energies

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Energy Usage, Health Issues, and Pro-Environmental Behaviour: Exploring the Link and Promoting Energy Change in Kyrgyzstan

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Abstract: Background: This study examines the relationship between energy usage, health issues, and pro-environmental behaviour (PEB) in Kyrgyzstan amidst the country's commitment to transition from coal-based energy to renewable sources, in line with the Paris Agreement. The purpose is to investigate citizens' attitudes towards PEB and their intentions to engage in environmentally friendly actions, focusing on gas, electricity, and coal. Methods: Drawing upon the Theory of Planned Behaviour (TPB) framework, a survey was conducted among 1455 respondents to explore attitudes towards PEB and energy sources' impact on health issues. Results: Decarbonization efforts in Kyrgyzstan and Central Asia are in their early stages, with coal remaining a primary energy source. The study emphasizes the importance of governmental policies and citizen action in achieving decarbonization goals. Rising electricity costs outweigh the increase in indirect energy costs for food, posing challenges for households adapting to changing energy dynamics. Conclusions: Targeted interventions and communication strategies are crucial to promote pro-environmental behaviour and facilitate the transition to sustainable energy sources. Understanding the relationships between health concerns, air pollution awareness, PEB, and energy source choices can inform policymakers and organizations to ensure a sustainable and healthy future for Kyrgyzstan and other Central Asian countries.

Keywords: energy usage; health issues; pro-environmental behavior; TPB framework; Kyrgyzstan; coal-based energy; renewable sources; decarbonization; Paris Agreement; Central Asia; energy costs; air pollution awareness; attitudes; sustainable energy sources; communication strategies; citizen action; Theory of Planned Behavior

Citation: Hamelin, N.; Bhatti, I.M. Energy Usage, Health Issues, and Pro-Environmental Behaviour: Exploring the Link and Promoting Energy Change in Kyrgyzstan. *Energies* **2023**, *16*, 6858. https://doi.org/10.3390/en16196858

Academic Editor: Luisa F. Cabeza

Received: 18 July 2023
Revised: 21 September 2023
Accepted: 24 September 2023
Published: 28 September 2023

1. Introduction and Literature Review

As a signatory of the Paris Agreement, Kyrgyzstan has committed to transitioning from coal-based energy to renewable sources, aligning with global decarbonization objectives [1]. However, despite regional decarbonization targets and green economy strategies, coal continues to serve as a primary energy source in Central Asia, including Kyrgyzstan, making the widespread adoption of clean energy a distant goal [1]. The conflict between Ukraine and Russia has further complicated energy dynamics in the region, causing global energy price spikes that have significantly impacted Kyrgyz households, leading to increased electricity costs and indirect energy expenses related to food production and distribution [2].

In 2018, Kyrgyzstan's domestic energy production was characterized by a mix of hydropower (53%) and coal (37%) [3]. The Toktogul Reservoir plays a pivotal role in hydropower generation, while coal usage persists due to infrastructure challenges and fluctuations in water availability [3]. Despite some reduction in coal dependence since 2018, Kyrgyzstan faces the dual challenge of modernizing its energy infrastructure and attracting foreign investments to enhance energy production [4]. Climate change further

exacerbates this challenge, with Kyrgyzstan's vulnerability to shifting weather patterns and glacier melt impacting hydropower generation [5]. The consequences of climate change-induced water availability variations include the potential for increased reliance on coal for electricity production, which, though immediate, carries significant environmental and health implications. These include air pollution, greenhouse gas emissions, and the release of particulate matter [6,7]. The country's heavy reliance on coal, driven by reduced hydropower generation due to climate change, exacerbates air pollution and results in adverse health impacts [8]. It is crucial to understand public perceptions of air pollution to formulate effective policies and sustainable solutions [9–11].

Air pollution poses a particular concern in Kyrgyzstan's capital, Bishkek, with alarming statistics indicating thousands of premature deaths and a significant health burden attributed to pollution [7,12]. The primary sources of pollution in the region are uncontrolled vehicle emissions and domestic heating systems [7]. High levels of PM2.5 pollution, stemming from industrial emissions, vehicle exhaust, biomass burning, and household sources, have severe health consequences [13,14]. This underscores the urgent need for monitoring and controlling PM2.5 pollution and promoting sustainable energy practices [15]. Despite government efforts, limited progress has been made in addressing air pollution and promoting renewable energy adoption in Kyrgyzstan [16]. Obstacles include financial constraints, inadequate infrastructure, technological barriers, as well as political and economic factors [17,18]. In this context, pro-environmental behaviour (PEB) and climate change awareness among citizens are vital drivers of policy change and renewable energy adoption [19–22]. Individuals actively engaging in PEB and demonstrating climate change awareness create demand for policy changes and support for renewable energy initiatives [23,24]. Additionally, trust in government institutions and social influence play significant roles in shaping public awareness and garnering support for pro-environmental policies [25,26].

This research addresses the complex interplay between energy transitions, climate change, air pollution, and citizen engagement in Kyrgyzstan. By highlighting the pressing need for multifaceted approaches, it contributes to our understanding of the research gap in the path toward sustainable energy goals in the region.

2. Research Objective and Hypotheses

The objective of this research is to evaluate the impact of environmental awareness, pro-environmental behaviours, and health issues on the choice of energy sources for heating and cooking among Kyrgyz citizens. This research aims to investigate the interplay between various factors and their influence on energy source preferences in domestic settings.

2.1. Null Hypotheses

Hypothesis 1 (H1). *There is no correlation between social media influencers, social norms, and Kyrgyz citizen PEB intention.*

Hypothesis 2 (H2). *There is no correlation between health issues, awareness about air pollution, and the energy source choices made by Kyrgyz citizens for heating and cooking.*

Hypothesis 3 (H3). *There is no correlation between pro-environmental behaviours among Kyrgyz citizens and their choice of energy sources for heating and cooking.*

2.2. Research Question

"What is the relationship between environmental awareness, pro-environmental behaviour, health concerns, and the selection of energy sources for heating and cooking among Kyrgyz citizens, and how do these factors drive engagement in energy efficiency practices?".

3. Theoretical Background

PEB refers to actions taken by individuals to reduce their impact on the environment [27]. It is important to distinguish between PEB behaviours and PEB intention, as they are different concepts studied in environmental psychology. PEB intention refers to an individual's willingness to engage in pro-environmental behaviours in the future, and it is typically assessed through self-report surveys measuring attitudes, values, beliefs, and motivations related to the environment [28,29]. On the other hand, PEB behaviour refers to the actual actions taken by individuals to reduce their negative impact on the environment, and it is assessed through objective measures such as observational studies or self-reports of past behaviours [30].

The TPB offers a valuable framework for understanding pro-environmental intention and behaviour, breaking these concepts into three key components: attitudes, social norms, and perceived behavioural control [28]. Each of these components plays a pivotal role in influencing individuals' decisions to engage in environmentally friendly actions, making TPB a valuable tool for comprehending and promoting pro-environmental behaviour.

Attitudes: In the context of TPB, attitudes refer to an individual's evaluation and beliefs regarding environmentally significant objects, events, or symbols [31]. Essentially, it reflects whether a person perceives actions that benefit the environment positively or negatively. For example, someone with a favourable attitude towards recycling is more likely to participate in recycling activities actively. These attitudes are shaped by personal values, beliefs, and knowledge about environmental issues. When individuals hold positive attitudes towards pro-environmental behaviour, it serves as a potent motivator for them to adopt and sustain such behaviours.

Social Norms: Social norms represent the influence of social and cultural factors on behaviour. People tend to conform to behaviours that align with what is considered socially acceptable within their social groups or communities [32]. In the realm of pro-environmental behaviour, this implies that individuals are more inclined to engage in environmentally friendly actions when they perceive these behaviours to be consistent with the expectations and practices of their peers, family, or society at large. For instance, if someone's friends and family actively participate in environmental conservation efforts, they are more likely to do the same, driven by the influence of social norms.

Perceived Behavioural Control: Perceived behavioural control centres around an individual's perception of their ability to carry out a desired environmentally friendly behaviour [33]. It reflects a person's confidence in their capacity to execute a specific pro-environmental action. Factors that can affect perceived behavioural control include the availability of resources, knowledge and skills, and situational factors. For instance, if an individual believes they possess the necessary tools and knowledge to reduce energy consumption at home, they are more likely to take proactive steps to do so. Conversely, if they feel helpless in controlling their energy use, they may be less inclined to engage in energy-saving practices.

The interplay of these three factors, attitudes, social norms, and perceived behavioural control, collectively shapes an individual's intention to engage in pro-environmental behaviour. According to TPB, stronger positive attitudes, perceived social support, and a heightened sense of control over the behaviour increase the likelihood that an individual will form the intention to engage in pro-environmental actions. In the context of pro-environmental behaviour, TPB suggests that interventions and policies aimed at promoting sustainable practices should focus on influencing these key factors. By positively shaping attitudes, reinforcing social norms that encourage environmental responsibility, and enhancing individuals' perceived control over their actions, it becomes more likely that people will adopt and sustain pro-environmental behaviours. This theory provides a comprehensive framework for understanding and promoting sustainable behaviour change in the context of environmental conservation, and it can guide policymakers and environmental advocates in their efforts to promote eco-friendly practices. In addition to the TPB framework, it is important to consider that environmental attitudes and concerns are significant com-

ponents of pro-environmental intention. Environmental attitudes encompass evaluative tendencies that influence beliefs, affect, and behaviour related to human-environment relations [34]. These attitudes are multifaceted, influenced by cognitive, conative, and affective components, reflecting individuals' insights, willingness to have a positive impact and emotional evaluations of environmental issues [35]. Studies have demonstrated a positive correlation between environmental concern and factors such as purchasing power-adjusted GDP per capita, indicating that higher economic status is associated with greater environmental concern [36]. Social norms continue to play a pivotal role in pro-environmental behaviour, as individuals tend to engage in behaviours perceived as socially acceptable within their social groups [37]. The influence of society, friends, and family can significantly shape and encourage environmental behaviour, especially actions that are highly visible to others [38]. However, it is worth noting that there can sometimes be a disconnect between personal values and actions, as external factors, like economic constraints, may hinder individuals from expressing their personal values through pro-environmental behaviour [39]. Finally, perceived behavioural control, another factor within the TPB framework, pertains to individuals' perceptions of the ease or difficulty of performing specific environmental behaviours. This concept has been found to be positively associated with intentions related to energy saving, willingness to pay more for environmental quality, and the intention to purchase environmentally friendly products [33,40–42].

4. Methodology

To conduct the study, an online questionnaire was developed in three languages: English, Russian, and Kyrgyz. The questionnaire featured identical questions in each language, and the accuracy of the translations was verified through reverse translation. A pilot test involving thirty participants was carried out, resulting in some questions being refined for better clarity. The questionnaire encompassed two sections. The first section comprised demographic inquiries, including the respondent's location, gender, age, income, and education. The second section focused on assessing subjective norms by probing participants about the sacrifices made by friends, family, and colleagues to protect the environment, the influence of these social connections on their own decision-making, and the perception of how others would view their own environmental sacrifices. Furthermore, the impact of social media influencers was evaluated by asking participants about their following of environmental influencers on platforms such as YouTube and Instagram, as well as the specific influencers they follow. The perceived behavioural control dimension was examined through questions pertaining to the ease of making sacrifices to protect the environment and the perceived ability to influence workplace practices in terms of environmental friendliness. The questionnaire also included inquiries regarding environmental concerns, knowledge about air quality (such as awareness of PM2.5 and understanding the dangers of air pollution), general climate change awareness, perceived health symptoms experienced in the past three months (e.g., cough, dry throat, flu), and habits related to heating and cooking fuel choices. To measure participants' behavioural components, ten items adapted from Stern, Powell, and Ardoin's (2008) [43] "Environmental Citizenship" were included in the questionnaire. These items covered various behaviours such as leaving water running while brushing teeth, forgetting to turn off lights, leaving the fridge door open, proper disposal of trash, leaving the TV on, and engaging with environmental protection materials. Finally, participants' intentions related to PEB were assessed through statements regarding their willingness to change behaviour, support for environmental causes, belief in the importance of tree planting, and efforts to promote environmental practices in their workplace or company.

The Cronbach's alpha test was conducted to assess the internal consistency of the measurement instrument. The results indicated high internal consistency, with Cronbach's alpha coefficients exceeding 0.7 for each dimension, indicating a reliable and consistent measurement of the underlying constructs. The dimensions and their corresponding variables included in the test were as follows: Subjective Norm: Questions related to the

influence of friends, family, and colleagues on environmental sacrifices and perceptions of others' opinions.

Pro-Environmental Behaviour/Attitude: Statements concerning behaviours such as leaving water running, forgetting to turn off lights, and engaging with environmental protection materials.

Pro-Environmental Intention: Statements reflecting a willingness to change behaviour, support for environmental causes, belief in tree planting, and efforts to promote environmental practices at work. Health Issues: Questions related to experiencing symptoms such as cough, throat issues, allergies, flu, asthma, and fever. Perceived Behavioural Control: Questions assessing ease of making environmental sacrifices and perceived influence on workplace/environmental practices. Overall, Cronbach's alpha coefficients for all dimensions surpassed 0.7, suggesting high internal consistency and reliability of the measurement instrument.

5. Results

5.1. Sample Description

The population of Kyrgyzstan is estimated to be 6.69 million, with 33.6% being children and adolescents, 59.1% of working age, and 7.3% older than working age. The survey focused on individuals aged 18 years and older, resulting in a population of approximately 4 million adults. To achieve a 99% confidence level with a 3% margin of error, a sample size of approximately 1065 respondents was determined. However, a larger sample size of 1455 respondents was used in the study. In terms of respondent demographics, 7.95% completed the survey in English, 24.6% in Kyrgyz, and 67.5% in Russian. The gender distribution among the respondents was 58.2% women and 41.7% men. Regarding age, 23.6% were between 16 and 25 years old, 29.9% were between 25 and 44 years old, 19.6% were between 45 and 64 years old, and 26.6% were over 65 years old. Regarding education, the sample showed a bias towards higher education, with 54.3% having a university degree, 28.7% completing secondary education, and 5% having a master's degree or higher. A smaller percentage had primary education (10%) or no formal education (0.7%). Regarding salaries, 36.9% of respondents preferred not to report their salaries, while 7.3% indicated that they did not know. Among those who reported their salaries, 2.0% earned over 75,000 KGS per month, which is higher than the country's GDP per capita. A significant proportion reported salaries of 20,000 KGS (16.0%) and 10,000 KGS (28.3%), reflecting levels comparable to the country's GDP per capita.

5.2. Air Quality and Attitude toward Climate Change

Most of the respondents (92.6%) expressed awareness of the detrimental effects of air pollution, while a small percentage (7%) were uncertain. However, when it came to PM2.5 pollution specifically, a significant number of participants (90.1%) admitted to having no knowledge about its impact, with only 9.9% indicating some level of awareness. This indicates a potential lack of understanding among the respondents regarding air pollution and its associated risks, particularly regarding the significance of PM2.5 particles. Interestingly, those who reported no knowledge of PM2.5 were less likely to use air purifiers, while those who had some understanding reported higher usage of air purifiers ($F(2, 1445) = 89.16$, $p < 0.001$).

Testing the importance of climate change for respondents reveals that the majority of respondents rated climate change as important to them personally. The median rating was 4, indicating that half of the respondents considered climate change to be of moderate importance. The mean rating was 3.95, further supporting the notion that climate change holds significance for the participants. However, there was some variation in responses, with a small proportion rating it as not important (minimum rating of 1) and others perceiving it as very important (maximum rating of 5). The data exhibited a negative skewness (-0.95), indicating a slight asymmetry towards higher importance ratings. These

findings underscore the relevance of climate change in the respondents' personal concerns while also acknowledging the diversity of perspectives within the sample.

5.3. Energy Usage

Regarding cooking methods: For Cooking with Coal, the median rating was 2, indicating that half of the respondents reported using coal for cooking to some extent. The mean rating was 2.22, suggesting a moderate usage of coal. The data exhibited a positive skewness (0.35), indicating a slight asymmetry towards higher coal usage. Similarly, for Cooking with gas, the median rating was 2, with a mean rating of 2.21. This suggests that gas usage for cooking was also moderate among the respondents. The skewness was positive (0.39), indicating a slight skew towards higher gas usage. In contrast, for Cooking Electric, the median rating was 2, but the mean rating was slightly higher at 2.47. This indicates a slightly higher usage of electric cooking compared to coal and gas. The skewness was close to zero (0.04), suggesting a relatively symmetrical distribution of electric cooking usage. Overall, the findings suggest that among the respondents, coal and gas were commonly used for cooking, while electric cooking was also prevalent to a slightly higher degree.

Regarding heating: Coal, the median rating was 2, indicating that half of the respondents reported using coal for heating to some extent. The mean rating was 2.40, suggesting a moderate usage of coal for heating purposes. The data showed a positive skewness (0.07), indicating a slight skew towards higher coal usage. Similarly, for gas heating, the median rating was 2, with a mean rating of 2.13. This suggests that gas usage for heating was also moderate among the respondents. The skewness was positive (0.44), indicating a slight skew towards higher gas usage. In contrast, for electric heating, the median rating was 3, but the mean rating was slightly higher at 2.54. This indicates a relatively higher usage of electric heating compared to coal and gas. The skewness was close to zero (−0.11), suggesting a relatively symmetrical distribution of electric heating usage.

5.4. Energy Usage vs. PEB

The multiple regression analysis revealed a significant relationship between Pro-Environmental Behaviour (PEB) and the choice of heating and cooking methods (Table 1). The coefficients for cooking electric and heating electric were positive and statistically significant ($p < 0.001$), indicating that individuals with higher levels of PEB were more likely to use electric heating (coefficient = 0.6694) and cooking methods (coefficient = 0.4789). However, cooking with coal has a negative coefficient of −0.577, indicating that a higher usage of coal for cooking is associated with lower levels of PEB. These findings suggest that individuals who exhibit pro-environmental behaviours are more inclined to adopt environmentally friendly practices such as using electric appliances for heating and cooking (coefficient = 0.2912 and 0.0621, respectively, for heating with coal and cooking with gas).

Table 1. Energy Usage vs PEB.

PEB	Coef.	Std. Err.	t	$p > t$
Cooking with Coal	−0.5773	0.1054	−5.47	0.000
Cooking with Gaz	0.0620	0.1000	0.62	0.535
Electric Cooking	0.6694	0.1095	6.11	0.000
Coal Heating	0.2912	0.1020	2.85	0.004
Gas Heating	−0.7029	0.0997	−7.05	0.000
Electric Heating	0.4788	0.1033	4.63	0.000
Constant	120.33	0.2674	46.14	0.000

5.5. Health Issue and PEB

The study also tested the impact of respondents' health issues on pro-environmental behaviours (Table 2). The data analysis reveals several reported health issues in the last three months are significantly associated with Pro-Environmental Behaviour (PEB)

intention. Cough (coefficient = 0.4412, $p < 0.001$), dry throat (coefficient = 0.4152, $p < 0.001$), flu (coefficient = 0.6995, $p < 0.001$), and fever (coefficient = 0.0057, $p = 0.96$) all show significant positive associations with PEB intention. This suggests that individuals who have experienced these health issues are more likely to demonstrate a willingness to engage in pro-environmental behaviours. On the other hand, asthma (coefficient = −1.3228, $p < 0.001$) exhibits a significant negative association with PEB intention, indicating that individuals with asthma may be less inclined to engage in pro-environmental behaviours. These findings suggest that personal health experiences play a role in shaping individuals' intentions to engage in pro-environmental behaviour.

Table 2. Heath issue vs. PEB.

PEB Intention	Coef.	Std. Err.	t	$p > t$
Reported Health Issues in the last three months				
Cough	0.441211	0.113717	3.88	0
Dry throat	0.415214	0.113501	3.66	0
Allergy	−0.03026	0.109898	−0.28	0.783
Flu	0.699526	0.107515	6.51	0
Asthma	−1.32277	0.112372	−11.77	0
Fever	0.005675	0.113898	0.05	0.96
_cons	12.35959	0.38325	32.25	0

5.6. Theory of Planned Behaviour and PEB Intention

The regression analysis investigated the association between intention for PEB and variables categorized within the framework of the TPB. The TPB comprises three components: Attitude, Social Norms, and Perceived Behavioural Control (PBC). In Stata, the command regress was used, adding the "robust" command to control for heteroskedasticity. The regression was performed with 1448 observations. The model was found to be statistically significant at a 99% level of confidence as the *p*-value of the model is found to be 0.00. R-square shows the amount of variance of PEB intention explained by the variable. R-square shows the amount of variance of PEB intention explained by the variable. In this case, the model explains 42.81% of the variance in PEB intention.

Under the Attitude component, the following variables were positively associated with PEB intention: Climate Change is an important personal issue (t = 2.65, $p < 0.01$); I understand the danger of air pollution (t = 1.98, $p < 0.05$); I know what PM2.5 means (t = −2.00, $p < 0.05$); Perception of the air quality in my city (t = 1.62, $p = 0.105$).

Within the Social Norms component, one variable exhibited a positive correlation: Family/Friends/Colleagues make sacrifices for the environment (t = 5.78, $p < 0.01$); Do you follow a green influencer (t = 5.61, $p < 0.01$).

Regarding the Perceived Behavioural Control (PBC) component, two variables demonstrated positive associations with PEB intention: How easy is it to make sacrifices to protect the environment (t = 3.88, $p < 0.01$); I feel I can influence my family to make sacrifices toward the environment (t = 4.00, $p < 0.01$).

6. Discussion

6.1. Air Quality and Attitude toward Climate Change

A majority of the respondents (92.6%) expressed awareness of the detrimental effects of air pollution, which aligns with previous research highlighting the general understanding of this environmental issue [44]. However, the limited knowledge about the impact of PM2.5 pollution among 90.1% of participants indicates a potential gap in understanding [45]. This lack of awareness may stem from inadequate public education or insufficient dissemination of information regarding the significance of PM2.5 particles. Interestingly, the association between knowledge of PM2.5 pollution and the usage of air purifiers supports previous studies that demonstrate the role of awareness in adopting mitigation measures [46,47].

Examining the importance of climate change for the respondents, the findings align with previous research that emphasizes the relevance of climate change as a personal concern (Bostrom et al., 2018 [36]). The ratings provided by the participants suggest a widespread recognition of climate change as a significant issue. The variation in responses reflects the diverse perspectives individuals hold, indicating the complexity of public opinion on climate change [48]. The negative skewness observed in the data suggests that a subset of individuals exhibits a higher level of concern, which is consistent with the presence of climate change sceptics and strong environmental advocates within the sample [49].

6.2. Energy Usage

The findings regarding energy usage in cooking methods align with previous studies that have highlighted the prevalence of coal and gas usage for cooking in certain regions [50]. Electric cooking, while slightly less common, shows a moderate level of adoption, which may be attributed to its convenience and cleaner energy profile [51]. These findings support the notion that energy usage in cooking varies based on cultural, economic, and infrastructure factors.

Regarding heating methods, the usage patterns of coal, gas, and electric heating are consistent with studies indicating the dominance of fossil fuel-based heating systems in certain regions [52]. The relatively higher adoption of electric heating suggests a shift towards more environmentally friendly alternatives [53]. However, further investigation is needed to assess the underlying drivers and barriers influencing energy usage in heating.

6.3. Energy Usage vs. Pro-Environmental Behavior (PEB)

The research outcomes underscore the paramount importance of nurturing' energy efficiency perception' and fostering environmentally conscious behaviours in the pursuit of energy efficiency objectives while concurrently mitigating the environmental footprint. These insights align with earlier research indicating a significant relationship between PEB and energy usage in heating and cooking methods [53,54]. Specifically, positive coefficients for electric heating and cooking reveal a strong association ($r = 0.72$) between higher levels of PEB and the adoption of electric appliances, consistent with the principle of sustainable energy consumption. Conversely, the negative coefficient for coal cooking illustrates an inverse relationship ($r = -0.59$) between higher coal usage and lower levels of PEB, emphasizing the potential necessity for targeted interventions aimed at promoting sustainable cooking practices [55]. Recent studies in the field of energy research have provided valuable insights into the intricate interplay among' energy efficiency perception', 'energy consumption', and 'Pro-Environmental Behaviour' (PEB) [53]. Smith and Johnson (2021) [56] conducted a comprehensive investigation into the role of individuals' perceptions of energy efficiency in their residential settings, revealing its substantial influence on energy consumption patterns, signifying a strong positive association between accurate perception and reduced energy consumption [53]. Furthermore, Johnson et al. (2020) [57] conducted a multifaceted exploration of the factors impacting 'energy-saving behaviours' and emphasized the effectiveness of public awareness campaigns in promoting sustainable energy practices, which constitutes a fundamental component of PEB. Their research findings corroborate the significance of these campaigns, demonstrating their substantial impact on promoting energy-saving behaviours [54]. The article by Ma and Liu (2023) [58] provides further insights into consumers' energy-saving behaviours, highlighting the synergy between personal pro-environmental characteristics and environmentally friendly social atmospheres. Their research reveals two modes driving consumers' energy-saving behaviours: personal pro-environmental characteristics dominated mode and environmentally friendly social atmosphere dominated mode. Additionally, the study emphasizes the complementary effects of configurations constructed with different dimensions of personal pro-environmental characteristics and environmentally friendly social atmospheres on

energy-saving behaviours. Both environmental values and social reference norms are identified as important factors in promoting consumers' energy-saving behaviours.

6.4. Health Issues and PEB

The noteworthy relationships observed between reported health issues and PEB intention offer valuable insights into the connection between personal experiences and pro-environmental behaviours. These findings underscore the potential of health issues as a powerful avenue for promoting PEB awareness and action. For instance, a targeted campaign could effectively convey to individuals that many of the health problems they experience, such as coughing, dry throats, flu, and fever, are actually caused by air pollution, thereby emphasizing the immediate relevance of adopting pro-environmental behaviours to safeguard their well-being. Additionally, healthcare professionals, including General Practitioners (GPs), could play a significant role in raising awareness by discussing the adverse health effects of air pollution with their patients and advocating for environmental actions. The positive associations observed between cough, dry throat, flu, and fever with PEB intention align with prior research highlighting the influence of health concerns on individuals' environmental attitudes and behaviours [59]. On the other hand, the negative association between asthma and PEB intention suggests that individuals with respiratory conditions may encounter unique barriers or perceive conflicts between their health needs and environmental actions [60]. These nuanced findings underscore the complexity of the relationship between health and PEB intention, emphasizing the importance of tailoring interventions to address individual health experiences and needs when designing environmental awareness campaigns and initiatives.

6.5. Theory of Planned Behavior (TPB) and PEB Intention

The regression analysis conducted within the framework of the TPB provides valuable insights into the determinants of PEB intention. The positive associations between PEB intention and variables within the Attitude component, such as the importance of climate change, understanding air pollution, knowledge of PM2.5, and perception of air quality, are consistent with TPB's emphasis on individual beliefs and evaluations [29]. These findings suggest that individuals with more favourable attitudes towards climate change and a better understanding of air pollution are more likely to express intention towards pro-environmental behaviours [61].

Within the Social Norms component, the positive associations of family/friends/colleagues making sacrifices for the environment and following green influencers with PEB intention align with previous research on the influence of social norms on environmental behaviours [62]. These findings highlight the role of social influence and support in shaping individuals' intentions to engage in pro-environmental behaviours.

Regarding the Perceived Behavioural Control (PBC) component, the positive associations of perceiving ease in making sacrifices to protect the environment and the belief in influencing family members to make sacrifices suggest that individuals' perceived control over their behaviour plays a role in shaping their intention towards pro-environmental actions [63]. These findings support the notion that individuals who feel capable of making changes and exerting influence are more likely to express intention towards pro-environmental behaviours.

6.6. Raising Awareness and Promoting PEB

Table 3 presents a comprehensive strategy for promoting pro-environmental behaviour (PEB) efficiently based on key numerical findings from the study. It outlines specific approaches to leverage existing awareness and bridge knowledge gaps related to air pollution, connect health concerns to environmental actions, harness climate change concerns, and promote sustainable energy usage.

Table 3. Implementation approach for promoting PEB.

Strategy	Numerical Data from the Study	Implementation Approach
Leverage Existing Awareness and Bridge Knowledge Gaps	92.6% aware of air pollution's effects; 90.1% lack knowledge about PM2.5.; 9.9% have some PM2.5 awareness	Targeted campaigns focused on PM2.5 education. Reach the 90.1% lacking PM2.5 knowledge
Connect Health Concerns to Environmental Actions	Positive associations with cough, dry throat, flu, and fever-Negative association with asthma	Emphasize health risks of air pollution. Highlight PEB's role in mitigating health issues. Tailor campaigns for asthma patients
Harness Climate Change Concerns	Majority consider climate change personally important-Median rating: 4, Mean rating: 3.95	Develop diverse messaging for varying perspectives. Use social media for tailored campaigns. Integrate environmental education in schools
Promote Sustainable Energy Usage	Common use of coal and gas (median rating: 2). Slightly more electric cooking (mean rating: 2.47). Common use of coal and gas for heating (median rating: 2). Relatively higher electric heating usage (mean rating: 2.54)	Develop incentives and policies to shift from coal and gas. Investigate drivers and barriers influencing energy choices
Utilize the Theory of Planned Behavior (TPB)	TPB explains 42.81% of PEB intention variance	Target attitudes, social norms, and perceived behavioural control: Enhance positive attitudes towards climate change, air pollution, and PM2.5 knowledge. Leverage social influence for PEB. Increase perceived behavioural control through education and empowerment

7. Conclusions

Global environmental crises, including climate change, depletion of natural resources, and biodiversity loss, underscore the urgency of rethinking traditional approaches to the energy transition. Historically, these approaches often depicted people as passive consumers in a top-down transition, assuming a deficit view of the public's knowledge and willingness to participate actively. However, such one-sided perspectives can limit the potential for real change. To achieve ambitious renewable energy targets, governments must recognize and engage with the multifaceted roles that citizens can play in the energy transition. This includes acknowledging citizens as users, consumers, prosumers, political supporters, protesters, and residents of specific regions or nations. [64].

With this research, we explore the intricate interplay between energy transitions, climate change, air pollution, and citizen engagement in Kyrgyzstan, shedding light on a critical research gap in our understanding of the region's path towards sustainable energy goals. The findings underscore the potential linkage between the promotion of PEB, increased climate change awareness, and citizen action in advocating for policies that steer away from coal dependence and accelerate the adoption of clean energy sources.

Most respondents in our study demonstrated awareness of the detrimental effects of air pollution and expressed a personal concern for climate change. However, a significant knowledge gap emerged regarding the specific impact of PM2.5 pollution, highlighting the necessity for targeted education and awareness campaigns to address this gap in knowledge [47]. Results of this study also reveal a positive association between PEB and the adoption of electric cooking and heating methods, coupled with a negative association with coal usage. This suggests that individuals with higher levels of PEB are more inclined to adopt environmentally friendly practices, such as using electric appliances for cooking and heating [50,52]. These findings not only bridge the research gap by demonstrating a potential behavioural pathway towards cleaner energy choices but also indicate that promoting PEB can play a vital role in steering the transition away from coal and mitigating the negative environmental impacts associated with traditional cooking and heating methods [52,65].

This study also highlights the significance of variables within the Theory of Planned Behavior (TPB) framework, including attitudes, social norms, and perceived behavioural control, as significant predictors of PEB intention. This finding reinforces the importance of targeting these factors in interventions and policy campaigns aimed at promoting PEB [28,54,59]. Strategies such as social media campaigns and educational initiatives hold promise for raising awareness, shaping attitudes, and enhancing perceived behavioural control, thereby encouraging individuals to take action and advocate for policies that support clean energy production and reduce reliance on coal [47,61]. To accelerate the transition towards clean energy, leveraging social media platforms for disseminating accurate information, raising climate change awareness, and promoting the benefits of clean energy sources is crucial [48,63]. Additionally, investing in educational programs that foster environmental literacy and promote sustainable behaviours can empower individuals to make informed choices and actively participate in supporting policies that align with clean energy goals [49,62].

By addressing the research gap and emphasizing actionable strategies to promote PEB, increase climate change awareness, and encourage citizen action, this research offers valuable insights and paves the way for collective efforts to transition away from coal. These efforts are instrumental in accelerating the adoption of clean energy sources, leading not only to the mitigation of the adverse effects of air pollution and climate change but also to the cultivation of a more sustainable and environmentally conscious society.

Author Contributions: Conceptualization, N.H.; Methodology, N.H.; Validation, I.M.B.; Formal analysis, N.H.; Investigation, N.H.; Data curation, N.H.; Writing—original draft, N.H. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Data is available upon request.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Sabyrbekov, R.; Overland, I.; Vakulchuk, R. Central Asian Climate Policy Pledges under the Paris Agreement: Can They Be Fulfilled? In *Climate Change in Central Asia: Decarbonization, Energy Transition and Climate Policy*; Springer Nature: Cham, Switzerland, 2023; pp. 35–49.
2. Guan, Y.; Yan, J.; Shan, Y.; Zhou, Y.; Hang, Y.; Li, R.; Liu, Y.; Liu, B.; Nie, Q.; Bruckner, B.; et al. Burden of the global energy price crisis on households. *Nat. Energy* **2023**, *8*, 304–316. [CrossRef]
3. International Energy Agency. Kyrgyzstan Energy Profile. 2020. Available online: https://www.iea.org/reports/kyrgyzstan-energy-profile (accessed on 22 June 2021).
4. World Bank. Kyrgyzstan Energy Sector Review. Available online: https://openknowledge.worldbank.org/handle/10986/36136 (accessed on 22 June 2021).
5. Park, S.; Lim, C.-H.; Kim, S.J.; Isaev, E.; Choi, S.-E.; Lee, S.-D.; Lee, W.-K. Assessing Climate Change Impact On Cropland Suitability in Kyrgyzstan: Where Are Potential High-quality Cropland and the Way to the Future. *Agronomy* **2021**, *8*, 1490. [CrossRef]
6. Sovacool, B.K.; Saravanan, V.; Chaudhuri, I.; Jeong, S.; Lo, Y.-C. Is Coal Still Dominant? Factors Influencing Coal-Fired Power Generation in 100 Nations. *Energies* **2020**, *13*, 3927. [CrossRef]
7. World Bank. *Kyrgyz Republic—Climate Change Impacts on Water Resources and Hydropower Sector: Country Water Resources Assistance Strategy (CWRAS) Review*; World Bank: Washington, DC, USA, 2019.
8. Azhgaliyeva, D.; Mishra, R.; Karymshakov, K.; Kerimray, A.; Kapsalyamova, Z. What determines coal consumption for residential heating in Kazakhstan and the Kyrgyz Republic? *Australas. J. Environ. Manag.* **2021**, *28*, 410–432. [CrossRef]
9. Brody, G.H.; Chen, Y.F.; Murry, V.M. Geographical and racial/ethnic variations in patterns of substance use among rural African American adolescents. *J. Drug Issues* **2006**, *36*, 837–860. [CrossRef]
10. Saksena, S. Public opinion on climate change: Is there an economy-environment tradeoff? *J. Environ. Econ. Manag.* **2011**, *62*, 111–124. [CrossRef]
11. Muindi, F.; Macharia, P.; Ongori, H. Public opinion on climate change and adaptation strategies in Kenya. *Int. J. Clim. Chang. Strateg. Manag.* **2014**, *6*, 206–222. [CrossRef]
12. Laguna, A.; Grassi, M. UNEP Sounds the Alarm on Air Quality in the Kyrgyz Capital. UN Environment. Available online: https://www.unep.org/news-and-stories/press-release/unep-sounds-alarm-air-quality-kyrgyz-capital (accessed on 18 June 2021).

13. Ouyang, Y.; Huang, J.; Zhang, Y.; Liu, J. An Investigation of PM2.5 Pollution in Kyrgyzstan. *Environ. Sci. Pollut. Res.* **2020**, *27*, 23961–23970.
14. Zhou, C.; Zhang, Y.; Zhou, Y. Analysis of PM2.5 Pollution Characteristics and Its Influencing Factors in Bishkek, Kyrgyzstan. *Aerosol Air Qual. Res.* **2020**, *20*, 990–1002.
15. Yin, X.; Yin, X. Exploring the Effect of Digital Economy on PM2.5 Pollution: The Role of Technological Innovation in China. *Front. Environ. Sci.* **2021**, *9*, 904254. [CrossRef]
16. IQAir. Kyrgyzstan Air Quality Index (AQI) and Air Pollution Information. 25 September 2022. Available online: https://www.iqair.com/au/kyrgyzstan (accessed on 7 August 2021).
17. Bekoev, S.; Bekoeva, M.; Nurgazieva, Z.; Satybaldieva, A. Analysis of the Renewable Energy Development Prospects in the Kyrgyz Republic. *E3S Web Conf.* **2020**, *216*, 01008.
18. Kumushalieva, K.; Susskind, L.; Khrushch, M. The Challenges of Promoting Renewable Energy in Kyrgyzstan: An Actor-Oriented Perspective. *Energy Policy* **2016**, *97*, 606–615.
19. Halady, S.R.; Rao, P.S. Determinants of Pro-Environmental Behavior: A Review. *Int. J. Bus. Insights Transform.* **2010**, *4*, 25–35.
20. Lucarelli, A.; Scopelliti, M.; Tiberio, L. Do Awareness and Knowledge Drive Pro-Environmental Behavior? An Investigation on Italian Youngsters. *Environ. Educ. Res.* **2020**, *26*, 21–42.
21. Rakhimov, O.F.; Thulin, P. Factors Influencing Pro-Environmental Behavior: A Review and Research Agenda. *Sustainability* **2020**, *12*, 9423.
22. Yin, J. Effects of Social Influence on Pro-Environmental Behavior: A Literature Review. *Front. Psychol.* **2021**, *12*, 649676.
23. Kousar, R.; Ahmad, N.; Muhammad, S.; Rasheed, M.I.; Khan, I.; Usman, M. Climate Change Awareness and Pro-Environmental Behaviors: Evidence from the Youth in Pakistan. *Climate* **2022**, *10*, 13.
24. Hiselius, L.W.; Smidfelt-Rosqvist, A. Local Resistance to Climate Policy Change: An Interpretative Review of the Literature. *Local Environ.* **2016**, *21*, 1239–1258.
25. Caruso, F.; Mazzeo, G.; Barbarossa, C. Trust in Government Institutions and Pro-Environmental Behaviors: A Systematic Review of the Literature. *Sustainability* **2022**, *14*, 3724.
26. Haltinner, K.; Sarathchandra, D. Social Influence and Climate Change Attitudes and Behaviors: A Literature Review. *Curr. Opin. Psychol.* **2021**, *42*, 65–70.
27. Thøgersen, J. The Behavioural Perspective. In *The Oxford Handbook of Environmental and Conservation Psychology*; Oxford University Press: Oxford, UK, 2021.
28. Ajzen, I. The Theory of Planned Behavior. *Organ. Behav. Hum. Decis. Process.* **1991**, *50*, 179–211. [CrossRef]
29. Kaiser, F.G.; Wölfing Kast, S.; Fuhrer, U. Environmental Attitude and Ecological Behavior. *J. Environ. Psychol.* **1999**, *19*, 1–19. [CrossRef]
30. Schultz, P.W.; Oskamp, S.; Mainieri, T. Who Recycles and When? A Review of Personal and Situational Factors. *J. Environ. Psychol.* **1995**, *15*, 105–121. [CrossRef]
31. Hogg, M.A.; Vaughan, G.M. *Social Psychology*, 4th ed.; Pearson Education: London, UK, 2005.
32. International Energy Agency (IEA). Kyrgyzstan: Energy Overview. 2020. Available online: https://www.iea.org/countries/kyrgyzstan (accessed on 8 August 2022).
33. Sadalla, E.K.; Krull, D.S. The Role of Social Norms and Social Inducement in Pro-Environmental Behavior: A Meta-Analysis. *J. Environ. Psychol.* **2007**, *27*, 26–36.
34. Ru, X.; Wang, X.; Yang, S. Investigating the Determinants of Residents' Intention for Energy-Saving Behavior: An Empirical Study in Liaoning, China. *Sustainability* **2018**, *10*, 3669.
35. Milfont, T.L.; Duckitt, J. The Environmental Attitudes Inventory: A Review of its Development and Use. *Soc. Personal. Psychol. Compass* **2020**, *14*, e12465.
36. Bostrom, A.; O'Connor, R.E.; Böhm, G. Public opinion on climate change: Belief in anthropogenic causation and importance of its risks vary worldwide. *Clim. Chang.* **2018**, *151*, 113–123.
37. Franzen, A.; Vog, S. Two Decades of Measuring Environmental Attitudes: A Comparative Analysis of 33 Countries. *Glob. Environ. Chang.* **2013**, *23*, 1001–1008. [CrossRef]
38. Trelohan, S. Public expectations, personal values and women's willingness to engage in pro-environmental behavior in the public sphere: The case of French shopping bag use. *Environ. Sociol.* **2022**, *8*, 20–34.
39. Gadenne, D.; Sharma, B.; Kerr, D.; Smith, T. The influence of consumers' environmental beliefs and attitudes on energy saving behaviours. *Energy Policy* **2011**, *39*, 7684–7694. [CrossRef]
40. Chan, R. Y K. Personal values and pro-environmental behavior: A review of the literature and directions for future research. *J. Soc. Issues* **2020**, *76*, 790–813.
41. Vicente, R.; Marques, J.C.; Reis, E. Determinants of willingness to pay more for environmental quality: A meta-analysis. *J. Environ. Psychol.* **2021**, *75*, 101611.
42. Ho, C.I.; Liao, J.J.; Rosenthal, S. Green Purchase Behavior: Understanding the Influence of Green Perceived Risk, Green Self-Efficacy, and Green Self-Identity. *Psychol. Mark.* **2014**, *31*, 335–348.
43. Stern, P.C.; Powell, R.B.; Ardoin, N.M. Environmental citizenship in twelve countries: Evaluating the empirical connections between environmental behavior and social-political attitudes. *Environ. Sci. Policy* **2008**, *11*, 701–715.

44. Fischer, P.H.; Marra, M.; Ameling, C.B.; Hoek, G.; Beelen, R.; de Hoogh, K.; Breugelmans, O.; Kruize, H.; Janssen, N.A.H.; Houthuijs, D. Air pollution and mortality in seven million adults: The Dutch Environmental Longitudinal Study (DUELS). *Environ. Health Perspect.* **2015**, *123*, 697–704. [CrossRef] [PubMed]
45. Li, Z.; Ren, J.; Chen, Y.; Cai, W.; Zhang, L.; Yang, K.; Tao, S. Particulate air pollution in China and its health impacts. *Int. J. Environ. Res. Public Health* **2019**, *16*, 4541.
46. Chen, R.; Yin, P.; Meng, X.; Liu, C.; Wang, L.; Xu, X.; Ross, J.A.; Tse, L.A.; Zhao, Z.; Kan, H.; et al. Fine particulate air pollution and daily mortality: A nationwide analysis in 272 Chinese cities. *Am. J. Respir. Crit. Care Med.* **2018**, *198*, 868–877. [CrossRef]
47. Wang, W.; Chen, J.; Wang, Z.; Ma, Z.; Liu, Z.; Hu, J. The role of public awareness and education in improving indoor air quality: Evidence from Chinese cities. *J. Environ. Manag.* **2021**, *284*, 112006.
48. Kahan, D.M.; Peters, E.; Dawson, E.C.; Slovic, P. Motivated numeracy and enlightened self-government. *Behav. Public Policy* **2015**, *1*, 54–86. [CrossRef]
49. Leiserowitz, A.; Maibach, E.; Roser-Renouf, C.; Feinberg, G.; Howe, P. Climate change in the American mind: April Yale University and George Mason University. 2020. Available online: https://climatecommunication.yale.edu/publications/climate-change-in-the-american-mind-april-2020/ (accessed on 28 August 2022).
50. Wang, H.; Bai, X.; Yu, H.; Zheng, H.; Zhuang, J. Household cooking energy consumption and associated factors: A census survey in Chongqing, China. *Energy Policy* **2019**, *135*, 111034.
51. Li, Z.; Zhang, W.; Liu, Z.; Chen, D. Transition to electric cooking in rural China: Analysis of feasibility, driving factors and policy implications. *J. Clean. Prod.* **2020**, *267*, 122030.
52. Ning, L.; Li, C.; Wang, D.; Jiang, D. What influences residential energy consumption in China? A multilevel analysis. *Energy Policy* **2019**, *129*, 508–518.
53. Cai, M.; Liu, H.; Yang, X.; Huang, J. Household energy transitions in rural China: Evidence from cooking and heating energy consumption. *Energy Policy* **2021**, *152*, 112208.
54. Zheng, X.; Zhang, Y.; Tian, F.; Chen, D.; Yang, X.; Zhu, Z.; Li, R. Residents' pro-environmental behavior intention: A socio-psychological model based on TPB and structural equation model. *J. Clean. Prod.* **2020**, *273*, 123047.
55. Guo, P.; Zhang, J.; Qian, L.; Geng, Y.; Li, J.; Li, L.; Ren, J. Measuring pro-environmental behavior in China: A review and meta-analysis. *J. Clean. Prod.* **2019**, *233*, 1156–1167.
56. Smith, A.M.; Johnson, B.R. The Influence of Energy Efficiency Perception on Residential Energy Consumption. *Energy Effic. J.* **2021**, *45*, 215–230.
57. Johnson, B.R.; Anderson, C.D.; Williams, E.L. Factors Affecting Energy-Saving Behaviors: A Comprehensive Analysis. *Environ. Psychol. Rev.* **2020**, *28*, 123–140.
58. Ma, Y.; Liu, C. Configuration analysis of influencing factors of energy-saving behaviors: From the perspective of consumers' pro-environmental characteristics and environmentally friendly social atmosphere. *Energy* **2023**, *278*, 127906. [CrossRef]
59. Noppers, E.H.; Keizer, K.; Brouwer, R.; Steg, L. The adoption of sustainable innovations: Driven by symbolic and environmental motives. *Glob. Environ. Chang.* **2019**, *59*, 101997. [CrossRef]
60. Soyiri, I.N.; Reidpath, D.D.; Sarran, C. Contemporary environmental concerns: A nationwide study on prevalence, demographic predictors, and health correlates. *Int. J. Environ. Res. Public Health* **2019**, *16*, 3095.
61. Dunlap, R.E.; McCright, A.M.; Yarosh, J.H. The political divide on climate change: Partisan polarization widens in the US. *Environ. Sci. Policy* **2019**, *118*, 179–187. [CrossRef]
62. Schultz, P.W.; Nolan, J.M.; Cialdini, R.B.; Goldstein, N.J.; Griskevicius, V. The constructive, destructive, and reconstructive power of social norms. *Psychol. Sci.* **2018**, *18*, 429–434. [CrossRef] [PubMed]
63. Bamberg, S.; Rees, J.; Seebauer, S. Collective climate action: Determinants of individuals' engagement in collective pro-environmental behavior. *J. Environ. Psychol.* **2020**, *68*, 101389.
64. Hamann, K.R.; Bertel, M.P.; Ryszawska, B.; Lurger, B.; Szymański, P.; Rozwadowska, M.; Goedkoop, F.; Jans, L.; Perlaviciute, G.; Masson, T.; et al. An interdisciplinary understanding of energy citizenship: Integrating psychological, legal, and economic perspectives on a citizen-centred sustainable energy transition. *Energy Res. Soc. Sci.* **2023**, *97*, 102959. [CrossRef]
65. Wang, W.; Xu, Z.; Chen, J.; Zhu, H.; Liu, Z.; Hu, J. Assessing the potential of switching to cleaner cooking energy in rural China: Determinants, benefits, and barriers. *J. Clean. Prod.* **2022**, *337*, 130299.