model in terms of fitting to the entire research model. In the analysis of the structural model fit indices, the indicators of the measurement model of the factors include the standardized factor loadings of the factors. These indicators also include the values of alpha factor reliability and the overall reliability of the factors in the form of the Composite reliability. Additionally, the indicators of the measurement model involve the analysis of the Mean Variance Extraction (AVE) standards of the factors. These also involve the evaluation of the values of the factors in terms of the discriminant validity tests. The overall structural fit indices include the chi-square to degrees of freedom ratio (χ^2/df), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR).

In the third step, the test of the mediating effect via the Bootstrap approach was performed. This approach simulates the sampling distribution of the mediated effect via sampling. In comparison to the traditional test of the mediated effect via the Sobel test, the approach possesses greater statistical power. Moreover, the approach does not assume the indirect effect to follow a normal distribution[19]. In the research, the number of Bootstrap repeated sampling was determined to be 5,000 times. Additionally, the criterion to determine the significant mediated effect was that the 95% Confidence Interval contains a zero value. The robustness test of the research was performed by changing the measurement tool of the independent variable. That is to say, in the research, the single indicator "Household economic status grade" was adopted to substitute the overall energy poverty perception score to re-estimate the model to test the robustness of the key conclusion. All statistical analysis was finished in the Mplus 8.3 environments.

3. Results

3.1. Descriptive statistics and correlation analysis

The descriptive statistical results of each core variable and the correlation coefficient matrix are shown in **Table 2**.

Table 2. Descriptive statistics and correlations of main variables.

Variable	M	SD	1	2	3	4
Energy Poverty Perception	2.83	0.91	1	−0.27***	−0.24***	−0.31***
Environmental Concern	3.47	0.84	−0.27***	1	0.34***	0.42***
Perceived Behavioral Control	2.96	0.88	−0.24***	0.34***	1	0.38***
Clean Energy Adoption Intention	3.12	0.87	−0.31***	0.42***	0.38***	1

Note. **P < 0.05, **P < 0.01, ***P <0.001.*

From the descriptive statistics analysis, the mean of the energy poverty perception was 2.83 (SD = 0.91), below the midpoint of the scale of 3. This suggests a level of energy poverty perceptions that was medium to low. Additionally, the mean of the intention to adopt clean energy was 3.12 (SD = 0.87). This was slightly above the midpoint of the measure of 3.

Concerning the mediating factors, the highest mean value was recorded by environmental concern (M = 3.47, SD = 0.84), surpassing the adoption intention of clean energy by 0.35 points. This indicates that general awareness of the environment may not necessarily lead to specified intentions of action. The lowest mean value was recorded by the perceived behavioral control (M = 2.96, SD = 0.88) in the outcome-related factors, being 0.51 points lower than the environmental concern values. This implies a lack of reliance on the capability to carry out the environmental activities. The values for skewness and kurtosis for the factors were between -0.43 to 0.38 and between -0.51 to 0.29 respectively.

The result of the Pearson correlation analysis showed that there was a significant negative correlation between the perception of energy poverty and the adoption intention of clean energy ($r = -0.31$, $P < 0.001$), supporting Hypothesis 1. Additionally, the results revealed a negative correlation between the perception of energy poverty and the concern for the environment ($r = -0.27$, $P < 0.001$) and perceived behavioral control ($r = -0.24$, $P < 0.001$), supporting the conservation of resources theory. More importantly, the results showed that the concern for the environment correlated more highly to adoption intention than the perceived behavioral control (r = 0.42 compared to r = 0.38 for the latter). Additionally, all values of r in the analysis were less than 0.70.

3.2. Measurement model and structural model verification

Prior to the structural model analysis, the reliability and validity of the measurement model was established by the confirmatory factor analysis whose results appear in **Table 3**.

Table 3. Measurement model results.

Construct	Item	Factor Loading	Cronbach's α	CR	AVE
Energy Poverty Perception			0.76	0.77	0.53
	EPP1: Subjective economic status	0.71			
	EPP2: Perceived social class	0.74			
	EPP3: Life satisfaction	0.68			
Environmental Concern			0.83	0.85	0.58
	EC1: Worry about environmental problems	0.79			
	EC2: Perceived seriousness of pollution	0.76			
	EC3: Concern for future generations	0.72			
	EC4: Priority of environmental protection	0.78			
Perceived Behavioral Control			0.71	0.73	0.51
	PBC1: Ability to act environmentally	0.73			
	PBC2: Confidence in making a difference	0.69			
	PBC3: Ease of adopting clean energy	0.62			

Construct	Item	Factor Loading	Cronbach's α	CR	AVE
Clean Energy Adoption Intention			0.79	0.81	0.59
	CEAI1: Willingness to pay more for clean energy	0.84			
	CEAI2: Willingness to sacrifice convenience	0.77			
	CEAI3: Intention to use clean energy	0.68			

Table 3. (*Continued*)

In **Table 3**, all the factors of the measurement model have achieved acceptable levels. The values of the standardized factor loadings of the four latent constructs varied between 0.62 to 0.84. These values surpassed the threshold of 0.50. It was also noticed that the highest value of the loading took place in CEAI1 (clean energy adoption intention) at 0.84, 0.22 points higher than the lowest one in PBC3 (perceived behavioral control) at 0.62. This indicates that the willingness to pay for clean energy (CE) would act as a more precise determinant compared to the ease of adoption. This may be due to the challenges in determining the specific efficacy.

Concerning the reliability of the measures, the values of the alpha reliability coefficients for all scales varied between 0.71 and 0.83. A higher internal consistency was shown by the environmental concern dimension ($\alpha = 0.83$) compared to the one shown by the perceived behavioral control dimension ($\alpha = 0.71$) by a margin of 0.12. Such a difference suggests higher reliability of the measures for the environmental dimension compared to the efficacy measures. The composite reliability of CR varied between 0.73 and 0.85. All values exceed the minimum criterion of 0.70.

As for the convergent validity test of the measures, the Average Variance Extracted (AVE) values of all measures fall in the range of 0.51 to 0.59, all of which surpassed the critical value of 0.50. The highest AVE was recorded in the adoption intention of clean energy (AVE = 0.59), followed by the lowest in the perceived behavior control (AVE = 0.51) but significantly surpassed the critical threshold of 0.50. This implies that the items in the adoption intention have more in common in terms of variability compared to the items under the construct of behavior control. As for the factor loading values, the results also support the same interpretation. The measurement model had a very good model fit in terms of $\chi^2/df = 2.34$, CFI = 0.94, TLI = 0.92, RMSEA = 0.052, SRMR = 0.041.

Having established that the measurement model properties are satisfactory, we moved on to test the structural model hypotheses. The path coefficients in the structural model appear in **Figure 2**.

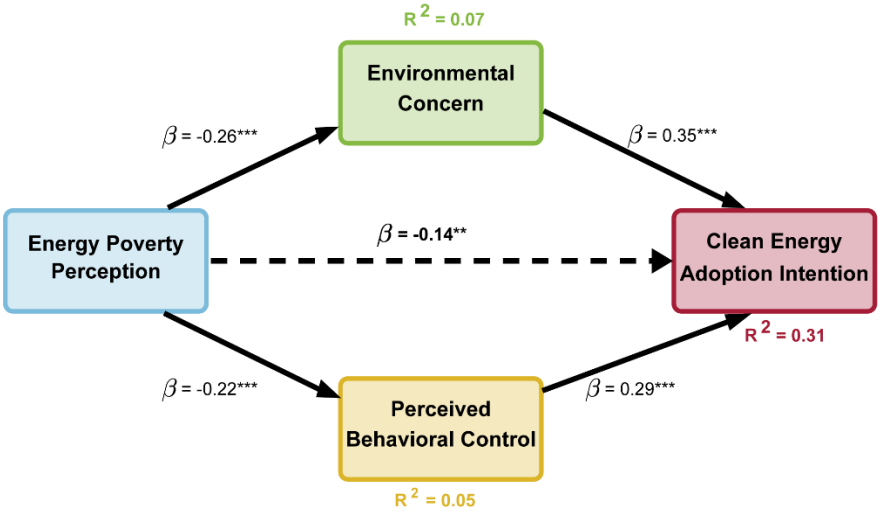

Figure 2. Path coefficients of structural equation model.

In **Figure 2**, there was a good fit of the structural model (χ^2/df = 2.51, CFI = 0.93, TLI = 0.91, RMSEA = 0.058, SRMR = 0.047) and the model was able to account for 31% of the variance in clean energy adoption intention.

Energy poverty perception had a highly significant direct negative effect on adoption intention (β = -0.14, $P < 0.01$) in support of hypothesis H1. Concerning the mediating paths, energy poverty perception had a more significant negative effect on environmental concern (β = -0.26, $P < 0.001$) than on behavioral control (β = -0.22, $P < 0.001$). Likewise, environmental concern had a more significant positive effect on adoption intention (β = 0.35, $P < 0.001$) than behavioral control (β = 0.29, $P < 0.001$). These effects affirm that the environmental concern path in the total mediation effect (-0.091) has more influence than the behavioral control path (-0.064).

Regarding control variables, the results revealed the strongest influence to be in education (β = 0.18, $P < 0.001$), followed by household income (β = 0.12, $P < 0.01$). The effect of age was quite small but negative (β = -0.08, $P < 0.05$), while gender, urban/rural, and region did not have significance.

3.3. Mediating effect Test

To estimate the mediating effect of the two psychological steps, the Bootstrap test was performed (resampling 5,000 times); the results appear in **Table 4**.

Table 4. Bootstrap mediation analysis results.

Path	Effect	SE	95% CI Lower	95% CI Upper	% Of Total
Total Effect	−0.295	0.038	−0.369	−0.221	100.0%
Direct Effect (H1)	−0.140	0.042	−0.222	−0.058	47.5%
Total Indirect Effect	−0.155	0.024	−0.202	−0.108	52.5%
Indirect via Environmental Concern (H2)	−0.091	0.017	−0.128	−0.061	30.8%
EPP → EC	−0.260	0.031			
EC → CEAI	0.350	0.038			
Indirect via Perceived Behavioral Control (H3)	−0.064	0.015	−0.098	−0.037	21.7%
EPP → PBC	−0.220	0.036			
PBC → CEAI	0.290	0.041			

Note: *Bootstrap samples = 5,000. CI = confidence interval. EPP = energy poverty perception; EC = environmental concern; PBC = perceived behavioral control; CEAI = clean energy adoption intention.*

Table 4 showed that both psychological factors significantly mediated the effect of the perception of energy poverty on adoption intention for clean energy. The mediated effect for concern for the environment was −0.091 (95% Confidence Interval [-0.128, -0.061]), while the mediated effect via PBC was −0.064 (95% Confidence Interval [-0.098, -0.037]). These values did not contain zero, confirming H2 and H3.

Comparing both paths, the effect of environmental concern was higher at 30.8% compared to the effect of perceived behavioral control at 21.7% by a magnitude of 9.1%. A difference of 0.027 in the absolute effect magnitude indicates that the downplaying of environmental concerns in a resource-scarce context serves as a relatively more robust psychological process compared to the weakening of self-efficacy.

The total indirect effect was -0.155 (95% CI [-0.202, -0.108]), explaining 52.5% of the total effect, while the direct effect of -0.140 explained the remaining 47.5%. The indirect effect having a greater magnitude than the direct effect by 5% suggests that the psychological mechanisms together have a more significant effect compared to the unmediated path. The direct effect being significant despite the inclusion of the mediators suggests that the factors of environmental concern and the perceived control influence the relationship in a partial manner.

3.4. Robustness test

In order to verify the sensitivity of the core finding to the operationalization of the variables, the structural equation model was re-estimated by replacing the overall energy poverty perception score with a single indicator "household economic status grade". The robustness test results are presented in **Figure 3**.

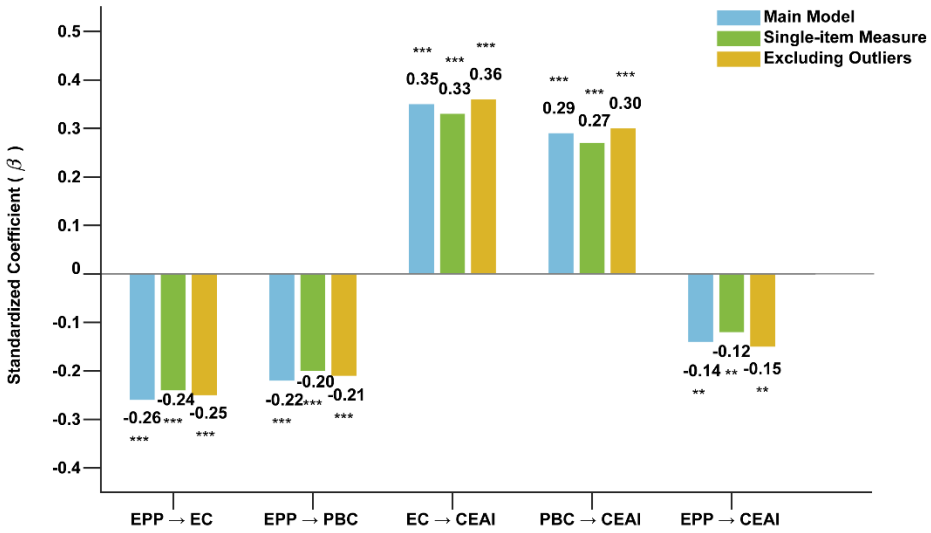

Figure 3. Robustness test results.

As illustrated in **Figure 3**, the path coefficients in both robustness models retained their sign and statistical significance. For the single-item approach, the direct effect decreased by a mere 0.02 points from β = -0.14 to β = -0.12 (P< 0.01). The direct effect in the model excluding the outliers was the same as the main model at β = -0.15 (P < 0.01).

Concerning the mediated paths, the effect of the perception of energy poverty on environmental concern varied between β = -0.24 (single-item) and β = -0.26 (main model), while the effect on perceived behavioral control varied between β = -0.20 and β = -0.22. All of the deviations remained were 0.02 points or less. Additionally, in the outcome paths, the effect of environmental concern on adoption intention (β = 0.33-0.36) was always larger than the effect of the perceived behavioral control (β = 0.27-0.30) by approximately 0.06 points.

The mediated effect via environmental concern was -0.079 (95% CI [-0.112, -0.051]) for the single-item model, while the mediated effect via perceived behavioral control was -0.054 (95% CI [-0.086, -0.028]). In both cases, neither of the confidence intervals contained zero, verifying the significance of the mediated effects. These findings verify all three hypotheses.

4. Discussion

In the present research, the psychological mechanisms underpinning the influence of energy poverty perception on adoption intention of clean energy for Chinese citizens have been identified, finding that both concern for the environment and the perception of control over behavior have a significant partial mediating effect. These research findings have the value of contributing to the existing body of research about energy poverty in terms of turning the attention of the research from the deprivation itself to the subjective perception of deprivation.

The negative correlation between the perception of energy poverty and the intention to adopt clean energy in the present analysis validates current trends of research into the psychological repercussions of resource scarcity in the context of energy adoption intentions but the strength of the effect ($\beta = -0.14$) indicates that one of several factors contributes to adoption intentions. Indeed, the present findings reflect the latest trends of research into the complex nature of the psychological antecedents of pro-environmental intentions in general. Recent research has demonstrated that pro-environmental intentions are shaped by complex cognitive processes beyond economic considerations[20], and that structural barriers significantly influence sustainable behavior adoption[21]. The finding that psychological mechanisms account for 52.5% of the total effect in the present analysis underscores the importance of understanding these internal processes.

The relatively more salient role of environmental concern over perceived control (30.8% vs. 21.7% of the total effect) provides important insight into the nature of psychological salience under conditions of perceiving scarcity. Such a finding lends support to theoretical expectations derived from the conservation of resources approach concerning the cognitive focusing of mental states under stressful conditions[22]. The relative salience of the two mediating effects also provides new information concerning the design of interventions to stimulate more pro-environmental action. Contrary to the latter approach, the results of prior examinations of the salience of co-benefit framing in turning the focal point of household members toward the conservation of resources instead of immediate concerns over the economy may also prove ineffective for inducing psychological salience over the pursuit of sustainability objectives under conditions of perceiving scarcity[23].

The present findings contribute to the existing body of knowledge in three overlapping fields concerning the energy poverty-environmental behavior interface. The results corroborate the growing body of evidence regarding the salience of perceived need compared to supply in shaping pro-environmental behavior[24]. The integrated theoretical framework employed in this study reflects a general trend toward theoretical eclecticism in contemporary environmental psychology, moving beyond single theoretical orientations to provide a more comprehensive understanding of the connection between resource experiences and environmental intentions[25]. These findings also align with the growing recognition that sustainable transition processes must factor in justice considerations to simultaneously achieve environmental objectives and social equity[26].

These empirical implications of the findings point to the need for the application of policy interventions that tackle simultaneously the alleviation of energy poverty and the promotion of the adoption of clean energy instead of considering both aims in a competitive manner. The mediating role of environmental

concern suggests that communication strategies emphasizing health and economic co-benefits of clean energy adoption may prove more effective for energy-poor populations than messages focused primarily on environmental protection[27]. The significant mediation through perceived behavioral control indicates that programs providing practical skills training, financial subsidies, and visible demonstrations of successful clean energy adoption in similar communities could help overcome the self-efficacy barriers that energy poverty perception creates[28]. Effective strategies in changing the target toward the adoption of the alternative energy form have already been shown to be successful in the context of interventions for vulnerable groups from the economic point of view[29].

Several limitations of this research warrant acknowledgment and point toward directions for future investigation. The cross-sectional design precludes causal inference, as the associations observed could potentially reflect reverse causation or unmeasured confounding variables, a limitation that could be addressed through longitudinal research tracking changes in energy poverty perception and adoption intentions over time[30]. The use of proxy measures to assess energy poverty perception, while grounded in established measurement frameworks, may not fully capture the specific experiences of energy burden and energy access limitations that characterize energy poverty as distinct from general economic hardship, suggesting the need for future research employing purpose-designed energy poverty perception scales[31]. The reliance on the ISSP subsample, while providing validated environmental attitude measures, resulted in a reduced sample size and may limit generalizability to the broader Chinese population, though the demographic diversity of the final sample partially mitigates this concern. The focus on behavioral intentions rather than actual behavior represents a common limitation in environmental psychology research, and future studies should examine whether the psychological pathways identified here similarly predict observed clean energy adoption behaviors in real-world settings[32].

5. Conclusion

The present research adopted structural equation modeling with Bootstrap mediation analysis based on the 2021 Chinese General Social Survey to explore the role of energy poverty perception in molding the intention of adoption for clean energy via psychological mechanisms. Empirically, the present research revealed that energy poverty perception was a negative predictor of the intention of adoption for clean energy both directly and indirectly, in which environmental concern and perceived behavioral control served as significant partial mediators jointly explaining more than half of the total effect, with a relatively greater explanatory power of the effect of environmental concern than the effect of behavioral control.

The novelty of the presented research resides in the establishment of a holistic theoretical framework that encompasses both the traditional spheres of research of energy poverty studies and the studies of environmental behavior since these studies revealed the psychological architecture connecting the subjective experiences of resource scarcity to the suppressed intentions concerning sustainable behavior. These results have vital implications for the design of appropriate policy interventions concerning the promotion of clean energy to the energy-vulnerable since their successful implementation have to be concerned not only with material conditions of scarcity but also with the psychological barriers configured by the former.

Conflict of interest

The authors declare no conflicts of interest.

References

1. Lin, B. and Y. Wang, Does energy poverty really exist in China? From the perspective of residential electricity consumption. Energy Policy, 2020. 143: p. 111557.
2. Abbas, K., et al., Do socioeconomic factors determine household multidimensional energy poverty? Empirical evidence from South Asia. Energy Policy, 2020. 146: p. 111754.
3. Churchill, S.A., R. Smyth, and L. Farrell, Fuel poverty and subjective wellbeing. Energy economics, 2020. 86: p. 104650.
4. Liu, Z., et al., Impact of energy poverty on the welfare of residents and its mechanism: an analysis based on CGSS data. China Soft Sci, 2020. 8: p. 143-163.
5. Llorca, M., A. Rodriguez-Alvarez, and T. Jamasb, Objective vs. subjective fuel poverty and self-assessed health. Energy economics, 2020. 87: p. 104736.
6. Churchill, S.A. and R. Smyth, Energy poverty and health: Panel data evidence from Australia. Energy economics, 2021. 97: p. 105219.
7. Nie, P., Q. Li, and A. Sousa-Poza, Energy poverty and subjective well-being in China: New evidence from the China Family Panel Studies. Energy Economics, 2021. 103: p. 105548.
8. Zhang, Z., et al., Household multidimensional energy poverty and its impacts on physical and mental health. Energy Policy, 2021. 156: p. 112381.
9. Zhao, J., et al., Assessing energy poverty and its effect on CO2 emissions: the case of China. Energy economics, 2021. 97: p. 105191.
10. Li, X., H. Yang, and J. Jia, Impact of energy poverty on cognitive and mental health among middle-aged and older adults in China. Humanities and Social Sciences Communications, 2022. 9(1): p. 1-13.
11. Ajzen, I., The theory of planned behavior: Frequently asked questions. Human behavior and emerging technologies, 2020. 2(4): p. 314-324.
12. Yuriev, A., et al., Pro-environmental behaviors through the lens of the theory of planned behavior: A scoping review. Resources, Conservation and Recycling, 2020. 155: p. 104660.
13. Demerouti, E., Job demands-resources and conservation of resources theories: How do they help to explain employee well-being and future job design? Journal of Business Research, 2025. 192(C).
14. Kikko, Y. and T. Ishigaki, Divergent effects of environmental concern and risk perception on pro-environmental intention: an international study across 17 countries. Scientific Reports, 2025. 15(1): p. 7766.
15. Alkire, S. and J. Foster, Counting and multidimensional poverty measurement. Journal of public economics, 2011. 95(7-8): p. 476-487.
16. Bednar, D.J. and T.G. Reames, Recognition of and response to energy poverty in the United States. Nature Energy, 2020. 5(6): p. 432-439.
17. Healy, J.D. and J.P. Clinch, Fuel poverty, thermal comfort and occupancy: results of a national household-survey in Ireland. Applied Energy, 2002. 73(3-4): p. 329-343.
18. Gunzler, D., et al., Introduction to mediation analysis with structural equation modeling. Shanghai archives of psychiatry, 2013. 25(6): p. 390.
19. Hayes, A.F., Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. 2017: Guilford publications.
20. Xie, L., et al., Who suffers from energy poverty in household energy transition? Evidence from clean heating program in rural China. Energy Economics, 2022. 106: p. 105795.
21. Campos-Uscanga, Y., et al., Running in natural spaces: gender analysis of its relationship with emotional intelligence, psychological well-being, and physical activity. International Journal of Environmental Research and Public Health, 2022. 19(10): p. 6019.
22. Cezarino, L.O., et al., Corporate social responsibility in emerging markets: Opportunities and challenges for sustainability integration. Journal of Cleaner Production, 2022. 362: p. 132224.
23. Tawde, S., R. Kamath, and R. ShabbirHusain, 'Mind will not mind'–Decoding consumers' green intention-green purchase behavior gap via moderated mediation effects of implementation intentions and self-efficacy. Journal of Cleaner Production, 2023. 383: p. 135506.
24. Chen, D., et al., Evaluating the effects of laver cultivation on tidal flat erosion: Toward sustainable environmental practices. Journal of Environmental Management, 2024. 366: p. 121830.
25. Ho, V.C., et al., Assessing immediate emotions in the theory of planned behavior can substantially contribute to increases in pro-environmental behavior. Frontiers in Climate, 2024. 6: p. 1344899.
26. Kotyza, P., et al., The predictive power of environmental concern, perceived behavioral control and social norms in shaping pro-environmental intentions: a multicountry study. Frontiers in ecology and evolution, 2024. 12: p. 1289139.

27. Miller, L.B. and R.E. Rice, (Mis) matched direct and moderating relationships among pro-environmental attitudes, environmental efficacy, and pro-environmental behaviors across and within 11 countries. Plos one, 2024. 19(6): p. e0304945.
28. Ryan, S.C., et al., Short-term changes in mental health help-seeking behaviors following exposure to multiple social stressors and a natural disaster. Social Science & Medicine, 2024. 348: p. 116843.
29. Wang, Y., et al., The impact of energy poverty on the health and welfare of the middle-aged and older adults. Frontiers in public health, 2024. 12: p. 1404014.
30. Wu, L., Q. Liu, and L. Li, Can the household clean energy transition ameliorate health inequality? Evidence from China. Frontiers in Public Health, 2024. 12: p. 1348234.
31. Zhang, Z. and L. Hu, Is there a stronger willingness to pay for photovoltaic power generation with high education in China? Plos one, 2024. 19(4): p. e0296714.
32. Rana, M., et al., Understanding the adoption of renewable energy technologies by households in South Asia: a theory of planned behavior perspective. Discover Sustainability, 2025. 6(1): p. 477.