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Why Low-Carbon Publicity Effect Limits? The Role of Heterogeneous Intention in Reducing Household Energy Consumption

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Abstract: Low-carbon knowledge is seen as having a key role in interfering with household energy consumption behaviors by wide consensus from political and academic areas. Whether low-carbon publicity will help to reduce household energy consumption is still in dispute. By constructing an integrated knowledge-intention-behavior model and using 1335 detailed survey questionnaires of household energy behavior in Henan Province, the central area in China, this paper finds that in the developing area low-carbon knowledge or publicity cannot positively impact household energy-saving behavior even if mediated by energy awareness and energy-saving attitudes. Low-carbon knowledge does improve energy-saving attitude and attitude does not decrease household energy consumption directly. Familiarity with particular energy-saving knowledge would decrease the household energy consumption but not significantly in the statistics. Path analysis unfolds the reason that the heterogeneous effects of purchase-based intention and habitual intention explain energy consumption behavior. Subgroup analysis supports those economic factors of income and energy prices play key roles in explaining such household energy consumption behavior in the rapid urbanization area. This paper gives new evidence on the residential energy-saving behavior intervention among developing areas.

Keywords: household energy behavior; rapid urbanization areas; structural equation model

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1. Introduction

To promote the energy transition in households, measures of changing energy consumption behavior are always conducted by governments. On addressing climate change, low-carbon knowledge publicity has been widely adopted around the world, which is hoped to influence the energy behavior of the residential sector. It is the same in China. After joining the Paris Agreement in 2009, the notion of "low-carbon" has been transmitted thoroughly in Chinese society. However, China's household energy consumption has still risen during the past years. In fact, China's household energy consumption is increasing rapidly and makes up 12.7% in 2019 [1]. Whether and how the low-carbon knowledge publicity helps to reduce household energy consumption should be investigated seriously, especially under the background of China's declaration to reach the peak of carbon emission by 2030 and carbon neutrality by around 2060. The household sector has great potential in achieving long-term, significant, and cost-effective energy consumption reduction and related greenhouse gas emissions [2].

Previous studies demonstrated that there is a knowledge-action gap, a value-action gap, an attitude-action gap, or an intention-action gap via the perspective of cognitive behavior theory, which can explain why knowledge publicity cannot achieve an expected reduction of energy consumption [3,4]. As this paper argues, however, low-carbon knowledge cannot be seen directly as general energy-saving-related knowledge. Whether low-

carbon knowledge can be translated energy-saving related awareness and attitude is the first gap, namely knowledge-awareness and knowledge-attitude gaps [5–7]. Then the second level is an attitude-behavior gap [8–10]. On this topic, researchers always take energy-saving intention as the main reason, because energy-saving attitudes cannot impact energy behavior directly and there is also an intention level in people's cognitive system [11,12].

Yes, intention is much closer to the decision-making process but leading to energy-saving behavior is still very complex [13,14]. Since the economic factors always play key roles in the decision-making process before real action, such as saving money on buying cheaper energy devices or paying less for energy-efficient appliances in real purchases, it is no surprise that some studies cannot find obvious impacts of energy-saving attitude on energy curtailments [15,16]. Studies in the perspective of economics explain such a gap by the energy rebound mechanism [17,18]. It claims that the nature of energy is a commodity which means household energy consumption is influenced by energy prices, family income, and other economic factors because of changes in energy efficiency. However, opponents argue that residents' behavior does not generally fall short of their environmental concerns and commitments just because they are pursuing material interests and extrinsic rewards [19].

Arguments on the above imply that "intention" cannot be seen as a "black box" while it is neglected by most of the current literature. This paper tries to make a contribution to this point. Inspired by [20], we divided *habitual intention* and *purchase-based intention* to explore the role of heterogeneous energy-saving intention in the knowledge-behavior gap problem. Habitual intention represents the willingness of residents to save energy in their daily behaviors (such as turning off electronic equipment in time), which is a solid motive for energy conservation and independent of the cost-effectiveness consideration. [13]. A person with pro-environmental habits will always perform a better energy-saving behavior. Hence habitual intention can lower some of the negative consequences of energy consumption even if energy efficiency or energy prices change. Purchase-based intention is measured as the willingness to save energy in purchasing when family income or product prices change [7,20]. People in developing areas are always sensitive to the price due to budget constraints.

Focusing on heterogeneous intention is very important for two reasons. First, the policy implication will be very interesting to policy-makers. On one hand, measures such as nurturance education start with kids and can be taken to cultivate citizens' good habits of energy-saving or being environmentally friendly. On the other hand, specific policies targeting the purchased-based intention should be made in a wiser way like extra moral rewards for energy-efficiency products which can offset the economic loss subjectively. Secondly, distinguishing the heterogeneity of intention is very important for people's energy behavior adjustment in underdeveloped regions, especially in areas with lower average income. Habitual intention may have spillover to purchase-based intention, which means the division is not static but changeable. A pro-environmental habit may result in an energy-saving behavior some time [21,22].

The purpose of this research is to explore whether and how low-carbon knowledge publicity will reduce household energy consumption and focus on the impacts of heterogeneous intention. The novelty of this paper lies in two aspects. First, this paper explores the two-tier channels of the knowledge-behavior gap and focuses on the role of heterogeneous intention, which can make a contribution to current studies. Second, this paper adds new empirical evidence for developing areas which are also experiencing fast urbanization currently. These areas always face critical household energy consumption issues and have a typical characteristic of uneven income level. This paper collects data by 1335 surveys in Henan Province, a central part of China, which is different from most current Chinese studies.

This paper formulates a household energy integrated knowledge-intention-behavior model (Figure 1). Based on the questionnaire survey and structural equation model (SEM) analysis, this paper finally identifies the key path of how low-carbon knowledge affects household energy behavior. The remainder of this paper is structured as follows. Section 2

demonstrates the theoretical model and hypotheses, Section 3 introduces the research design, including the case, questionnaires, data, and model. Section 4 carries on the empirical analysis, and Section 5 gives discussion and conclusions.

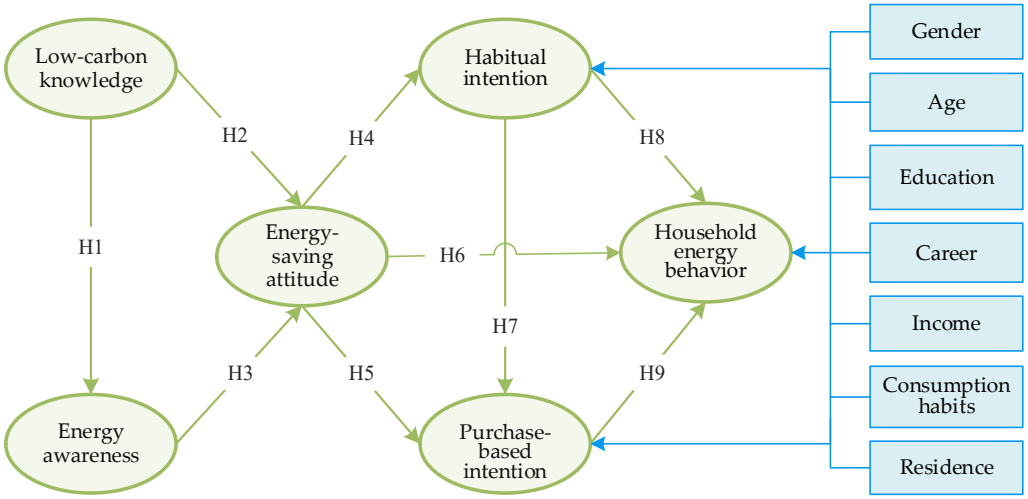


Figure 1. Hypothetical household energy integrated model.

2. Theoretical Model and Hypothesis

Household energy behavior in this paper is broadly defined as behaviors related to energy use in a resident's life (including clothing, food, residence, travel, and so on), which is a complex social and technological phenomenon influenced by various interrelated factors [2,23]. A large body of research from the perspective of cognitive behavior theories divided these factors into residents' characteristics and external factors. Personal objective characteristics (gender, academic background, income, and family size) have a significant impact on energy-saving behavior, according to research [12,24,25], while some studies based on different cases show the opposite [7,26,27]. On the subjective characteristics, it has been a consensus that energy-saving intention is a direct antecedent variable of behavior [3,4,7,11,28]. Numerous studies demonstrate that energy-saving knowledge, awareness, and attitude are important factors affecting final energy-saving behavior to various degrees [5,8,29–31]. Additional evidence from some research suggests that social responsibility, moral consciousness, perceived behavior control, and personal norms affect energy-saving behavior significantly [4,11].

External factors, such as policy norms, publicity, and education, product market, and situational factors are widely studied. In more detail, policy norms play positive roles in energy-saving intention and behavior, which has been proven in many studies [24,32]. Further research differentiated policies and norms and found that a proper combination of descriptive and imperative norms is the best way to promote energy-saving behavior [33], and financial incentives are the most favorable to promote pro-environmental behavior [27]. Studies also show that publicity and education influenced household energy-saving behavior significantly [7,11]. In addition, research set in fast-developing cities provided evidence that the comprehensive influence of external factors on energy-saving behavior is greater than that of personal characteristics due to the indirect effect on energy-saving intention and personal subjective characteristics [7].

Based on the research above, this paper is dedicated to exploring whether and how low-carbon publicity helps to decrease household energy consumption in the rapid urbanization area. Due to the popularization of related knowledge being the most common form of low-carbon publicity in this period, effective publicity is characterized by the improvement of residents' low-carbon knowledge and energy awareness, which has been proved both in developed and fast-developing regions [5,34]. Therefore, we set low-carbon knowledge and energy awareness as the start point of the model. Low-carbon knowledge as an external factor refers to the resident's capability to access the impact of carbon

emissions, and an individual's amount of knowledge on carbon emissions [35]. Energy awareness as an internal factor shows the resident's perception of their household energy consumption [25]. Further, energy-saving attitude was used as a mediating variable to bridge the gap between knowledge and intention [27]. In order to differentiate the effect of price-related factors, we creatively divide energy-saving intention into habitual intention and purchase-based intention to examine the influence of income or energy price change on household energy decision-making. Figure 1 presents a simplified model to explain the hypothetical relationship among residents' low-carbon knowledge, energy awareness, habitual intention, purchase-based intention, and household energy behavior.

Low-carbon knowledge and energy awareness are both critical in residents' attitudes toward energy conservation since an informed consumer who can make responsible decisions requires related knowledge and awareness [5]. Low-carbon knowledge in this research refers to residents' understanding of carbon emissions from household energy usage [6]. As an external factor, knowledge takes effect by influencing residents' energy-saving attitudes, which is a key component in explaining energy-saving intention [6,7]. Numerous studies proved the positive relationship between knowledge, awareness, and attitude [34,36–38]. Similar results are also reported in [29,39], which claimed that a lack of energy-related knowledge will stymie household energy conservation. In line with previous research, we thus propose the following hypotheses:

Hypothesis 1. *Low-carbon knowledge has a positive influence on energy awareness.*

Hypothesis 2. *Low-carbon knowledge has a positive influence on energy-saving attitudes.*

Energy awareness has significant positive effects on residents' energy-saving behavior via related attitudes and intentions [40–42]. Research on the topic of green purchase concludes that consumer attitudes regarding green products are favorably connected with environmental awareness [5]. Similar research employs environmental awareness as a moderating variable and shows that awareness of corrective measures helps customers to protect the environment [30,43]. Based on the above research, the more energy awareness a consumer has, the more positive attitudes are shown toward energy saving, so we thus derive the following hypothesis:

Hypothesis 3. *Energy awareness has a positive influence on energy-saving attitudes.*

Attitudes reflect the degree that an individual has a favorable or unfavorable evaluation of a particular behavior, which plays an important role in intention and behavior [32]. There is emerging literature based on the theory of planned behavior (TPB) that shows a positive relationship between energy-saving attitude and intention [5,42,44], as well as some research into the reason for the gap between attitude and intention [3]. Research set in India demonstrates that attitude toward environmentally sustainable products mediates the relationship between environmental knowledge and purchase intention [34]. Meanwhile, residents' attitudes about energy conservation have a direct impact on their energy consumption choices [8–10]. Based on previous research, the more favorable one's attitude toward saving energy, the more likely one is to develop energy-saving intention and behavior. Therefore, we propose the following hypothesis:

Hypothesis 4. *Energy-saving attitudes have a positive influence on habitual intention.*

Hypothesis 5. *Energy-saving attitudes have a positive influence on purchase-based intention.*

Hypothesis 6. *Energy-saving attitudes have a negative influence on household energy consumption behavior.*

According to [20], a variety of behaviors that essentially involve the same behavior, whether purchase-based or habitual, are clearly related, and it would seem logical to extend them to other academic and policy contexts. As for intention, the distinction between habitual intention and purchase-based intention is not static, the former may overflow to the latter when external situations change. Therefore, it is hypothesized that:

Hypothesis 7. *Habitual intention has a positive influence on purchase-based intention.*

Intention is a direct antecedent variable of behavior that indicates how likely a person is to engage in a particular conduct [45]. Based on the TPB, a resident's energy-saving intention is the direct influencing factor of energy-saving behavior, and it can also be used to predict household energy behavior positively [28]. Furthermore, abundant research based on different regions has confirmed that energy-saving intention has a significant impact on shaping and changing energy-saving behaviors [3,4,7,11]. Therefore, it is hypothesized that:

Hypothesis 8. *Habitual intention has a negative influence on household energy consumption behavior.*

Hypothesis 9. *Purchase-based intention has a negative influence on household energy consumption behavior.*

In addition, demographic characteristics should also be taken into consideration. Household energy behavior, as a part of lifestyle, is the characteristic performance of daily behavior under the guidance of certain conditions and values, with significant differences between groups. Plenty of research shows the divergence in energy consumption structure among different genders, ages, education backgrounds, occupations, consumption habits, family sizes, and residences [7,24,46–48]. Therefore, we added them to the model as control variables.

3. Data and Method

3.1. Sampling and Data Collection

Unlike with cases in Jiangsu [24], Beijing [32], and other developed regions [4] in China, here the case of Henan represents most of the developing areas for several reasons. First, it owns the largest population and has a lower-middle-level economic condition. Henan Province accounts for almost 7% of the total population of China, but the per capita GDP is only CNY 57061 (USD 8274) with a rank of 18 in total in 2019 [1]. Secondly, it has experienced rapid economic growth and fast urbanization during the past decade. Henan province has an average GDP growth rate of 9.1% (7.7% in China), and its average urbanization rate went up by a speed of 3.2% (2.6% in China) per year from 2010 to 2019. It is typically the nature of a place under development. Thirdly, household energy consumption has considerably expanded. Compared to 2000, per capita electricity consumption in Henan increased by 7.7 times, and domestic natural gas consumption increased by 17.2 times in 2019 [49]. The number of household private cars was 31500 vehicles in 2019, much higher than the average number of 14,400 among 31 provinces in China.

The questionnaire was designed based on the literature, revised after expert consultations, and adjusted after 50 pilot tests, in order to ensure reliability and validity. A four-part questionnaire, including 52 closed-end questions with multiple-choice scale or five-point Likert scale measurements were finally adopted in the survey. In the first part, questions focused on residents' low-carbon knowledge, energy awareness, and attitude toward saving energy: knowledge about carbon emissions, aware household energy expenditures, care energy efficiency labeling, etc., developed by the authors of [6,25,29,41]. In the second part, questions about past experience and expected energy consumption under income change were designed to measure energy-saving intention, adapted from [32]. The third part was formed by questions targeting residents' household energy consumption: electricity, gasoline, food, and clothing-related energy to make sure the latent variable is measured by multi-item scales [50]. It also included household energy purchase behavior and presumed behavioral change of home appliances under the variation of energy prices, enlightened and suggested by the authors of [34,42]. The last part was intended to gather demographic information such as gender, age, family size, education level, household annual income, consumption habits, and so on. The questions are described and discussed in further detail in Sections 3.2 and 4.

In this paper, we adopt a random sampling method following [42] by randomly visiting commercial and residential neighborhoods during summer vacation (from July 10 to August 12) in 2018 and winter vacation (from January 25 to February 28) in 2019. Considering the efficiency of sampling, data were mainly gathered by the Internet for the second

time. The electronic version of the questionnaire was spread by social media (WeChat) and the questionnaire platform (Questionnaire Star) which can be automatically pushed to more mobile phone users. 367 out of 1702 returned questionnaires were deleted, having failed to answer all questions or a response time of fewer than 2 min. Finally, 1335 valid samples were obtained, resulting in a successful recovery rate of 78.4%. This sample size fulfilled the requirement for a large sample in statistics.

We need to clarify that this by-hand paper considers an energy-related issue that seasons can obviously influence household energy consumption behavior. Residents who fill out the questionnaire should have a full understanding of their household consumption of electricity, heating, and travel patterns throughout the year. Simultaneous sampling in summer and winter helps to balance these related issues, so as to ensure that the sample avoids the deviation caused by "consumers only answering questions according to the current situation" as far as possible. Secondly, there were almost 1.1 billion mobile phone users and more than 1.1 billion WeChat users in China by 2019. The Internet penetration rate of Henan province reached 91.3%, and the total number of Internet users exceeded 110 million, which indicates that any offline respondents who can participate in our survey have a mobile phone. These actual conditions enable the difference between online and offline random sampling very small.

We were aware of the potential "observed" deviation between online and offline surveys and tried to alleviate it by questionnaire design so that many items are objective (i.e., frequency of washing, number of appliances, private cars, etc.). We further made a comparison which showed that there was no difference except for sample size. The self-selection bias in the process of the online survey should also be in consideration; however, it is obviously an inevitable and uncontrollable deviation in similar published research [6]. Residents who voluntarily participate in the online survey are interested in the topic, and are concerned and understand their household energy consumption, and therefore are our target sample. The objective status quo expressed by them is very important to our research. Finally, according to our literature review, this paper has the largest number of samples in relevant studies, which can also help to alleviate the deviation caused by self-selection [3,4,24,32].

3.2. Descriptive Statistics

Table 1 shows the demographic profile and the sample's descriptive statistics, the gender distribution is not much different, 52.43% females and 47.57% males, while the age of most respondents ranged between 18 and 55 years old. The mean family size is 3.68, and most of them lived in urban areas. It is therefore likely that urban residents are overrepresented and rural residents underrepresented, compared to the equivalent proportions for Henan. However, the difference between urban and rural areas is not the focus of this article. The annual family income of most respondents ranged between CNY 80,000 and 150,000 (USD 1209 to 22,668), which is broadly representative of the income level in Henan. The level of education is relatively high, 38.88% have a bachelor's degree and 34.63% have a master's or doctoral degree. As for consumption type, most residents put convenient and economical purchase first, only 4.79% of residents pay attention to environmentally friendly consumption.

Table 2 represents the summary statistics of the main latent variables. Low-carbon knowledge in our questionnaire was measured by how extent the respondent knows low-carbon knowledge related to household energy use, refer to [6,29]. As descriptive statistics reported, only about 29%, 40%, and 56% of respondents have low-carbon knowledge about clothing, food, and travel tools, respectively. On average, less than half of respondents know about carbon emissions knowledge about household consumption, lower than our expectation.

Table 1. Descriptive statistics of demographic information (N = 1335).

Characteristics	Specifications	Counts	Proportion (in %)
Gender	Male	635	47.57
	Female	700	52.43
Age	18–25	303	22.70
	26–35	490	36.70
	36–55	507	37.98
	More than 56	35	2.62
Education background	High School and Below	99	7.42
	College or undergraduate	255	19.10
	Bachelor's degree	519	38.88
	Master's degree or above	462	34.61
Family income (CNY)	80,000 or less	257	19.25
	80,001–150,000	654	48.99
	150,001–300,000	321	24.04
	More than 300,000	103	7.72
Family size	1	39	2.92
	2–3	613	45.92
	4–6	657	49.21
	7 or above	26	1.95
Consumption type	Enjoyment-oriented	165	12.36
	Economical	465	34.83
	Convenient	641	48.01
	Environmentally friendly	64	4.79
Place of residence	Urban	1080	80.90
	Rural	255	19.10

Source: Author analysis.

Table 2. Descriptive statistics of the latent variables (N = 1335).

Questionnaire Items	Counts	Proportion (in %)
Low-carbon knowledge		
Respondent knows carbon emissions about cloth	383	28.69
Respondent knows carbon emissions about food	539	40.37
Respondent knows carbon emissions about travel tools	743	55.66
Energy awareness		
Respondent knows water expenditures	681	51.01
Respondent knows electricity expenditures	742	55.58
Respondent knows gas expenditures	616	46.14
Energy-saving attitude		
Respondent cares about energy efficiency labeling	838	62.77
Respondent agrees to pay more on energy-efficient products	833	62.40
Respondent holds energy saving while shopping matters	836	62.62
Habitual intention		
Respondent tends to turn off the light in time	474	35.51
Respondent tends to turn off the tap in time	796	59.63
Respondent tends to turn off the air conditioner in time	843	63.15
Respondent tends to turn off the office equipment in time	499	37.38
Respondent tends to turn off the drinking water equipment in time	694	51.99
Purchase-based intention		
Respondent would save electricity when income increases	63	4.72
Respondent would save water when income increases	78	5.84
Respondent would save gasoline when income increases	95	7.11
Respondent would save clothing when income increases	77	5.76
Respondent would save food-related energy when income increases	116	8.79

Source: Author analysis.

In line with [25,41], energy awareness in this research was measured by the direct assessment of whether respondents know about their household energy consumption. We hold that most of the residents know their household energy expenditure, but actually only about half of the respondents were aware. Among them, more than half of males know about their household consumption, which is significantly higher than the proportion of men in the questionnaire. It is contrary to what we expected, while most women are the protagonists of family affairs in China, but statistics demonstrate men have better energy awareness.

We assessed the participant's attitude toward energy saving by adopting the measures of energy efficiency labeling, energy-efficient products, and the importance of energy saving while shopping, which is more adaptive to our sample. As Table 2 shows below, more than 62% of respondents care about whether there is energy efficiency labeling with appliances and are willing to pay more on products of higher energy efficiency.

As to habitual intention, we refer to the research of [32] that adopts past experience to measure residents' habits of saving energy in daily lives. In statistics, residents show better performance on the water and air conditioner, which about 60% of respondents intended to turn off in time, while light and household office equipment such as computer shows lower intention to save energy, less than 40%.

Based on the theoretical framework and [51–53], we adopt expected energy consumption under the increase of residents' income to measure purchase-based intention. Different from previous research, this new variable is used to express the change in household energy consumption under the continuous rise of the resident's income in the future, and to better reflect the impact of economic factors on household energy willingness and behavior. Statistics show that less than 10% of respondents would save energy when their income increases, which means continuous improvement of economic conditions might be the main role hindering household energy conservation in rapid urbanization areas.

In many items of household energy consumption behavior, three questions related to transportation are finally included in the model, which is the same as the perspective in [50]. The three items are the number, displacement, and mileage of private vehicles. Although Henan Province is a developing region, China's extensive power coverage and affordable electricity price make the consumption of home appliances unable to reflect the energy behavior characteristics of different families. Private cars, as a travel tool with a higher purchase price and usage cost, are more representative and differentiated. According to the statistics, 74% of our respondents own at least one car, and 18% of families own two or more private cars.

3.3. Characteristic-Based Analysis

3.3.1. Characteristics of Household Appliances

According to the questions on the behavioral change of different appliances under the variation of energy prices, we find that the elasticity of refrigerators, range hoods, electric cookers, and computers is relatively small, while that of life-improving products, such as electric heaters, air conditioners, and microwave ovens is relatively large, which is similar with the results of [51]. One reason that leads to the difference is heterogeneous intention. The former is more inclined to necessities of life which is highly related to habitual intention tended to stay as is, while the latter is mainly heating facilities or kitchen appliances with high substitutability which is vulnerable to price fluctuations and closer to purchase-based intention. In the context of rapid urbanization and continuous improvement on family income, residents will have higher requirements for living standards, which means energy products used to improve the living environment have tremendous growth potential. Therefore, price-related factors need to be considered in the study of household energy behavior.

3.3.2. Characteristics of Household Energy Purchase Behavior

As for purchase behavior, although residents show high energy-saving attitudes, the results in decision-making are not satisfactory. About 63% of respondents show a positive attitude toward saving energy. However, only 14.53% of residents care about

energy conservation and environmental protection at decision points, 50.26% of residents pay attention to price at first, followed by product performance (21.05%). Price-related factors still play the most important role in household energy purchase behavior after large scale and lasting low-carbon publicity, providing complementary evidence that price-related factors might be the main reason why low-carbon publicity effect limits in rapid urbanization areas.

3.4. Method

There are complex interaction mechanisms among knowledge, awareness, attitude, intention, and behavior. Additionally, latent variables are subjective which may lead to large measurement errors. This paper then constructs a structural equation model (SEM) to clarify the direct and indirect relationship between them. The structural equation model is a multivariate statistical model based on the covariance matrix to analyze the causal relationship between variables [54]. It integrates two statistical methods of factor analysis and path analysis, which can not only test the direct and indirect relationship between multiple latent variables but also estimate the fitting consistency of the whole model, to show the result of mechanism analysis in a clearer way. In this paper, SPSS 23.0 and Amos 24.0 are used for data analysis and hypothesis testing. The structural equation model is divided into two parts, the measurement model and structural model. The details are as follows:

3.4.1. Measurement Model

Since latent variables cannot be directly measured, they need to be converted into measurable observation variables. The structural relationship between latent variables and observed variables is usually expressed as:

$$\mathrm{X} = \Lambda x \xi + \delta \tag{1}$$

$$\mathrm{Y} = \Lambda y \eta + \varepsilon \tag{2}$$

where ξ is an exogenous latent variable, η is an endogenous latent variable, X is the vector composed of the exogenous latent variable corresponding to the observed variable, Y is the vector composed of the endogenous latent variable corresponding to the observed variable, Λx and Λy are the factor load coefficient matrix, representing the relationship between the observed variable and its latent variable, and δ and ε are the error terms.

3.4.2. Structural Model

The structural model describes the causal relationship between latent variables, which is usually linear. The structural equation is usually expressed as:

$$\eta = \mathrm{B}\eta + \Gamma\xi + \zeta \tag{3}$$

where η is an endogenous latent variable, ξ is an exogenous latent variable, B and Γ represent the path coefficient matrix, ζ is the error term of the structural equation, and ξ and ζ are not related.

4. Results

4.1. Reliability and Validity Test

Through factor analysis, we get rid of some items that do not meet the standard, and finally get 6 factors composed of 22 indicators. The detailed result of the reliability and validity test is shown in Table 3. The Cronbach's alpha coefficient of each variable is higher than the value of 0.75 which means each measurement index has high reliability. Based on relevant research, the content validity of the questionnaire is ensured by expert consultations, pilot tests, and group discussions. Confirmatory factor analysis is used for structural validity, and the result shows almost all factor loadings of measurement indexes are greater than 0.50 (Figure 2), indicating the observed variables can reflect their

corresponding latent variables in a good way. The average extraction variation (AVE) of each variable is higher than 0.45, and the composite reliability (CR) is higher than 0.75 which means all variables have good discriminant and convergence validity.

Table 3. Results of confirmatory analysis.

Latent Variable	Indicators	Cronbach's A	CR	AVE
Low-carbon knowledge	3	0.772	0.778	0.539
Energy awareness	3	0.801	0.820	0.613
Energy-saving attitude	3	0.785	0.788	0.555
Habitual intention	5	0.818	0.820	0.477
Purchase-based intention	5	0.829	0.839	0.517
Household energy behavior	3	0.818	0.824	0.613

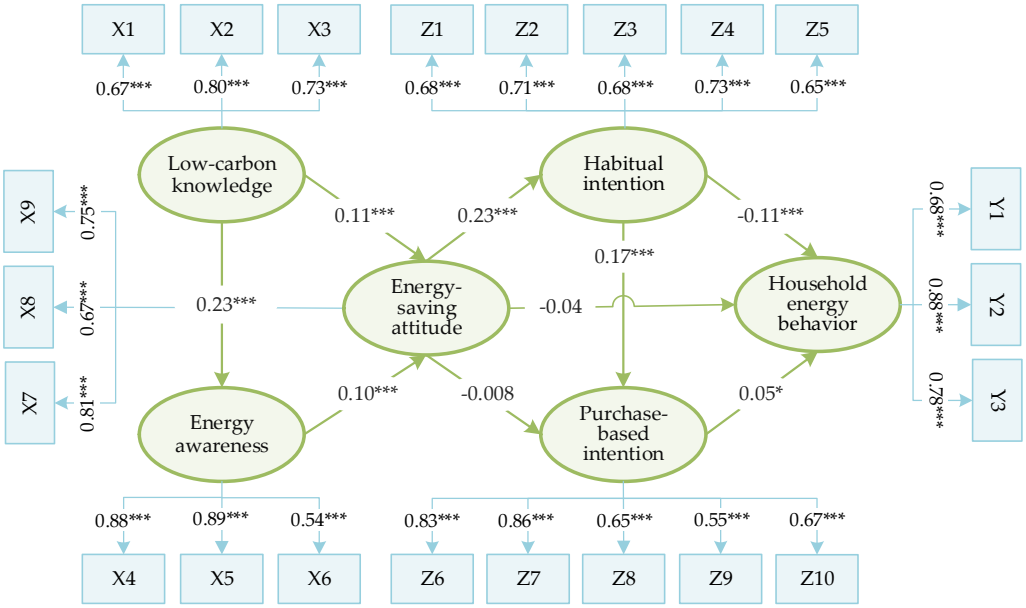


Figure 2. Estimated results of the household energy integrated model. Note: 1. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 4 summarizes the fitting results of the structural equation model, and all the test values are at an acceptable level. The goodness of fit test of the model is excellent, indicating that the overall model has great internal consistency, reliability, and stability in both theoretical and statistical senses.

Table 4. Fitting index of the household energy integrated knowledge-intention-behavior model.

Index	CMIN/DF	NFI	IFI	TLI	CFI	RMSEA	SRMR
Model results	3.560	0.934	0.952	0.944	0.952	0.044	0.041
Standard	<5	>0.8	>0.9	>0.8	>0.9	<0.05	<0.05
Model accuracy	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent

4.2. Empirical Results

Figure 2 demonstrates the model result, the path coefficient reflects the influence among variables, such as "Habitual intention" on "Household energy behavior". The standard path coefficient of direct effect is −0.11, and the coefficient of indirect effect is $0.05 \times 0.17 \approx 0.01$. Therefore, the comprehensive effect of "Habitual intention" on "Household energy behavior" is $-0.11 + 0.01 = -0.10$. Through the figure below, we can verify the basic assumption of this paper, that is, due to the existence of gaps between knowledge, attitude, heterogeneous intention, and behavior, low-carbon knowledge publicity

cannot achieve its ideal effect on energy conservation, which is consistent with existing findings [3,5].

Table 5 shows the result of hypotheses testing of the structural model. From the path and effect analysis, it can be concluded that both low-carbon knowledge and energy awareness are helpful to improve resident's energy-saving attitude (the effect value is 0.15 and 0.23 respectively) and further enhance habitual intention (the effect value is 0.14), similar results as [5,7,34]. Additionally, energy awareness significantly moderates the nexus between low-carbon knowledge and resident's attitude toward energy saving, which is a similar result as [30,40]. Therefore, Hypotheses 1, 2, 3, and 4 are confirmed.

Table 5. Hypotheses testing of the household energy integrated model.

Hypothesis	Path	UnStd. Coefficient	Z-Value	*p*	Result
H1	Low-carbon knowledge → Energy awareness	0.129	6.690	***	Accepted
H2	Low-carbon knowledge → Energy-saving attitude	0.145	3.129	***	Accepted
H3	Energy awareness → Energy-saving attitude	0.228	2.850	***	Accepted
H4	Energy-saving attitude → Habitual intention	0.135	6.584	***	Accepted
H5	Energy-saving attitude → Purchase-based intention	−0.005	−0.226	/	Rejected
H6	Energy-saving attitude → Energy behavior	−0.043	−1.127	/	Rejected
H7	Habitual intention → Purchase-based intention	0.180	4.989	***	Accepted
H8	Habitual intention → Energy behavior	−0.197	−3.060	***	Accepted
H9	Purchase-based Intention → Energy behavior	0.094	1.662	*	Rejected

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Contrary to our expectations, energy attitude has a negative effect on purchase-based intention (the effect value is −0.005) and further increases household energy consumption (the effect value is 0.09). The probable explanation is that residents show high purchase-based intention for economic necessity rather than confirming the value of energy conservation and environmental protection, and thus lead to the invalidity of energy-saving attitude. Therefore, Hypothesis 5 has not been proved.

The path of energy-saving attitude on household energy consumption has not been verified, that is, there is no direct relationship between attitude and behavior, residents' attitude toward energy-saving is only affected in an indirect way (habitual intention), which is the same as the conclusion of [43]. Therefore, Hypothesis 6 is rejected.

Habitual intention has a significant positive effect on purchase-based intention (the effect value is 0.18). Combined with the content of the questionnaire, residents with high habitual intention tend to consume energy conservatively when their relative income increases. Therefore, Hypothesis 7 is accepted.

Habitual intention has a significant negative effect on household energy consumption (the effect value is −0.2), which means residents with high habitual intention tend to choose more energy-efficient ways. The results support the research of [27,28] which pointed out that residents' energy-saving intention is the direct cause of their behavior. Therefore, Hypothesis 8 is verified.

Purchase-based intention has a positive impact on household energy consumption (the effect value is 0.09), which means residents with high purchase-based intention save energy mainly for economic reasons and tend to change original household energy behavior to consume more energy when their relative income increases or energy price falls [52,53]. Combined with the economic situation of our case, this viewpoint needs more attention on the background of rapid urbanization and continuous improvement of the resident's income in the future. Therefore, Hypothesis 9 is rejected.

Household demographic characteristics are found to be insignificant statistically in this empirical analysis as the control variables, probably due to diverse effects from different socio-demographic groups [7], which would be further analyzed in the subgroup analysis.

4.3. Explanation and Further Analysis

Table 6 shows us the total effect among latent variables, which can conclude that low-carbon knowledge publicity does have a positive effect on energy-saving attitude, intention, and behavior. However, there is a paradox that residents with higher purchase-based intention consume more household energy, which is also the reason why low-carbon knowledge has a limited effect on final energy consumption. To further explore this paradox, we analyze the mediating effect between energy-saving attitude and energy consumption behavior next.

Table 6. The total effect of the knowledge-intention-behavior integrated model.

	Low-Carbon Knowledge	Energy Awareness	Energy-Saving Attitude	Habitual Intention	Purchase-Based Intention
Energy awareness	0.129				
Energy-saving attitude	0.174	0.228			
Habitual intention	0.024	0.031	0.135		
Purchase-based intention	0.003	0.004	0.020	0.180	
Energy consumption behavior	−0.012	−0.015	−0.067	−0.180	0.094

As Figure 2 showed before, there are four paths between energy-saving attitude and energy consumption behavior, one is the direct effect, the other three paths are indirect effects through habitual intention and purchase-based intention respectively, or simultaneously. Only two indirect paths are statistically significant, the negative way through habitual intention and the positive way through both habitual intention and purchase-based intention, the result is shown in Table 7.

Table 7. The mediating effects between energy-saving attitude and behavior.

Action Pathways	Direct Effect	Indirect Effect	Total Effects
Energy-saving attitude → Energy behavior	−0.043	−0.025	−0.067
Energy-saving attitude → Habitual intention	0.135	/	0.135
Energy-saving attitude → Purchase-based Intention	−0.005	0.024	0.020
Habitual intention → Energy behavior	−0.197	0.017	−0.180
Purchase-based intention → Energy behavior	0.094	/	0.094

Combining the definition of purchase-based intention and analysis above, it is, therefore, plausible to infer that the paradox is related to the motivation of the resident's intention, that is, many residents choose to save energy for economic reasons rather than voluntarily. Put simply, the influence of economic factors on residents' energy-saving behavior is greater than that of environment-related reasons, which have also been proved by the authors of [32,41]. Compared with residents living in developed regions, residents living in fast-developing areas pay more attention to the economic benefit, saving, or constraint [55]. The rapid development of the economy and energy efficiency technology has brought about a continuous decline in energy use costs and an increase in residents' income, which has further promoted the huge growth in household energy consumption, making the effect of low-carbon publicity on energy conservation seem to be limited. It is also the reason why an energy-saving attitude has no significant impact on purchase-based intention.

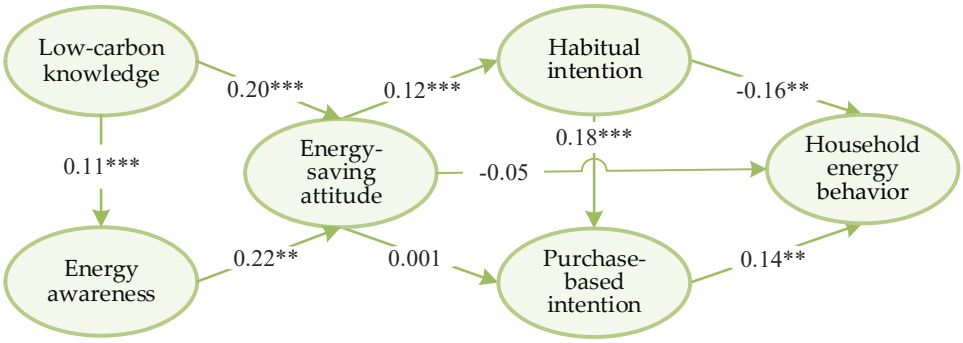
The second reason for this paradox is the "rebound effect" of household energy consumption. With the continuous decline of household energy cost, residents unconsciously consume more energy, which makes the actual household energy consumption not reach the expectation. More specifically, even though residents with high purchase-based intention tend to be more conservative after the cost of energy products or services decline (their household energy expenditure remains the same or even decreases), they may still unconsciously consume more energy than in the past, which ultimately makes the effect of purchase-based intention on household energy consumption positive in statistical level.

Owing to the positive effect of purchase-based intention on energy behavior produced by "economic motivation" and "rebound effect", the negative effect generated by habitual

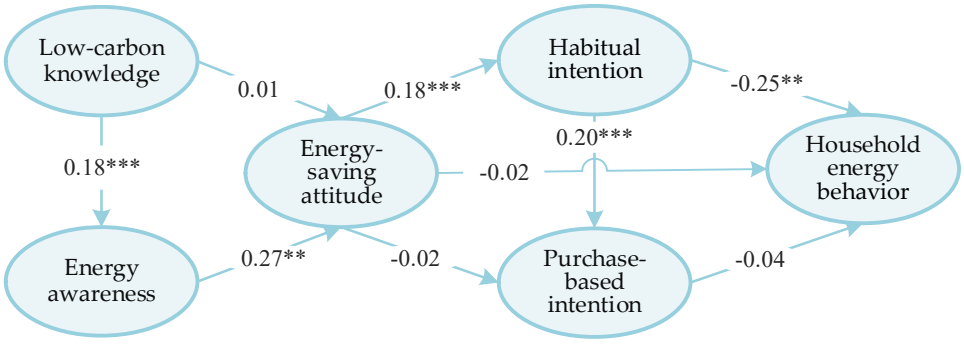
intention is weakened or even offset. Due to the long-term economic development, the gap between purchase-based intention and energy consumption may still be the main reason for the limited effect of knowledge publicity for some time yet. Evidence in the rapid urbanization region suggests that we should face up to the limited but positive role of low-carbon publicity and pay more attention to the guidance of residents' purchase-based behavior.

4.4. Subgroup-Based Analysis

To further verify the inference that low-carbon knowledge publicity has a limited effect, we next analyze the path relationship of family income grouping. As Figure 3 shows below, low-carbon knowledge plays a more positive role in energy-saving attitudes directly among low-to-middle income families, while it only works in indirect ways among high-income families by the mediating effect of energy awareness. Obviously, energy-saving attitudes of high-income families show a more positive effect on habitual intention than low-to-middle families, and both groups only have an indirect effect on purchased-based intention. As for energy consumption behavior, high-income families show higher habitual intention to save energy, and the adverse effect of purchase-based intention on energy consumption is negative. In more detail, the energy decision-making of high-income families is less affected by price-related factors and their energy-saving behaviors come from the affirmation of the value of a low-carbon lifestyle and environmental protection to some extent. In other words, rich residents' energy-saving behavior is more stable, a similar result to [53,56].



a. Family income below ￥150,000



b. Family income over ￥150,000

Figure 3. Path diagram of different family income groups. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Comparing the results of these two groups, the most obvious divergence is the purchase-based intention that low-to-middle income families show a higher and more positive effect on energy consumption. Due to the gap between purchase-based intention and energy consumption behavior, actual energy conservation generated by low-carbon publicity would be offset, further confirming the analysis results of the mediating effect above.

5. Discussion and Conclusions

5.1. Discussion

To quantitatively analyze the effect of public policy publicity on household energy consumption in rapid urbanization areas, this paper explores the heterogeneous role of intention based on an integrated knowledge-intention-behavior model. It finds a limited effect of low-carbon publicity. The results are as follows. Firstly, the same as previous studies, this paper finds a positive relationship among low-carbon knowledge, energy awareness, and energy-saving attitude, which means low-carbon publicity can help to change people's attitude toward energy conservation. However, the positive effect cannot be transferred to final household energy consumption directly because of the heterogeneous intention. Habitual intention will be enhanced by the channel of low-carbon knowledge $\rightarrow$ energy awareness $\rightarrow$ energy-saving attitude and results in a significant decrease in household energy consumption, while the channel does not work when goes through purchased-based intention. It shows that household energy consumption will go up when the energy prices decline, or income increase in the developing area. Compared to the high-income family group, the low-income family subgroup proves to be a more significant effect on increasing household energy consumption via purchase-based intention. Those results indicate that economic development is very important to fill the knowledge-behavior gap in developing regions. What is more, habitual intention can positively influence purchased-based intention. It implicates to nudge people to cultivate energy saving intention in line with low-carbon life standards, daily habits such as switching off their laptop and lights and turning down the faucet can enhance the purchased-based intention to some extent. Finally, this paper also finds that household demographic characteristics have no statistical significance in the empirical analysis as the control variables.

The nature of household energy consumption behavior is of much importance to policy-makers and entrepreneurs. This study provides a new analytical framework of household energy behavior by linking the cognitive theory to energy economics. It unfolds the detailed role of intention in the knowledge-behavior gap, of which the empirical evidence gives new information of low-carbon development for undeveloped regions. Certainly, it needs more tests and other scholars' verification. What is more, a disputed application of mix-sourced data should be truthfully discussed. In this paper, we adopt a random sampling strategy based on both offline and online investigations. It is a risk, admittedly, but not a big one in our case. The investigated questions listed in the questionnaire are mainly related to facts and behaviors, which are not strongly influenced by political concerns, public participation, or something about ideology. Therefore, as we claimed in the methodology part, it does have flaws and risks but has no significant influence on our analysis of this paper. However, we do not think this strategy is suitable for other cases or countries, especially where mobile Internet is not as popular as in China. When discussing some related topics such as poverty, social wealth, and political participation, the digital divide will significantly lead to sample errors between online and offline. In areas where the Internet has caused significant political polarization, researchers should also fully face up to the differences between offline and online questionnaires. Last but not least, it is also very interesting and worthy of an in-depth study on what changes will take place in the traditional micro investigation methods and theories under the background of the digital era. With the rapid development of the new generation of information and communication technology, the feasibility of obtaining first-hand data based on micro investigations is greatly improved, but the theories and rules under the same background seemingly have not been improved at the same pace.

5.2. Conclusions

As above, this paper firstly concludes that low-carbon publicity in developing regions cannot fully show positive effects on household energy conservation, because the purchase-based intention will break down the causal chain of knowledge-intention-behavior. This is not the same for habitual energy-saving intentions, which is always formed in the details of

our lives, a stable reflection of education, social tendencies, and personal experience, while the purchase-based energy-saving intention is flexible and easily impacted by economic conditions. Therefore, in developing regions, there is a long way to go to improve residents' awareness of energy conservation and develop energy-saving habits through low-carbon publicity. Secondly, economic development is vital to household energy-saving behaviors in urbanized regions. Although it seems that continuing to improve the level of economic development can solve the problem, we still suggest that policymakers take this proposal more seriously. Economic growth can indeed improve the transition effect of low-carbon knowledge on energy-saving behavior, but it may bring more consumption. Since there is a positive effect of habitual intention on the purchase-based intention for energy conservation, we strongly suggest that the government keep investing in low-carbon knowledge promotion and educate residents in their daily lives. Thirdly, due to the significant difference between the low-income and high-income groups, policy-makers should be aware of such gaps in energy-saving behaviors caused by economic disparities and encourage the poor to take energy-saving behaviors by well-directed measures. At the same time, the governments should launch special projects to address the intention-behavior gap in the poor group, since the results unfold that the poor also have a strong sense of energy saving but are limited by incomes. If necessary, we suggest giving energy subsidies in order to avoid further energy inequality under the background of energy-saving policies.

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References

1. China Statistical Yearbook. 2020. Available online: https://data.cnki.net/yearbook/Single/N2020100004 (accessed on 10 August 2021).
2. Belaïd, F.; Joumni, H. Behavioral attitudes towards energy saving: Empirical evidence from France. *Energy Policy* **2020**, *140*, 111406. [CrossRef]
3. Wang, J.; Shen, M.; Chu, M. Why is green consumption easier said than done? Exploring the green consumption attitude-intention gap in China with behavioral reasoning theory. *Clean. Responsible Consum.* **2021**, *2*, 100015. [CrossRef]
4. Fu, W.; Zhou, Y.; Li, L.; Yang, R. Understanding household electricity-saving behavior: Exploring the effects of perception and cognition factors. *Sustain. Prod. Consum.* **2021**, *28*, 116–128. [CrossRef]
5. Zaremohzzabieh, Z.; Ismail, N.; Ahrari, S.; Abu Samah, A. The effects of consumer attitude on green purchase intention: A meta-analytic path analysis. *J. Bus. Res.* **2021**, *132*, 732–743. [CrossRef]
6. Pothitou, M.; Hanna, R.F.; Chalvatzis, K.J. Environmental knowledge, pro-environmental behaviour and energy savings in households: An empirical study. *Appl. Energy* **2016**, *184*, 1217–1229. [CrossRef]
7. Zhang, C.-Y.; Yu, B.; Wang, J.-W.; Wei, Y.-M. Impact factors of household energy-saving behavior: An empirical study of Shandong Province in China. *J. Clean. Prod.* **2018**, *185*, 285–298. [CrossRef]
8. Joshi, Y.; Rahman, Z. Consumers' sustainable purchase behaviour: Modeling the impact of psychological factors. *Ecol. Econ.* **2019**, *159*, 235–243. [CrossRef]
9. Boesen, S.; Bey, N.; Niero, M. Environmental sustainability of liquid food packaging: Is there a gap between Danish consumers' perception and learnings from life cycle assessment? *J. Clean. Prod.* **2019**, *210*, 1193–1206. [CrossRef]

10. Golob, U.; Kronegger, L. Environmental consciousness of European consumers: A segmentation-based study. *J. Clean. Prod.* **2019**, *221*, 1–9. [CrossRef]
11. Xu, Q.; Hwang, B.-G.; Lu, Y. Influencing paths of the behavior-driven household energy-saving exploring the influencing paths of the behavior-driven household energy-saving intervention—Household energy-saving option. *Sustain. Cities Soc.* **2021**, *71*, 102951. [CrossRef]
12. Wang, Q.-C.; Chang, R.; Xu, Q.; Liu, X.; Jian, I.Y.; Ma, Y.-T.; Wang, Y.-X. The impact of personality traits on household energy conservation behavioral intentions—An empirical study based on theory of planned behavior in Xi'an. *Sustain. Energy Technol. Assess.* **2020**, *43*, 100949. [CrossRef]
13. Steg, L. Promoting household energy conservation. *Energy Policy* **2008**, *36*, 4449–4453. [CrossRef]
14. Urban, J.; Ščasný, M. Exploring domestic energy-saving: The role of environmental concern and background variables. *Energy Policy* **2012**, *47*, 69–80. [CrossRef]
15. Carlsson-Kanyama, A.; Linden, A.-L.; Eriksson, B. Residential energy behaviour: Does generation matter? *Int. J. Consum. Stud.* **2005**, *29*, 239–253. [CrossRef]
16. Whitmarsh, L.; O'Neill, S. Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *J. Environ. Psychol.* **2010**, *30*, 305–314. [CrossRef]
17. Du, K.; Shao, S.; Yan, Z. Urban residential energy demand and rebound effect in China: A stochastic energy demand frontier approach. *Energy J.* **2021**, *42*, 175. [CrossRef]
18. Georges, E.; Cornélusse, B.; Ernst, D.; Lemort, V.; Mathieu, S. Residential heat pump as flexible load for direct control service with parametrized duration and rebound effect. *Appl. Energy* **2017**, *187*, 140–153. [CrossRef]
19. Frederiks, E.R.; Stenner, K.; Hobman, E.V. Household energy use: Applying behavioural economics to understand consumer decision-making and behaviour. *Renew. Sustain. Energy Rev.* **2015**, *41*, 1385–1394. [CrossRef]
20. Barr, S.; Gilg, A.W.; Ford, N. The household energy gap: Examining the divide between habitual- and purchase-related conservation behaviours. *Energy Policy* **2005**, *33*, 1425–1444. [CrossRef]
21. Thøgersen, J. A cognitive dissonance interpretation of consistencies and inconsistencies in environmentally responsible behavior. *J. Environ. Psychol.* **2004**, *24*, 93–103. [CrossRef]
22. Thøgersen, J.; Ölander, F. To what degree are environmentally beneficial choices reflective of a general conservation stance? *Environ. Behav.* **2006**, *38*, 550–569. [CrossRef]
23. Estiri, H. A structural equation model of energy consumption in the United States: Untangling the complexity of per-capita residential energy use. *Energy Res. Soc. Sci.* **2015**, *6*, 109–120. [CrossRef]
24. Yue, T.; Long, R.; Chen, H. Factors influencing energy-saving behavior of urban households in Jiangsu Province. *Energy Policy* **2013**, *62*, 665–675. [CrossRef]
25. Brounen, D.; Kok, N.; Quigley, J.M. Energy literacy, awareness, and conservation behavior of residential households. *Energy Econ.* **2013**, *38*, 42–50. [CrossRef]
26. Spandagos, C.; Yarime, M.; Baark, E.; Ng, T.L. "Triple Target" policy framework to influence household energy behavior: Satisfy, strengthen, include. *Appl. Energy* **2020**, *269*, 115117. [CrossRef]
27. Wang, Z.; Zhang, B.; Li, G. Determinants of energy-saving behavioral intention among residents in Beijing: Extending the theory of planned behavior. *J. Renew. Sustain. Energy* **2014**, *6*, 053127. [CrossRef]
28. Webb, D.; Soutar, G.; Mazzarol, T.; Saldaris, P. Self-determination theory and consumer behavioural change: Evidence from a household energy-saving behaviour study. *J. Environ. Psychol.* **2013**, *35*, 59–66. [CrossRef]
29. Han, Q.; Nieuwenhijsen, I.; de Vries, B.; Blokhuis, E.; Schaefer, W. Intervention strategy to stimulate energy-saving behavior of local residents. *Energy Policy* **2013**, *52*, 706–715. [CrossRef]
30. Rustam, A.; Wang, Y.; Zameer, H. Environmental awareness, firm sustainability exposure and green consumption behaviors. *J. Clean. Prod.* **2020**, *268*, 122016. [CrossRef]
31. Na Kang, N.; Cho, S.H.; Kim, J.T. The energy-saving effects of apartment residents' awareness and behavior. *Energy Build.* **2012**, *46*, 112–122. [CrossRef]
32. Wang, Z.; Zhang, B.; Yin, J.; Zhang, Y. Determinants and policy implications for household electricity-saving behaviour: Evidence from Beijing, China. *Energy Policy* **2011**, *39*, 3550–3557. [CrossRef]
33. 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.* **2007**, *18*, 429–434. [CrossRef]
34. Kumar, B.; Manrai, A.K.; Manrai, L.A. Purchasing behaviour for environmentally sustainable products: A conceptual framework and empirical study. *J. Retail. Consum. Serv.* **2017**, *34*, 1–9. [CrossRef]
35. Said, A.M.; Yahaya, N.; Ahmadun, F. Environmental comprehension and participation of Malaysian secondary school students. *Environ. Educ. Res.* **2007**, *13*, 17–31. [CrossRef]
36. Akbar, W.; Hassan, S.; Khurshid, S.; Niaz, M.; Rizwan, M. Antecedents affecting customer's purchase intentions towards green products. *J. Sociol. Res.* **2014**, *5*, 273–289. [CrossRef]
37. Haryanto, B. The influence of ecological knowledge and product attributes in forming attitude and intention to buy green product. *Int. J. Mark. Stud.* **2014**, *6*, 83. [CrossRef]
38. Noor, N.A.M.; Muhammad, A.; Kassim, A.; Jamil, C.Z.M.; Mat, N.; Mat, N.; Salleh, H.S. Creating green consumers: How environmental knowledge and environmental attitude lead to green purchase behaviour? *Int. J. Arts Sci.* **2012**, *5*, 55–71.

39. Harland, P.; Staats, H.; Wilke, H.A.M. Situational and personality factors as direct or personal norm mediated predictors of pro-environmental behavior: Questions derived from norm-activation theory. *Basic Appl. Soc. Psychol.* **2007**, *29*, 323–334. [CrossRef]
40. Li, X.; Zhang, D.; Zhang, T.; Ji, Q.; Lucey, B. Awareness, energy consumption and pro-environmental choices of Chinese households. *J. Clean. Prod.* **2021**, *279*, 123734. [CrossRef]
41. Rausch, T.M.; Kopplin, C.S. Bridge the gap: Consumers' purchase intention and behavior regarding sustainable clothing. *J. Clean. Prod.* **2021**, *278*, 123882. [CrossRef]
42. Blok, V.; Wesselink, R.; Studynka, O.; Kemp, R. Encouraging sustainability in the workplace: A survey on the pro-environmental behaviour of university employees. *J. Clean. Prod.* **2015**, *106*, 55–67. [CrossRef]
43. Zeng, S.; Qin, Y.; Zeng, G. Impact of corporate environmental responsibility on investment efficiency: The moderating roles of the institutional environment and consumer environmental awareness. *Sustainability* **2019**, *11*, 4512. [CrossRef]
44. Li, Y.; Chen, K. Factors influencing consumers' green purchase intention—Exploratory research based on grounded theory. *Enterp. Econ.* **2017**, *36*, 72–78. [CrossRef]
45. Ajzen, I. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *J. Appl. Soc. Psychol.* **2002**, *32*, 665–683. [CrossRef]
46. Sardianou, E. Estimating energy conservation patterns of Greek households. *Energy Policy* **2007**, *35*, 3778–3791. [CrossRef]
47. Feng, W.; Reisner, A. Factors influencing private and public environmental protection behaviors: Results from a survey of residents in Shaanxi, China. *J. Environ. Manag.* **2011**, *92*, 429–436. [CrossRef]
48. Martinsson, J.; Lundqvist, L.J.; Sundström, A. Energy saving in Swedish households. The (relative) importance of environmental attitudes. *Energy Policy* **2011**, *39*, 5182–5191. [CrossRef]
49. China Energy Statistical Yearbook. 2020. Available online: https://data.cnki.net/yearbook/Single/N2021050066 (accessed on 10 August 2021).
50. Bamberg, S.; Schmidt, P. Incentives, morality, or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz, and Triandis. *Environ. Behav.* **2003**, *35*, 264–285. [CrossRef]
51. Yu, B.; Zhang, J.; Fujiwara, A. Evaluating the direct and indirect rebound effects in household energy consumption behavior: A case study of Beijing. *Energy Policy* **2013**, *57*, 441–453. [CrossRef]
52. Zhao, X.; Cheng, H.; Zhao, H.; Jiang, L.; Xue, B. Survey on the households' energy-saving behaviors and influencing factors in the rural loess hilly region of China. *J. Clean. Prod.* **2019**, *230*, 547–556. [CrossRef]
53. Zhang, J.; Teng, F.; Zhou, S. The structural changes and determinants of household energy choices and energy consumption in urban China: Addressing the role of building type. *Energy Policy* **2020**, *139*, 111314. [CrossRef]
54. Reisinger, Y.; Turner, L. Structural equation modeling with Lisrel: Application in tourism. *Tour. Manag.* **1999**, *20*, 71–88. [CrossRef]
55. Al-Ghandoor, A.; Jaber, J.; Al-Hinti, I.; Mansour, I. Residential past and future energy consumption: Potential savings and environmental impact. *Renew. Sustain. Energy Rev.* **2009**, *13*, 1262–1274. [CrossRef]
56. Danlami, A.H.; Applanaidu, S.-D.; Islam, R. Axiom of the relative income hypothesis and household energy choice and consumption in developing areas: Empirical evidence using Verme model. *Kasetsart J. Soc. Sci.* **2018**, *39*, 422–431. [CrossRef]