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Research article

Unveiling the relation between household energy conservation and subjective well-being: Insights from structural equation modeling

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ABSTRACT

Electricity is essential to Pakistan's economy and, it helps to improve the living standards of people. However, the state has long suffered from problems like imbalances in the supply of energy, excessive energy use, and frequent power outages. The present study focused on investigating the relationship between energy-saving behavior, consumption, and subjective well-being in households in urban areas of Punjab, Pakistan. Using Structural Equation Modeling (SEM), the research analyzed how different features of electricity use and energy-saving practices affect the quality of life for families in the region. According to research findings, a strong intention to save electricity is also linked to enhanced subjective well-being. When families have an intention toward conserving energy, they feel a more positive change in overall households' subjective well-being while electricity consumption which is measured in terms of electricity bills, negatively affects the household well-being. The current research concludes that some families can experience a financial benefit from lower energy bills, and others would need assistance switching to more environment-friendly energy habits. Governments must adopt price-control mechanisms and electricity subsidies for low-income groups to encourage ethical energy usage and well-being, while also undertaking awareness programs aimed at a varied audience.

1. Introduction

The United Nations Environment Programme [1] has warned of the impending calamitous rise in temperature, more than 3 °C. This temperature rise is a huge concern to humanity since it has the potential to cause ozone depletion, ecological destruction, and catastrophic weather occurrences. The International Energy Agency ([2]) pointed out in 2020 that a shift to clean and sustainable energy is necessary to overcome this issue. Southeast Asia uses many fossil fuels. It is time to switch to cleaner energy, like renewables, and be more efficient, especially in the fast-growing ASEAN economies [3].

Energy is of vital importance in improving people's lives. It enables longer food preservation, supports education, enhances convenience through household appliances, reduces labor intensity, and even provides opportunities for women's employment. Additionally, using electricity may improve environmental conditions and lower air pollution, particularly from renewable energy

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sources like solar and wind power [4–6]. The energy used for domestic purposes is critical in enhancing quality of life, and residents have a significant influence [7]. The most economical and environmentally friendly choice is electric energy, which promotes regional and national economic expansion, improves living standards, and advances social progress [8]. Notably, electricity is essential to modern society's ability to function. Energy generation is critical to enhancing many aspects of our daily lives. For starters, it allows perishable food and critical drugs to be stored in freezers for prolonged periods, considerably improving public health [9]. Secondly, electric lighting lets you study for longer, encouraging the use of technology for learning and skill development [10]. Thirdly, having various household equipment at one's disposal makes it easy to entertain, control the climate, and boost individuals' well-being [11]. Using electricity has additional benefits, like less labor force and time savings. It also provides women with additional possibilities in the workforce, such as the opportunity to work independently [5]. Lastly, by reducing the need for conventional energy sources like coal, adopting electricity could enhance the environment and reduce air pollution [6]. By converting from fossil fuels to renewable energy sources like solar and wind power, global warming may be slowed down, and carbon emissions may be significantly reduced [12]. Utilizing electricity has, therefore, become more significant as a factor in assessing people's general quality of life [13].

When energy is seen as a commodity, family income rises in direct proportion to the cost of energy usage, indicating a positive association between household income and energy expenses. The amount of energy used, often expressed in kilowatt-hours (kWh), is the primary statistic used to evaluate residential electricity consumption. Due to the lack of relevant price data, it is not easy to convert spending into a quantity such as kWh [14]. This issue arises because the evaluation of household spending mainly considers the amount of money spent rather than the quantity of energy used. Theoretical and empirical studies have sought to overcome this measurement challenge by estimating the demand system [14,15]. Even with all of the data, the observable metric is still expenditure. In a recent work Du et al. [15] used a demand system model to predict the energy demand function. The goal framing theory investigates people's engagement in pro-environmental behavior, particularly energy-saving practices, within the normative goal of perceiving energy efficiency and conservation as a socially responsible undertaking ([16,17]; Binder et al., 2019).

Furthermore, it could be challenging to reduce household energy expenses if people are content with how much energy they use. In this case, policymakers should look into other options for lowering greenhouse gas emissions at the household level. Examining how subjective well-being and household energy usage are related can provide valuable information about how households can lower their energy use and, in turn, their greenhouse gas emissions. As the effects of climate change worsen, it is anticipated that energy-saving measures such as cutting back on the quantity of fossil fuels used to generate energy sources like electricity and increasing energy efficiency will become more commonplace [16,18,19]. However, more research is needed that examines energy use, subjective well-being, and the impacts of responsible energy use worldwide. The goal of this investigation is to fill in that information gap.

There is little need to be more of a connection between energy-saving methods, electricity consumption, and subjective well-being (SWB) in Pakistan. Given Pakistan's recent history of energy policy blunders that have resulted in severe power shortages and substantial economic losses [20], thus this study gap becomes more critical. The elements that contribute to Pakistan's unstable power consumption are still numerous and include the industrial (25.7 %), residential (50.5 %), bulk supply (5.2 %), agricultural (9.5 %), and commercial (8 %) sectors (Yearbook, P.E, 2018). The strong relationship between energy use and economic development substantially impacts the overall quality of life of the population ([21]; [22]; [23]; [24]). There is slight data on the long-term effects of pro-environmental behaviour, despite many studies supporting a favourable association between these behaviours and subjective well-being. Examining the relationship's long-term viability may reveal important information on how regular participation in naturally friendly activities affects people's subjective well-being. Research on the relationship between pro-environmental behaviour and subjective well-being has been conducted, but little is known about the effects of particular interventions (such as energy-saving campaigns and educational initiatives) on well-being and energy consumption. Manipulative more operative policies and programmes may benefit from an investigation of the efficacy of these initiatives.

The current study intends to investigate the effects of energy-saving measures and how energy use influences people's subjective well-being in Pakistan in light of these proven links. Survey-based techniques were employed in this study to shed light on an essential but little-studied topic. Furthermore, the Structural Equation Model forms the basis of the present study. The current study gap that has been found relates to the insufficient comprehension of the correlation between energy-saving activities, electricity usage, and subjective well-being (SWB) in Pakistan. This gap is crucial considering Pakistan's past energy policy challenges and the substantial influence of energy use on economic and social welfare. The study objective is to investigate the process by which Pakistani residents acquire and incorporate energy-saving behaviors into their daily lives.

The study is structured as follows: Section 2 presents the literature review, which outlines the study's research objectives. Section 3 research methodology covers the theoretical background and presents variable descriptions along with the proposed methodology. Section 4 follows, describing the results and discussing the key empirical findings. Finally, Section 5 concludes the study.

2. Literature review

A multifaceted relationship exists between energy-saving intention, electricity consumption, and subjective well-being. Those who practice pro-environmental habits out of a desire to conserve energy could feel personally fulfilled and satisfied. Hunjra et al. [25] addressed how being environmentally conscious affects one's quality of life, focusing on factors including perceived environmental effect, self-concept, autonomy, and personal beliefs. He found that adopting ecologically friendly practices may potentially improve quality of life.

According to Anderson et al. [26], socioeconomic standing only sporadically influences subjective well-being (SWB). SWB is more influenced by sociometric behaviour, such as respect and appreciation in face-to-face groups. Kaida and Kaida [27] highlighted how crucial psychological elements are to creating a sustainable society. They suggested that pro-environmental behaviour can enhance

present and future subjective well-being, but expectations of better future well-being may not always facilitate it. Jones [28] investigated the Impact of energy-saving techniques such as LED streetlight investments on subjective well-being across the 100 largest US counties. Results showed that LED retrofits generate significant positive well-being impacts, varying by demographic characteristics and streetlight replacement number.

Igawa et al. [29] studied how summer heating affects people's well-being in Japan, concentrating on the connection between electricity consumption and subjective well-being. The findings indicated that increased cooling energy requirements can affect subjective well-being, with the lowest-income group requiring the most energy due to less efficient dwellings.

Wu et al. [30] examined the Impact of electricity consumption on residents' subjective well-being in China. They found that increased consumption improves overall well-being. Okulicz-Kozaryn and Altman [31] investigated the relationship between energy use and subjective well-being at the societal level, revealing that life satisfaction, the most common measure of subjective well-being, is unrelated to energy use. According to Sun et al. [32], higher clean electricity consumption leads to increased happiness, particularly among those with housing and low education, as well as middle-aged and elderly residents.

Binder and Blankenberg [33] found that green behaviour and sustainable consumption positively impact life satisfaction in Great Britain. However, this boost is primarily due to self-image, not concrete pro-environmental behaviours. Welsch and Biermann [34] studied the relationship between subjective well-being and energy prices in 21 European countries. Results showed that energy prices significantly impact subjective well-being, with effects more pronounced in individuals from the lowest income quartile and during high energy expenditure periods. [35] examined the Impact of energy poverty on subjective well-being among Chinese adults aged 18 and over, finding that EP leads to higher levels of depression and that individual health and household food expenditure mediate this relationship. Aydin [36] explored the relationship between current consumption and the hedonic happiness model promoted by global consumer culture. It suggests that sustainable consumption depends on the individual pursuit of subjective well-being or happiness.

Jabeen et al. [37] investigate the factors affecting consumers' intention to utilize renewable power generation technologies for domestic use. The research exclusively utilized primary data sourced from 230 Pakistani households. The statistical findings revealed that various factors, such as subjective norms, attitudes, relative advantages, perceived behavioural control, and limited access to electricity, positively impact consumers' willingness to adopt renewable power generation technologies. Conversely, the study identified cost as a prohibiting factor, diminishing consumers' intention to embrace renewable power generation technologies.\

Wu et al. [30] conducted a study on the influence of household electricity usage on the subjective well-being of Chinese individuals. They conducted a micro-mixed cross-sectional research using data from the Chinese General Social Survey (CGSS). Increasing household electricity use benefitted females and those with lower levels of education but did not affect men or those with greater levels of education, according to their heterogeneity study. Furthermore, their data showed no nonlinear relationship between increased electricity use and increased residents' life satisfaction. To evaluate the national policies of Poland and Slovakia, Barwiska et al. (2022) employed novel metrics to enhance energy efficiency and the welfare of families and people. They carried out desk research and content analysis to evaluate these policies in-depth. They concluded that lowering a building's energy use directly correlated with lower operating costs, a trustworthy gauge of people's financial well-being. Additionally, it was discovered that generating power and heat from self-owned resources and renewable energy sources improved environmental and energy welfare and encouraged independence from external energy sources.

Zawadzki et al. [38] examined the connection between individuals' pro-environmental actions and their subjective well-being. Primary data from many sources, such as the European Social Survey, Web of Science, Scopus, professional email lists, and authorship team data, were used in their research. Through empirical study, they established a direct link between people's subjective well-being and their pro-environmental behaviours. The results also showed that governments and programme planners look for ways to design sustainability projects that benefit the environment and people in a "win-win" manner. [39] has found pro-environmental behavior to be positively related to subjective well-being [40] examined the main variables influencing electricity consumption during the COVID-19 pandemic in light of the pandemic's long-term consequences on international economies using primary data from 511 Pakistanis. Structural equation modeling discovered that the drive to conserve energy reported financial benefits, perceived behavioural control, and perceived environmental concern were all positively and significantly correlated. Ali et al. (2019) employed the Technology Readiness Index and the Theory of Planned Behaviour to examine the variables impacting customer's tendency to buy energy-efficient household products. They collected primary data from 396 eligible households to determine whether customers intended to purchase energy-saving household items. Using a hypo-deductive research approach, they found that while factors impeding residents' technological readiness hurt this connection, factors enhancing residents' technological readiness favoured residents' perceptions of their intended purchases. According to Xiangdan & Shunsuke (2023) in many nations, home energy use is positively correlated with life satisfaction and rises with wealth. Although energy-saving practices are beneficial, buying energy-saving devices by themselves won't significantly lower energy use.

3. Research methodology

This section provides the methodology for determining Household electricity-saving behaviour, its impact on consumption, and subjective well-being in Pakistan.

3.1. Theoretical background

Albert Bandura's Social Learning Theory (1901–1994) underscores that learning takes place through observation, imitation, and modeling, emphasizing the crucial role of social influence and external reward in influencing behavior. Important principles

encompass observational learning and the significant impact that role models have in shaping behavior. The Goal Framing Theory, formulated by Lindenberg and Steg (2013), investigates how various goals shape and impact behavior. The theory suggests that individuals' behaviors are motivated by three categories of objectives: hedonic (seeking pleasure), gain (self-interest), and normative (pro-social and environmental). This theory is especially applicable in comprehending pro-environmental behaviors since it examines how presenting environmental efforts as socially accountable might motivate involvement. The Theory of Planned Behavior (TPB), formulated by Ajzen [41], posits that behavior is motivated by intentions, which are shaped by attitudes, subjective norms, and perceived behavioral control. This hypothesis is crucial for forecasting and comprehending behaviors, such as the adoption of energy-saving methods. Closing the knowledge deficit in research.

The application of Goal Framing Theory can provide insights into how presenting energy-saving actions as socially responsible might increase motivation and engagement among residents. By prioritizing normative objectives, such as environmental accountability, the research can examine if this approach results in increased implementation of energy-conserving behaviors and enhanced subjective well-being. The Theory of Planned Behavior (TPB) can be utilized to comprehend the factors that influence individuals' intentions and actions toward conserving energy. The study aims to analyze attitudes, subjective norms, and perceived behavioral control to determine the main elements that impact residents' intentions to conserve energy and how these intentions manifest in their actual behavior.

Investigate the variables that influence the research model:

TPB supports the idea that intentions can predict behavior. The study posits that there is a positive correlation between intentions to save electricity and subjective well-being (SWB), indicating that those who have the goal to save electricity are more likely to experience higher levels of SWB. The Goal Framing Theory posits that presenting the aim to conserve power as a normative objective might augment pro-environmental conduct, resulting in heightened subjective well-being. The adoption of electricity-saving habits can be explained by the Social Learning Theory, which posits that individuals learn and imitate such actions through observation and modeling. Community programs and educational efforts can act as exemplars for conduct. The TPB proposes that the perception of one's ability to manage their behavior and the influence of social norms affect behaviors related to saving electricity. These behaviors are hypothesized to have a positive correlation with subjective well-being (SWB). The theory of planned behavior (TPB) suggests that the perception of escalating electricity prices might impact attitudes and perceived behavioral control, potentially resulting in behavioral modifications targeted at decreasing consumption. Goal Framing Theory posits that presenting price rises in the context of a normative framework, such as emphasizing the importance of sustainable energy usage, can potentially reduce the negative effects on subjective well-being (SWB).

Socio-demographic characteristics, such as age, education, and money, have an impact on how individuals learn and adopt new behaviors, according to Social Learning Theory. The TPB proposes that these elements also impact attitudes, subjective norms, and perceived behavioral control, consequently shaping intents and behaviors associated with energy conservation.

3.2. Study area

This study looks at the effects of household energy-saving measures on power usage and subjective well-being in Punjab (the largest province of Pakistan). The region's business and industrial activity, household consumption, and agricultural needs impact its energy needs. The link between daily living, economic activity, and electricity consumption is complex in Punjab. Changes in household electricity conservation practices could significantly impact the stability and output of the province's economy because the industrial sector relies so significantly on power for operations. Energy is required for cooking, lighting, and appliances; household consumption is significant. Understanding the impacts of energy-saving measures on domestic usage is crucial for conserving resources and improving the standard of living. Most people in Punjab work in agriculture, making it primarily an agricultural region. The sustainability and effectiveness of agricultural practices can be impacted by changes in electricity consumption patterns, which can thus have an impact on rural resident's capacity to survive. Punjab's diverse energy landscape provides an exciting setting for investigating the dynamic relationships between household power-saving behaviour, electricity use, and subjective well-being. The findings can provide valuable insights for local populations, policymakers, and researchers interested in energy efficiency and well-being in similar regions.

3.3. Subjective well-being (latent dependent variable) indicators

The variable used to capture SWB (subjective well-being) is life satisfaction. It is based on the answers to the following questions: satisfaction from "Family life and health, wealth and facilities, parental financial status, harmony among household members, relationship with spouse, better relation with family members, relationship with family relatives and friends, present house and surroundings, daily religious activities and how satisfied are you with the way decisions are taken in your family". A Lickert scale of 1–5 is used for data collection, where 1 represents unsatisfied and 5 represents completely satisfied. For the validity of the index, we used confirmatory factor analysis in the present study. The constructs and indicators of subjective well-being were taken from previous studies. Questions shaping constructs had been adapted from different sources as follows (Munir et al., 2019), with ten items.

3.4. Intention to save electricity

Financial worries may lead consumers to seek alternative electricity sources when market power rates rise. Creating your electricity could be a less expensive option than utilizing a more costly grid energy supplier. Fuel, maintenance, depreciation, and market prices

will all be factored into the cost of generating energy. If our generation's costs are less than the projected market price, it is deemed the superior option.

Hypothesis 1 a. Intention to save electricity in the household is favourably correlated with subjective well-being.

3.5. Electricity saving behaviour

Financial considerations are the primary driver of money consciousness, which considerably impacts electricity-saving behaviour (Delmas et al., 2013). Psychological and external factors also influence people's tendency to conserve power, whereas external factors affect behaviour more. Perceived rewards, including organizational, financial, and environmental advantages, positively impact energy-saving aims. Government policies, influenced by the media, educational institutions, and others, are substantially correlated with energy-saving behaviour.

The constructs and indicators, in this research, were taken from previous studies. Questions shaping constructs had been adapted from different sources as follows, energy saving intention (Gao et al., 2017) with three items, and energy saving behavior (Lopes et al., 2019) also with three items.

Hypothesis 2 a. Household electricity-saving behaviour positively correlates with household subjective well-being.

3.6. Electricity Sustain Increase in Prices (ESIP)

Electricity prices are essential elements that affect the household's subjective well-being (Regier, 1993). The power Sustain Increase in Prices (ESIP) phenomenon is defined by the slow and continual increase in power costs over a long period. Electricity price increases can be linked to various causes, including changes in energy production technologies, fluctuations in supply and demand, changing government regulations, and increased environmental concerns. Electricity is a vital service that tremendously impacts the everyday lives of individuals and households, significantly influencing their comfort, convenience, and general quality of life.

Hypothesis 3. A sustained increase in electricity prices negatively affects the household's subjective well-being.

3.7. Socio-demographic factor

Hypothesis 4a. A person's ambition to preserve energy in their home is positively correlated with their household size.

Hypothesis 4b. A household's aim to preserve energy in their houses is positively correlated with their income.

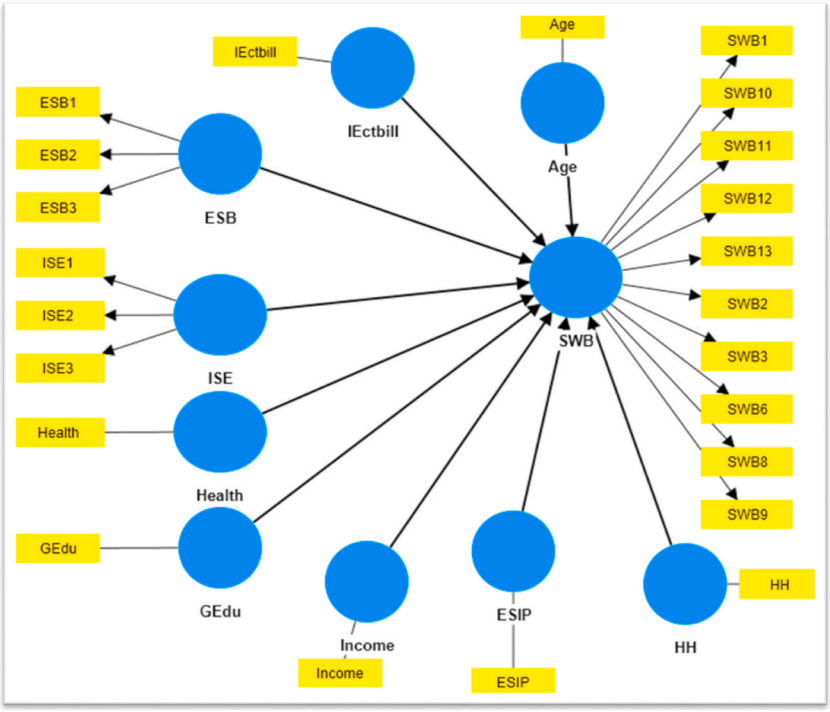

Fig. 1. Conceptual framework of present study.

Hypothesis 4c. An individual's aim to preserve energy in their home is positively impacted by the general education of their household.

Hypothesis 4d. An individual's goal to save energy in their houses is positively impacted by the state of their household.

Hypothiesis 4e. The aim of a person to preserve energy in their home is positively correlated with the age of the household.
Hypothesis 4e: The household's electricity bill favours people's intentions to reduce their energy use at home.

Based on the above discussion, the following framework is presented (Fig. 1)

3.8. Proposed methodology

3.8.1. Data

The study's hypothesis was explored using survey data obtained from households in Punjab, Pakistan. Known as the country's largest province and a central hub for politics, economy, and culture, Punjab served as the focal point for this research. For the collection of data convenience sampling technique was used because convenient sampling can be useful in exploratory research or when the researcher has limited resources and time. The present study relied on a convenient sampling method for the collection of primary data. For the population of Punjab (urban areas), estimated at around 400 thousand as per recent surveys, a sample size of 415 households was selected for analysis of this study. The formula employed to determine the sample size was based on the equation:

$$S = Z^2 \times P \times \frac{(1-P)}{M^2}$$

Where S represents the sample size, Z is the normal distribution's critical value at the selected confidence level. P denotes the assumed population proportion (50 % or 0.5), and M represents the margin of error.

3.8.2. Survey Instrument

To collect data, a structured questionnaire was employed, comprising four distinct sections:

General details (such as interviewer's name and interview date), Demographic information (including age, education level, family size, and income), Three fundamental constructs of the theory of planned behaviour (Ajzen,1991) attitude towards electricity conservation, subjective social norms, and perceived behavioural control, Subjective evaluation of household physical health.

To evaluate the effect of perceived and subjective norms on adaption methods, the study used Smart Partial Least Squares (PLS) route modeling and partial least squares regression with a standard error margin of 5 %. The method was chosen for its ability to explore both additive causal and linear models, both of which find support in existing research.

3.9. Proposed analytical approach

Equations were utilized in the study to show how endogenous and exogenous latent variables related. The inner model constructs the link between the theory's latent variables, sometimes referred to as the structural model. PLS is meant to be used with recursive models, which include causal chain systems. The measurement model delineates relationships between endogenous and indicator variables. The structural equation model scrutinizes the correlation between latent variables and indicators. It employs reflexive and formative models for indicator variables. Reflexive models involve hidden factors impacting indicators, while formative models propose unobservable effects of indicators on latent variables, implying causality without directional determination. Weight relation scores showcase variances between indicators and their latent variables. The equations for weight connections are expressed as:

$$\in_b = \sum\nolimits_{kb} W_{kb} X_{kb} \tag{5}$$

$$\eta_i = \sum\nolimits_{ki} W_{KI} Y_{KI} \tag{6}$$

Where W_{kb} and W_{kb} shows the weights, k used to estimate latent variables $\in_b$ and η_i.

Two tests are used for structural models: the path coefficient estimation test and the R-squared test. Convergent validity is assessed using the measurement model's convergent validity (outer model), which establishes the strength of the relationship between latent variables and their corresponding indicator variables in the reflexive measurement paradigm. Reliability assessment is an essential test for the measurement model (outer model) in the SEM-PLS framework. The model's dependability in this study is evaluated using Composite dependability (CR) and Average Variance Extracted (AVE) metrics. High levels of trustworthiness for latent variables are indicated by a composite reliability (CR) score greater than 0.7. The CR can be computed using the following formula:

$$\boldsymbol{CR} = \frac{\left(\sum_{i=1}^{n} \boldsymbol{\lambda i}\right)^2}{\left(\sum_{i=1}^{n} \boldsymbol{\lambda i}\right)^2 + \sum_{i=1}^{n} \boldsymbol{e_i}} \tag{7}$$

Average Variance Extract (AVE) can be determined by the following formula:

$$AVE = \frac{\sum_{i=1}^{n} \lambda i^2}{\sum_{i=1}^{n} \lambda i^2 + \sum_{i=1}^{n} e_i} \quad (8)$$

4. Results and discussion

4.1. Demographic information

Descriptive analysis facilitates the comprehension of this study by preparing both the researcher and the audience for a deeper exploration of the econometric analysis within the study's specified framework (see Table 1). Table 2 delineates the demographic statistics of households within the research area. Age emerges as a pivotal factor in determining individuals' capacity to seize opportunities, showcasing a solid correlation with everyone's level of responsibility. The acquired data validates these findings. Table 2 concisely outlines the age distribution among the respondents in this study. Notably, most registered members (21.68 %) fall within the age bracket of 26–35, while another significant cohort lies between 36 and 45 (20.72 %), actively engaging in developmental pursuits. Furthermore, the age distribution of respondents indicates 10.12 % below the age of 25, 18.31 % between 46 and 55, and 29.16 % above 55.

Gender's impact on subjective well-being is multifaceted and intertwined with intricate social, cultural, and individual variables. Understanding and rectifying gender-based well-being disparities hold utmost importance in fostering an equitable and inclusive society, ensuring everyone, irrespective of gender identity, experiences elevated subjective well-being. In this study, female participation comprised 159 participants (38.31 %), while male participation accounted for 256 participants (61.68 %), signifying a predominance of male representation within the sample.

The influence of household size on well-being significantly contributes to the quality of life for individuals and families, potentially affecting well-being positively or adversely based on various factors and individual circumstances. Among the 415 respondents, 36.14 % reported residing in households with fewer than four individuals, whereas 42.40 % had five to seven occupants. Additionally, 16.87 % mentioned living in households with 8–10 members, while a minor fraction (4.58 %) resided in homes accommodating 11 to 15 individuals.

This comprehensive descriptive analysis delineates the distribution of respondents across diverse marital status categories. It highlights a substantial majority (74.2 %) identifying their marital status as "married," followed by a sizable proportion (22.2 %) identifying as "single." A smaller subset reported being "divorced" (3.4 %), while an even smaller fraction (0.2 %) identified as "widowed."

Among respondents, an associate degree emerged as the most prevalent level of general education, accounting for 29.31 % of valid responses and ranking second in popularity. Conversely, a bachelor's degree held the highest prevalence at 42.89 %. In contrast, 12.29 % reported possessing a high school diploma or lower. Master's and Ph.D. degrees were the least frequently cited educational levels, each receiving minimal response rates.

Regarding health descriptors, the majority of respondents classified their health status as "mixed" (30.6 %) or "good" (32.8 %). A notable subset (28.60 %) indicated "bad" health, with a smaller proportion (8.0 %) expressing "terrible" health.

Table 1
A summary of the literature review. This table should seebe placedms at the end of literature review. this table shows the summary of literature.

Author(s) and year	Context	Nature of the study	Relationship
Hansen, Slagsvold [42]	two waves panel data using multivariate analyses	Empirical study	negative between age & subjective well-being
Stone et al [43]	Primary data and ordinary least square regression	Empirical study	U shaped between age & subjective well-being
Sacks et al. (2012)	Time series	Empirical study	positive between income and subjective well-being
Chen et al. [44]	Cross-sectional data and multiple linear regression analysis	Empirical study	inverted V-shaped association between household size and well-being
Steptoe et al [45]	Panel data	Empirical study	positive between Health and subjective well-being
Wang & Sohail [46]	Time series data	Empirical study	positive role of education in enhancing subjective well-being
Majeed et al. (2019)	Time series data	Empirical study	positive between education and subjective Well-being
Kumari [47]	panel-corrected standard error (PCSE) model.	Empirical study	positive between income, electricity consumption, and subjective Well-being
Wu et al.(2022)	Primary data	Empirical study	positive between Saving electricity and subjective well-being
Hanssen et al., 2004	Secondary data	Empirical study	positive between electricity saving behavior and subjective well-being
Ming et al., 2015	Panel data	Empirical study	electricity is a necessity for consumers increase in price does not have a strong impact on demand
Zibin (2017)	Time series data and fuzzy regression discontinuity design	Empirical study	The larger increase in electricity price induced a decrease in electricity use
Xiangdan, Sohunsuke (2022)	Cross-sectional data	Empirical study	positive between electricity saving behavior and subjective well-being

Table 2
Demographic characteristics of household.

Demographics	Frequencies	Percentages (%)
Gender		
Female	159	38.31 %
Male	256	61.68 %
Age		
under 25	42	10.12 %
26–35	90	21.68 %
36–45	86	20.72 %
46–55	76	18.31 %
56 and above	121	29.16 %
Household Size		
under 4HH	150	36.14 %
5-7 HH	176	42.40 %
08-10HH	70	16.87 %
11-15HH	19	4.58 %
Marital status		
Unmarried	92	22.20 %
Married	308	74.20 %
Divorced	14	3.40 %
Widow	1	0.20 %
General Education		
High school or below	51	12.29 %
Associate degree	122	29.31 %
Bachelor's Degree	178	42.89 %
Master's degree	46	11.08 %
PhD	18	4.34 %
Income		
less than 99,000	255	61.44 %
100000 to 250,000	146	35.18 %
251,000 to 400000	10	2.40 %
410000 and above	4	0.96 %

In Table 2, most respondents (61.44 %) reported an income below 99,000, with a significant proportion (35.18 %) falling within the 100,000 to 250,000 income range. A minor segment (2.40 %) reported an income between 251,000 and 400,000, while a negligible fraction (0.96 %) had an income exceeding 400,000.

4.2. The Respondent's electricity

Table 3's data reveals that 78.54 % of respondents spend less than 80,000 per month on energy. The percentage of respondents with electricity expenses between 81,000 and 150,000 was lower (16.87 %).

Less than 5 % of respondents (4.58 %) said they had over 150,000 in electrical costs.

4.3. Measurement model (outer model)

The substantial value of the standardized loading factor (λ) signifies a considerable level of convergent validity. As per Hair et al. [48], a value of 0.5 suggests the achievement of a strong degree of convergent validity. The value of the two indicators is less than 0.4 but we consider further analysis based on the main and important indicator to measure domains of subjective well-being. Moreover, recent expansions in psychometric research highlight the importance of investigating the contribution of each item to the overall measurement model, rather than each variable depending on cutoff values [48,49].In present study context involves a specific population or cultural setting where assured items may uniquely contribute to understanding SWB. This contextual relevance supports the retention of items that, despite lower loadings, are relevant by the intended respondents or have theoretical backing. The outer model loadings, depicted in Table 4 and Fig. 2, offer an understanding of the outcomes from the assessment of convergent validity conducted within the context of Punjab, Pakistan.

Table 3
Results – bill of electricity of the respondent.

Bill of Electricity	Frequencies	Percentages
Under 25,000 to 80000	380	78.54 %
Between 81000 and 150000	32	16.87 %
Above 150000	3	4.58 %

4.4. Evaluation of the inner structural model and hypothesis examination

The inner structural models divulge intricate relationships among latent variables. During the partial least squares analysis, the coefficient for the route variable is ascertained by balancing the structural model. This is determined based on the t-statistic value obtained from bootstrapping with a participant sample size 415. Specifically, the coefficient for the route parameter within the inner model of Punjab (Pakistan) is presented in both Fig. 3 and Table 5. Upon scrutinizing the impact of ISE, a t-statistic value of 3.648, surpassing 1.98, signifies a positive and significant influence on subjective well-being, **thus** supporting **the acceptance of hypothesis 1a.** ESB of households exhibits a positive and substantial impact on SWB, increasing it by 0.131 units, which is statistically significant, **thereby confirming hypothesis 2**. However, the influence of escalating power prices on subjective well-being is negative but statistically insubstantial, recorded at −0.007 units with a t-statistic value of 0.039 (below 1.98), indicating no significant impact in this context.

Consequently, hypothesis 3 regarding subjective standards is refuted. Regarding household size, it demonstrates a positive yet statistically negligible impact on subjective well-being, validating hypothesis 4a with a t-statistic value of 0.048, exceeding 1.98. Conversely, income exhibits a minor positive influence on subjective well-being, amounting to 0.099 units. Despite a t-statistic value of 0.099, surpassing the 1.98 criterion, **hypothesis 4b is upheld.** GEDU's impact on subjective well-being portrays a positive association, evident from its significant and positive influence, with a t-statistic value of 2.214, exceeding the 1.98 criterion. **Hence,** supporting **hypothesis 4c.**

The significant predictive nature of health status is indicated by a t-statistic value of 5.468, contributing favourably with an impact size of 0.242 units, **aligning with hypothesis 4d.** On the contrary, age showcases a significant negative effect of −0.116 on subjective well-being, backed by a t-statistic value of 2.439, surpassing the 1.98 threshold. Moreover, power cost exhibits a considerable negative influence on subjective well-being, indicated by a substantial t-statistic value of 6.758, significantly exceeding the 1.98 threshold, leading to the invalidation of hypothesis 4e.

5. Discussion

The findings of this study contribute novel insights into the complex interplay between electricity price rises, energy-saving behaviors, and subjective well-being. The positive and statistically significant relationship ($\beta = 0.131$) between electricity-saving behaviors and respondents' well-being adds a unique perspective to existing literature. While previous studies have broadly examined pro-environmental behaviors and well-being [50,51], our research highlights specific actions such as utilizing LED lighting, optimizing thermostat settings, and minimizing standby power usage. These actions not only reduce electricity expenses but also enhance a sense of environmental responsibility and community cohesion, thereby boosting subjective well-being. This nuanced understanding underscores the importance of practical, everyday energy-saving practices as integral to enhancing well-being, beyond the general pro-environmental behaviors previously discussed.

Moreover, our study reveals a strong negative impact ($\beta = -0.339$) on subjective well-being due to sustained increases in electricity

Table 4
Results of confirmatory factor analysis.

Construct	Item	Standard factor loading	Cronbach's alpha	Composite reliability	AVE
Intention to save electricity (ISE)			**0.909**	**0.928**	**0.846**
My aim is to conserve energy within my household.	ISE1	0.919			
I am focused on reducing electricity consumption within my residence	ISE2	0.964			
I am committed to making efforts to minimize electricity usage in my home.	ISE3	0.922			
Electricity saving behaviour (ESB)			**0.699**	**0.769**	**0.626**
Typically, when I'm alone in a room, I make it a habit to power down electrical devices.	ESB1	0.777			
Consistently, I opt to shut off all electric appliances instead of keeping them on standby mode.	ESB2	0.909			
Lately, I've invested in energy-saving electrical equipment	ESB3	0.913			
Subjective Well-being (SWB)			**0.776**	**0.795**	**0.265**
Family life and health	SWB1	0.500			
Wealth and facilities	SWB2	0.543			
Present financial status	SWB3	0.289			
Harmony among household members	SWB6	0.544			
Relationship with spouse(only for married)	SWB8	0.591			
Better relation between family members	SWB9	0.344			
Relationship with family relatives and friends	SWB10	0.555			
Present house and surroundings	SWB11	0.400			
Daily religious activities	SWB12	0.721			
How satisfied are you with the way decisions are taken in your family	SWB13	0.519			

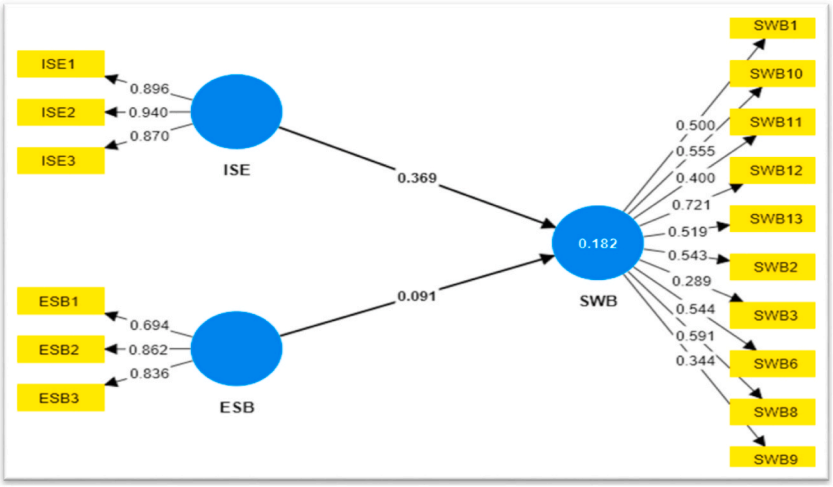

Fig. 2. Measurement model.

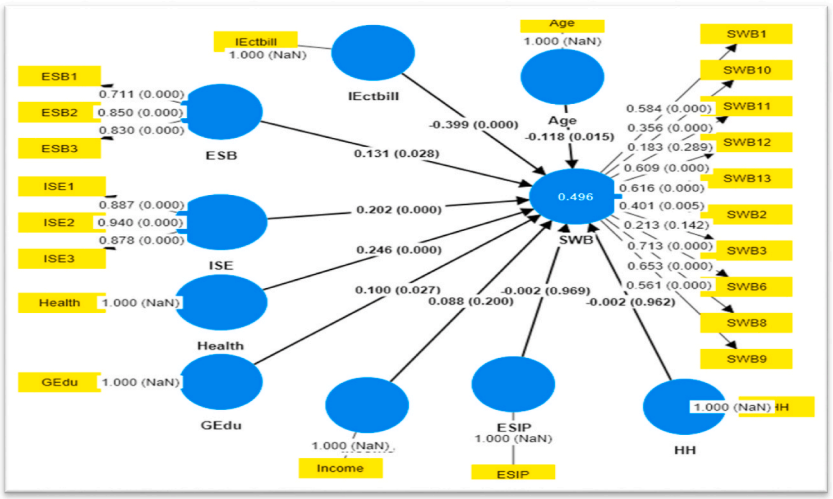

Fig. 3. Structural model.

Table 5
Path parameter coefficients.

Construct	Sample mean (M)	STDEV	T stat.	P values
ESB - > SWB	0.142	0.060	2.200	0.028
ESIP - > SWB	−0.007	0.043	0.039	0.969
Age - > SWB	−0.116	0.048	2.439	0.015
HH - > SWB	0.002	0.043	0.048	0.962
Health - > SWB	0.242	0.045	5.468	0.000
ISE - > SWB	0.202	0.055	3.684	0.000
Income - > SWB	0.099	0.068	1.283	0.200
lEctbill - > SWB	−0.407	0.059	6.758	0.000

prices. This aligns with the economic strain theory proposed by [52] but offers a more detailed examination of how continuous price hikes specifically in the energy sector affect well-being. Previous research by Jones [28] and Brown et al. [53] has noted the inverse relationship between rising electricity costs and household welfare. Our study, however, emphasizes the lasting psychological and emotional consequences of such economic pressures, providing a more comprehensive understanding of the long-term impacts of energy cost inflation on well-being.

Additionally, the study's examination of age ($\beta = -0.118$) and its impact on subjective well-being supports the "U-shaped curve of

happiness" theory [54,55]. The detailed analysis of middle-aged well-being decline due to job, financial, and familial responsibilities, followed by an increase in later life, adds specificity to this theory. The consideration of age-related health issues further enriches the discussion, linking the decline in physical health to lower well-being among older adults (Well-being et al., 2015).

Our findings on household size ($\beta = 0.002$) offer a nuanced perspective, suggesting that while household size alone does not significantly impact well-being, the quality of relationships within larger households plays a critical role. This supports the notion that social dynamics and cultural factors significantly moderate the relationship between household size and happiness [56,57].

The significant positive impact of health status ($\beta = 0.246$) on well-being aligns with extensive research highlighting the critical role of physical and mental health in life satisfaction [58,59]. Our study reinforces the World Health Organization's perspective on health as a fundamental right, essential for a high quality of life, and aligns with Sen's (1985) capability approach, emphasizing health as a core competence for leading meaningful lives.

Furthermore, the positive influence of the intention to save electricity ($\beta = 0.202$) on well-being underscores the psychological benefits of proactive environmental stewardship. This finding is supported by the Theory of Planned Behavior, which suggests that strong intentions to engage in specific behaviors, such as energy conservation, enhance overall well-being [41,60].

Lastly, the significant positive correlation ($\beta = 0.088$) between income and subjective well-being corroborates the well-documented relationship between financial resources and life satisfaction [61]. Our study also supports the "Easterlin Paradox," noting that the impact of income on well-being diminishes as income levels rise, offering a nuanced understanding of the financial determinants of happiness.

Overall, our research provides novel contributions by detailing the specific actions and circumstances that influence subjective well-being, particularly in the context of energy usage and economic pressures. This comprehensive approach offers valuable insights for policymakers and individuals aiming to enhance well-being through practical energy-saving measures and economic strategies.

5.1. Conclusion and policy implications

The conclusion of the present study emphasizes the compulsion of developing a comprehensive framework to understand family electricity-saving behaviour and its consequent consequences on subjective well-being. The study finds several factors related to energy-saving behaviours that positively impact subjective well-being, including health, household size, income, and power-saving goals and behaviours using structural equation modeling.

The results show that those actively participating in energy-saving plans report feeling more subjectively wealthy. This demonstrates how consciously consuming less electricity often makes people feel better. Subjective well-being among people who exhibit a strong desire for energy conservation. This implies that attempting to preserve energy could lead to an improved quality of life. The results show that larger households are linked to higher subjective well-being; according to this study, healthier people will likely use less energy overall. The capacity to actively engage in energy-saving activities may be related to this. In terms of energy use, higher wealth is associated with higher subjective well-being, which the stability and adaptability of investments in energy-saving equipment and procedures could explain.

On the other hand, the study identifies traits that negatively impact subjective well-being when combined with energy-saving activities. These are the effects of ageing, increased electricity costs, and rising power prices. It is declining subjective well-being related to growing power costs.This is likely due to the possibility that growing costs may result in difficulty on a financial level and worry about electricity costs. Age is a significant predictor of power utilization, and subjective well-being could result from discomfort related to energy-saving measures or a diminished ability to engage in energy-saving activities. Remarkably, there is a correlation between a rise in the price of electricity and a fall in subjective well-being over the reliability or quality of power distribution during sharply reduced rates, which may be the cause.

6. Policy implications

- ➢ Launch campaigns to raise public awareness of the importance of energy conservation and its positive effects on well-being programmes can be directed towards people of all ages and socioeconomic backgrounds to promote moral power usage.
- ➢ Implement Electricity Price Stabilization and Subsidy Programs

Provide targeted electricity subsidies for low and middle-income households to alleviate financial pressure. This could be funded through government budgets or international aid programs focused on energy affordability.

- ➢ Promote Energy-Saving Behaviors and Technologies to Enhance subjective well-being through the adoption of energy-efficient practices.

  In Pakistan the economical and social dimensions of energy consumption can be addressed by putting the above-mentioned policies into practice, which will ultimately improve the citizens' quality of life.

6.1. Limitations of the study

Our work has some limitations that should be addressed in future research. Our present inquiry is limited mainly to an urban area examination inside a single region in Pakistan. We did not conduct detailed province-level analyses or use a larger sample size, which is

necessary for developing more focused and practical policy recommendations at the provincial level. As a result, future research efforts may be expanded to a province level, allowing for formulation more context-specific policy recommendations in Pakistan. Comparative evaluations at the national and provincial levels would aid in establishing region-specific development strategies to improve overall human well-being.

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Fozia Munir: Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Nabila Khurshid:** Writing – original draft, Supervision, Software, Methodology, Conceptualization. **Jamila Khurshid:** Writing – review & editing, Software, Methodology, Data curation.

Declaration of competing interest

All authors declare that they have no conflict of interest in this paper.

Appendix

Section A: General information

A01. Name of Interviewer
A02. Name of Respondent **A03**. Date of Interview

Section B: Household Information

B01. How many persons live in your house?										
B02. Detail of Household Head.										
	1	2	3	4	5	6	7	8	9	10
Sr#	Enlist all individuals who normally live and eat their meals together in this household, starting with the head of household	Relationship to head:	Sex 1. Male 2. Female	Age (in years)	Marital status 1. Unmarried 2. Married	General education (in years)	Religious education 1. Nazra 2. Hifz	Health 1. Very Good 2. Good 3. Mixed 4. Bad 5. Very Bad	Income (in rupees per month)	Religious affiliation 1. Low 2. Very low 3. Moderate 4. High 5. Very high
B03. In your opinion, on which type of activities your family members spend most of their time?										
1. Economic activities (work)			**2.** Social activities			**3.** Home related activities			**4.** Religious activities	
B04. Your total electricity bill per month.										
B05. What you think sustain increase in electricity price enhance.										
1. Problems			**2.** Mental stress			**3.** Poverty				

Section C: Subjective Assessment of Household's Wellbeing and Behavior toward Electricity Saving

C01. Keeping in view the last three months please tell how much you and your family are satisfied with the following?					
	1. Totally unsatisfied	2. Unsatisfied	3. Mixed	4. Satisfied	5. Completely satisfied
Family life and health					
Wealth and facilities					
Present financial status					
Standard of food and daily requirements					

(*continued on next page*)

(*continued*)

C01. Keeping in view the last three months please tell how much you and your family are satisfied with the following?					
	1. Totally unsatisfied	2. Unsatisfied	3. Mixed	4. Satisfied	5. Completely satisfied
Quality of drinking water					
Harmony among household members					
Ethical behavior of household members with each other					
Relationship with spouse (only for married)					
Better relation between family members					
Relationship with family relatives and friends					
Present house and surroundings					
Daily religious activities					
How satisfied are you with the way decisions are taken in your family 13					
How satisfied are you with the time that your household members spend together					

C02. Keeping in view the last 3 months answer the following questions?					
	1.Strongly Disagree	**2. Disagree**	**3. Neutral**	**4. Agree**	**5. Strongly Agree**
Intention to save electricity					
• I intend to save electricity in my home.					
• I plan to save electricity in my home.					
• I will try to save electricity in my home.					
Electricity saving behavior					
• I always turn off electrical appliances when no one else is left in the room.					
• I always turn electrical appliances off completely rather than to a standby mode.					
• I have purchased energy efficient electrical appliances in the past few years.					
C03. What do you think how we can save electricity?					

References

[1] United Nations Environment Programme, Emissions Gap Report 2020, Retrieved from UNEP, UNEP DTU Partnership, 2020.
[2] IEA, World energy outlook, Retrieved from, https://www.iea.org/reports/world-energy-outlook-2020, 2020.
[3] H. Qiao, F. Zheng, H. Jiang, K. Dong, The greenhouse effect of the agriculture-economic growth-renewable energy nexus: evidence from G20 countries, Sci. Total Environ. 671 (2019) 722–731, https://doi.org/10.1016/j.scitotenv.2019.03.336.
[4] N. Apergis, J.E. Payne, A dynamic panel study of economic development and the electricity consumption-growth nexus, Energy Econ. 33 (5) (2011) 770–781.
[5] K. Kaygusuz, Energy services and energy poverty for sustainable rural development, Renewable and sustainable energy reviews 15 (2) (2011) 936–947.
[6] M. Sugiyama, Climate change mitigation and electrification, Energy Pol. 44 (2012) 464–468.
[7] D. Brounen, N. Kok, J.M. Quigley, Energy literacy, awareness, and conservation behavior of residential households, Energy Econ. 38 (2013) 42–50.
[8] S. Niu, Y. Jia, W. Wang, R. He, L. Hu, Y. Liu, Electricity consumption and human development level: a comparative analysis based on panel data for 50 countries, Int. J. Electr. Power Energy Syst. 53 (2013) 338–347.
[9] A. Bhide, C.R. Monroy, Energy poverty: a special focus on energy poverty in India and renewable energy technologies, Renew. Sustain. Energy Rev. 15 (2) (2011) 1057–1066.
[10] M. Kanagawa, T. Nakata, Analysis of the energy access improvement and its socio-economic impacts in rural areas of developing countries, Ecol. Econ. 62 (2) (2007) 319–329.
[11] S. Niu, X. Zhang, C. Zhao, Y. Ding, Y. Niu, T.H. Christensen, Household energy use and emission reduction effects of energy conversion in Lanzhou city, China, Renew. Energy 36 (5) (2011) 1431–1436.
[12] Xianzhu Wang, He Huang, Jingke Hong, Danfei Ni, Rongxiao He, A spatiotemporal investigation of energy-driven factors in China: a region-based structural decomposition analysis, Energy 207 (2020) (2020) 118249.
[13] A. De Almeida, P. Fonseca, B. Schlomann, N. Feilberg, Characterization of household electricity consumption in the EU, potential energy savings, and specific policy recommendations, Energy Build. 43 (8) (2011) 1884–1894.
[14] A. Deaton, J. Muellbauer, An almost ideal demand system, Am. Econ. Rev. 70 (3) (1980) 312–326, https://doi.org/10.2307/1924200.
[15] Q. Du, X. Han, Y. Li, Z. Li, B. Xia, X. Guo, The energy rebound effect of residential buildings: evidence from urban and rural areas in China, Energy Pol. 153 (2021) 112235, https://doi.org/10.1016/j.enpol.2021.112235.
[16] S. Lindenberg, L. Steg, Normative, gain, and hedonic goal frames guide environmental behavior, J. Soc. Issues 63 (1) (2007) 117–137.
[17] L. Steg, J.W. Bolderdijk, K. Keizer, G. Perlaviciute, An integrated framework for encouraging pro-environmental behavior: the role of values, situational factors, and goals, J. Environ. Psychol. 38 (2014) 104–115.
[18] R. Umit, W. Poortinga, P. Jokinen, P. Pohjolainen, The role of income in energy efficiency and curtailment behaviors: findings from 22 European countries, Energy Res. Social Sci. 53 (2019) 206–214.
[19] G. Trotta, Factors affecting energy-saving behaviors and energy efficiency investments in British households, Energy Pol. 114 (2018) 529–539.
[20] Z. Mohamed, P. Bodger, A comparison of Logistic and Harvey models for electricity consumption in New Zealand, Technol. Forecast. Soc. Change 72 (8) (2005) 1030–1043.
[21] A. Hussain, M. Rahman, J.A. Memon, Forecasting electricity consumption in Pakistan: the way forward, Energy Pol. 90 (2016) 73–80.
[22] F. Jamil, E. Ahmad, The relationship between electricity consumption, electricity prices, and GDP in Pakistan, Energy Pol. 38 (10) (2010) 6016–6025.
[23] B. Lin, C. Liu, Why is electricity consumption inconsistent with economic growth in China? Energy Pol. 88 (2016) 310–316.

[24] C. Zhang, B. Su, K. Zhou, S. Yang, Analysis of electricity consumption in China (1990–2016) using index decomposition and decoupling approach, J. Clean. Prod. 209 (2019) 224–235.
[25] A.I. Hunjra, T. Tayachi, M.I. Chani, P. Verhoeven, A. Mehmood, The moderating effect of institutional quality on the financial development and environmental quality nexus, Sustainability 12 (9) (2020) 3805.
[26] C. Anderson, M.W. Kraus, A.D. Galinsky, D. Keltner, The local-ladder effect: social status and subjective well-being, Psychological science 23 (7) (2012) 764–771.
[27] N. Kaida, K. Kaida, Pro-environmental behavior correlates with present and future subjective well-being, Environ. Dev. Sustain. 18 (2016) 111–127.
[28] B.A. Jones, Measuring externalities of energy efficiency investments using subjective well-being data: the case of LED streetlights, Resour. Energy Econ. 52 (2018) 18–32.
[29] M. Igawa, X. Piao, S. Managi, The impact of cooling energy needs on subjective well-being: evidence from Japan, Ecol. Econ. 198 (2022) 107464.
[30] Y. Wu, Y. Wu, Y. Zhang, X. Wang, Z. Song, The effect of building electricity consumption on residents' subjective well-being: evidence from China, Buildings 12 (6) (2022) 710, https://doi.org/10.3390/buildings12060710.
[31] A. Okulicz-Kozaryn, M. Altman, The happiness-energy paradox: energy use is unrelated to subjective well-being, Applied Research in Quality of Life 15 (2020) 1055–1067.
[32] Z. Sun, Y. Wu, H. Sun, D. Zhou, Y. Lou, L. Qin, The impact of building clean electricity consumption on residents' subjective well-being, Evidence from China. Buildings 12 (11) (2022) 2037.
[33] M. Binder, A.K. Blankenberg, Green lifestyles and subjective well-being: more about self-image than actual behavior? J. Econ. Behav. Organ. 137 (2017) 304–323.
[34] H. Welsch, P. Biermann, Energy affordability and subjective well-being: evidence for European countries, Energy J. 38 (3) (2017).
[35] P. Nie, Q. Li, A. Sousa-Poza, Energy poverty and subjective well-being in China: new evidence from the China family panel studies, Energy Econ. 103 (2021) 105548.
[36] N. Aydin, Subjective well-being and sustainable consumption. The international journal of environmental, Cultural, Economic and Social Sustainability 6 (5) (2010).
[37] G. Jabeen, Q. Yan, M. Ahmad, N. Fatima, S. Qamar, Consumers' intention-based influence factors of renewable power generation technology utilization: a structural equation modeling approach, J. Clean. Prod. 237 (2019) 117737.
[38] S.J. Zawadzki, L. Steg, T. Bouman, Meta-analytic evidence for a robust and positive association between individuals' pro-environmental behaviors and their subjective well-being, Environ. Res. Lett. 15 (12) (2020) 123007.
[39] M. Binder, A.-K. Blankenberg, H. Welsch, Pro-environmental norms and subjective well-being: panel evidence from the UK, Soc. Ind. Res. (2020), https://doi.org/10.1007/s11205-020-02426-4.
[40] B. Ahmad, M. Irfan, S. Salem, M.H. Asif, Energy efficiency in the post-COVID-19 era: exploring the determinants of energy-saving intentions and behaviors, Front. Energy Res. 9 (2022).
[41] I. Ajzen, The theory of planned behavior, Organizational Behaviour and Human Decision Processes 50 (2) (1991) 179–211.
[42] T. Hansen, B. Slagsvold, The age and subjective well-being paradox revisited: a multidimensional perspective, Norsk epidemiologi 22 (2) (2012), https://doi.org/10.1371/journal.pone.0242664.
[43] A.A. Stone, J.E. Broderick, D. Wang, S. Schneider, Age patterns in subjective well-being are partially accounted for by psychological and social factors associated with aging, PLoS One 15 (12) (2020) e0242664.
[44] D.T.H. Chen, Y.J. Wang, Inequality-Related health and social factors and their impact on well-being during the COVID-19 pandemic: findings from a national survey in the UK, Int. J. Environ. Res. Publ. Health 18 (3) (2021) 1014, https://doi.org/10.3390/ijerph18031014.
[45] A. Steptoe, A. Deaton, A.A. Stone, Subjective well-being, health, and aging, Lancet 385 (9968) (2015) 640–648.
[46] Z. Wang, M.T. Sohail, Short-and long-run influence of education on subjective well-being: the role of information and communication technology in China, Front. Psychol. 13 (2022) 927562.
[47] N. Kumari, P. Kumar, N.C. Sahu, Do electricity consumption and environmental quality enhance subjective well-being in G20 countries? Environ. Sci. Pollut. Control Ser. 28 (42) (2021) 60246–60267, https://doi.org/10.1007/s11356-021-14965-5.
[48] J.F. Hair, W.C. Black, B.J. Babin, R.E. Anderson, Multivariate Data Analysis, seventh ed., Prentice Hall, 2010.
[49] H.W. Marsh, A.J.S. Morin, P.D. Parker, G. Kaur, Exploratory structural equation modeling: an integration of the best features of exploratory and confirmatory factor analysis, Annu. Rev. Clin. Psychol. 10 (2014) 85–110.
[50] T.L. Milfont, J. Duckitt, The environmental attitudes inventory: a valid and reliable measure to assess the structure of environmental attitudes, J. Environ. Psychol. 30 (1) (2010) 80–94.
[51] S. Otto, F.G. Kaiser, Ecological behavior across the lifespan: why environmentalism increases as people grow older, J. Environ. Psychol. 40 (2014) 331–338.
[52] M.D. Johnson, N.L. Galambos, H.J. Krahn, Family context, life transitions, and subjective well-being from age 18 to 50 years, Dev. Psychol. 57 (11) (2021) 1968.
[53] D.P. Brown, C.H. Tsai, C.K. Woo, J. Zarnikau, S. Zhu, Residential electricity pricing in Texas's competitive retail market, Energy Econ. 92 (2020) 104953.
[54] A.A. Stone, J.E. Schwartz, J.E. Broderick, A. Deaton, A snapshot of the age distribution of psychological well-being in the United States, Proc. Natl. Acad. Sci. USA 107 (22) (2010) 9985–9990.
[55] D.G. Blanchflower, A.J. Oswald, Is well-being U-shaped over the life cycle? Soc. Sci. Med. 66 (8) (2008) 1733–1749.
[56] D. Kahneman, A.B. Krueger, Developments in the measurement of subjective well-being, J. Econ. Perspect. 20 (1) (2006) 3–24.
[57] A. Caputo, Social desirability bias in self-reported well-being measures: evidence from an online survey, Universitas Psychologica 16 (2) (2017) 245–255.
[58] E. Diener, S.D. Pressman, J. Hunter, D. Delgadillo-Chase, If, why, and when subjective well-being influences health, and future needed research, Appl. Psychol.: Health and Well-Being 9 (2) (2017) 133–167.
[59] T. Nakagawa, J. Cho, Y. Gondo, P. Martin, M.A. Johnson, L.W. Poon, N. Hirose, Subjective well-being in centenarians: a comparison of Japan and the United States, Aging Ment. Health 22 (10) (2018) 1313–1320.
[60] N.D. Sintov, S. Geislar, L. White, P.W. Schultz, Values and interventions: a means to understanding and achieving pro-environmental behavior change, Front. Psychol. 9 (2018) 905.
[61] E. Diener, R. Biswas-Diener, Will money increase subjective well-being? Soc. Indicat. Res. 57 (2002) 119–169.