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Influencing Factors of Commercial Energy Consumption Intention of Rural Residents: Evidence from Rural Chengdu

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Abstract: With rapid rural urbanization and new rural construction, the commercial energy consumption of rural residents shows a trend of rapid growth, and China's rural areas are also faced with environmental challenges brought by the increase of commercial energy consumption. China's commercial energy consumption behavior of rural residents has also undergone tremendous changes. However, scholars have neglected the research on rural residents' commercial energy consumption intention from a micro perspective. Therefore, this study takes the 5 villages in Chengdu out of the 100 representative villages in the Sichuan province as examples. From the perspective of the head of a family of permanent rural residents, extended planned behavior theory, exploratory factor analysis, and structural equation modeling are used to explore the influencing factors of rural resident commercial energy consumption intention and their relationship. Findings show that subjective norm, perceived behavioral control (PBC), and habit significantly affect residents' behavioral intention. Habits significantly influence subjective norms and PBC. Therefore, in the new rural construction, rural residents are the main body and participants of energy consumption. Local government departments should plan reasonably according to the needs and characteristics of residents, constantly improve commercial energy infrastructure, improve service level, and further strengthen farmers' attitude and satisfaction toward commercial energy. Moreover, they should increase the publicity and education of commercial energy, advocate green housing, and promote energy saving consumption reduction, and sustainable development in new rural areas.

Keywords: commercial energy consumption; rural residents; theory of planned behavior; exploratory factor analysis; SEM; empirical research



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1. Introduction

Accumulated scientific evidence shows climate change has posed a huge threat to global human development [1]. Global climate change caused by energy consumption and related carbon dioxide emissions generated by human activities has attracted extensive international attention [2,3]. In 2017, the global energy demand increased by 2.2%, which is higher than the 1.2% growth rate in 2016 and the average growth rate in the past 10 years (1.7%); this increase is the fastest growth year since 2013 [4]. At the same time, the “BP World Energy Outlook 2018” predicts that with the decline of China's coal demand, the growth of global coal consumption will stagnate. The world's energy consumption will continue to be electrified and gasified. Nearly 70% of the world's primary energy increment comes from the electricity industry, and the status of electrical energy is becoming increasingly prominent. Government policies, new technologies, and social preferences

will change the way energy is produced and consumed in the future in unpredictable manners [5].

As a developing country with rapid economic development, China's energy consumption has increased rapidly every year. Figure 1 shows the total and domestic energy consumption in China in the past 16 years. In 2016, China's total energy consumption was 435.819 million tons of standard coal, of which 542.09 million tons of standard coal were consumed by household energy. In 2016, the national per capita household energy consumption was 2.9 times that of 2001. Among them, the per capita household energy consumption for coal increased from 66 kg to 69 kg, the per capita household energy consumption for electricity increased from 127 kWh to 611 kWh, and the per capita household energy consumption for natural gas also increased from 3.3 m³ to 27.5 m³ (Energy Statistics Department of the National Bureau of Statistics, 2002–2017). In household energy consumption, the dominant position of energy type is gradually shifting from coal to electricity, and the energy consumption structure is changing. Household energy consumption has exceeded that of the industrial sector and has become a critical source of carbon emissions [6]. With the continuous growth of household energy demand, people begin to realize that direct and indirect carbon emissions caused by household consumption may become new growth points of carbon emissions [7].

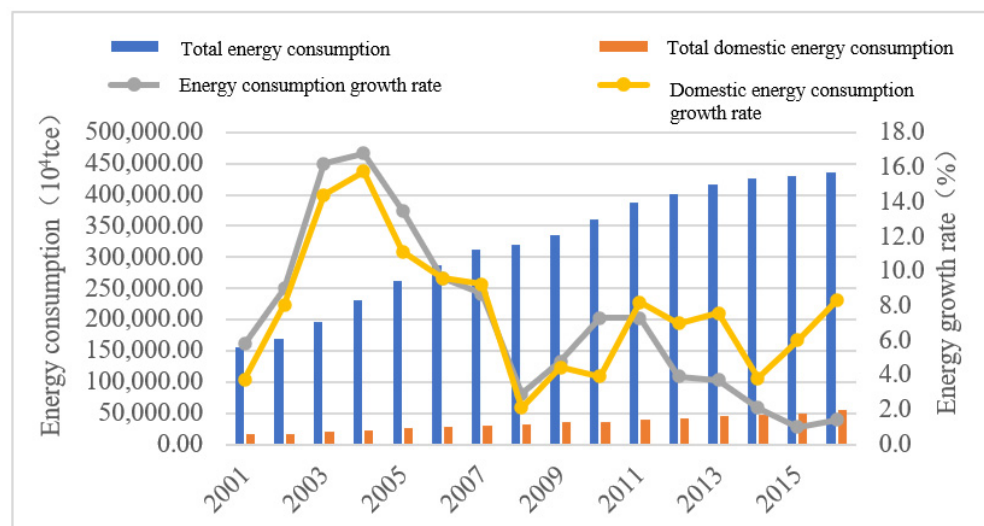


Figure 1. 2001–2015 total energy/domestic energy consumption and its growth rate in China. Source: China Energy Statistics Yearbook (2002–2017).

In the process of rapid urbanization and new rural construction, the energy consumption of rural residents in China also shows a rapid growth trend and the difference in energy consumption between urban and rural residents has gradually narrowed in the process of urbanization. In 2001, China's rural per capita living energy was only 44.3% of that of cities and towns. As of 2016, the per capita living energy of rural residents was nearly the same as that of cities and towns [8]. In 2016, the per capita living energy consumption in rural areas increased by 3.2 times compared with 2001. The annual average growth rate of per capita living energy in rural areas is considerably higher than that in urban areas. Figure 2 shows the per capita living energy consumption information of urban/rural residents in China from 2001 to 2016. The structure of rural energy consumption is transitioning from traditional non-commercial energy consumption forms (e.g., biomass energy and coal) to commercial energy consumption forms (electricity and natural gas) [9]. China's rural areas are also facing the challenges of energy structure transformation, energy efficiency, and environmental pollution caused by energy consumption. Rural residents' energy consumption is directly related to the quality of life [10]. Sustainable development of rural energy is of great significance to rural residents [11]. With the economic growth, China's rural energy demand shows a rapid growth momentum, and the rural energy pattern has

undergone profound changes. Energy poverty and environmental problems (such as air pollution) as results of energy consumption have become the limiting factors restraining the rural sustainable development [12]. Energy conservation and emission reduction of rural residents has now attracted more and more attention. “National energy conservation” and “green lifestyle” have become the important tasks of China’s “13th Five-Year Plan”.

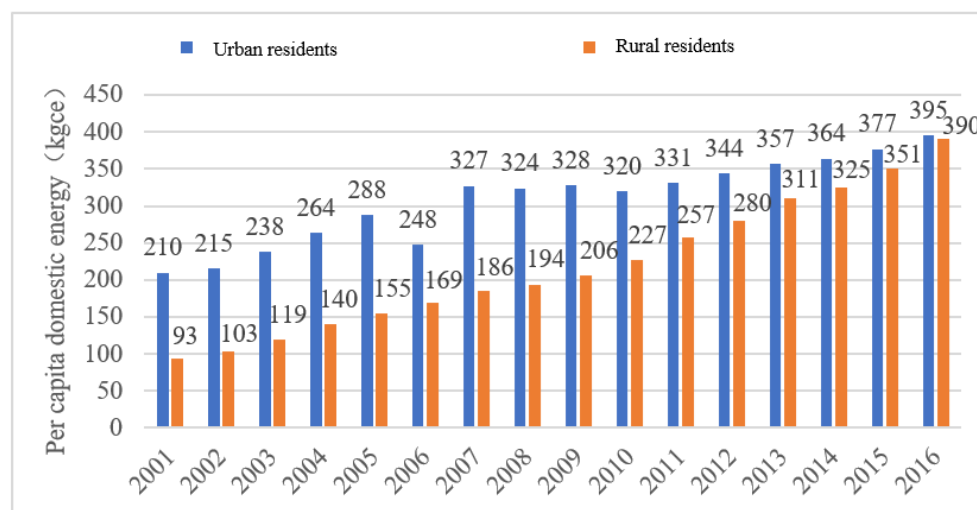


Figure 2. Urban/rural per capita energy for living. Scheme 2002.

Therefore, to address the substantial environmental challenge brought by the rapid growth of commodity energy consumption, this study attempts to expand the theory of planned behavior (TPB) from the perspective of rural residents and explore the influencing factors and their influencing relationships of rural residential commercial energy consumption intention, which has important theoretical and practical guiding significance for the construction of a new low-carbon village.

2. Literature Review

2.1. Rural Energy Consumption Research

Generally, rural energy consumption includes production and living energies; specifically, rural household energy is rural living energy, which refers to the energy consumed by rural households in cooking, lighting, and household cooling and heating appliances [12]. The energy used by rural households is divided into commercial energy and non-commercial biomass energy [13].

Current situation and structure of rural energy consumption: China’s rural energy consumption was divided into serious energy shortage stage, basically satisfied stage, and commercialization stage according to its course and future development [14]. Wang et al. (2000) and Miao (2017) analyzed the characteristics and current situation of China’s rural household energy consumption from different backgrounds and found that China’s rural energy consumption mode gradually transitioned from traditional non-commercial energy consumption mode to commercial energy consumption mode [9,15]. Fan et al. (2005) reported that biomass energy still accounts for a large proportion of rural household energy consumption in Chongqing by a field survey [16]. With the development of rural economy, commercial energy consumption also increases, and natural gas is the first choice for rural energy consumption in the future. With the continuous development of social economy and the opening of energy market, China’s rural energy consumption structure has gradually shifted from biomass energy to commercial energy [17]. Xu et al. (2018) analyzed the consumption structure of rural domestic energy in Beijing, Tianjin, and Hebei according to macro statistical data [18]. The dominant energy in the region is commercial energy, which is on the rise as a whole. At the same time, problems, such as high proportion of coal consumption, low energy utilization efficiency, and insufficient development of new

energy, still exist. Through the analysis of rural energy policy, Wang, et al. (2017) found that the impact of the policy can optimize the demand for local commercial energy. The demand for commercial energy by rural residents is on the rise, and the position of commercial energy in the energy consumption structure of rural households is becoming increasingly prominent [19]. Therefore, studying rural household commercial energy is important.

Influencing factors of rural energy consumption: Zhang (2009) took the Tai hu Lake region of Jiangsu Province as the research area [20], focusing on the impact of the increase of non-agricultural employment on rural energy consumption. Through a questionnaire survey, the authors found that non-agricultural income and non-agricultural employed population significantly affect household energy. Liang et al. (2012) found that topographic characteristics are one of the main factors affecting the rural energy consumption structure in southwest mountainous areas through regression analysis of energy consumption influencing factors [21]. Tang et al. (2012) and Yue (2014) analyzed the important influences of individual psychological characteristics and situational factors (e.g., social norms, consumption costs, and policies and regulations) on energy consumption behavior through empirical research [22,23]. Han (2016) conducted a field survey in nine villages in Linzhang County, Handan City based on TPB and the theory of value-belief-norm and found obvious differences in the choice behavior of clean energy among farmers with different family income levels and family cultural levels [24]. Dong et al. (2018) compared the energy structure and consumption level of different rural lives in Shanxi [25]. They found that the education level of farmers, the number of people working in their homes, and the awareness of low carbon affect farmers' choice of commercial energy and the use of clean energy. Nesbakken (1999) showed that the higher the household income level is, the higher the energy consumption will be, and that a positive relationship exists between the two [26]. On the basis of TPB and a normalization model, Abrahamse et al. (2009) explored the influencing factors of Dutch household energy consumption and energy conservation. The results showed that the psychological factors included in the TPB significantly affect residents' energy conservation behavior [27]. Han et al. (2013) studied the energy-saving behavior of Dutch residents and found that the difference of household personal characteristics makes the residents' energy-saving behavior significantly different [28].

Increasing attention has been paid to research on energy consumption behavior at home and abroad [29–31]. The development trend of China's rural household commercial energy is becoming increasingly important in the entire energy development. Then, which factors will affect the rural household commercial energy consumption is particularly important. The main body of household energy consumption is the rural residents. Therefore, studying the influencing factors and their influencing relationships of rural households' commercial energy consumption intention from the perspective of rural residents is of great importance.

2.2. Extended TPB Research

The theory of reasoned action (TRA) and TPB have been widely used by scholars to explain and predict behavior. Based on Fishbein and Ajzens' TRA [32], Ajzen proposed TPB to extend TRA [33–35]. Since then, TPB has been widely used in various fields. Ajzen [34,35] believed that attitude, subjective norms, and perception of behavior control will indirectly affect behavior implementation through behavioral intention.

2.2.1. Attitude

Attitude is a predictor of behavioral intention and individuals' overall evaluation of behavior [36]. Consumer attitudes and energy-saving behavior had a significant correlation [37]. Attitude factors depend on people's preference for energy-saving behaviors [38]. The attitude of rural residents toward comfort preference will directly affect residents' intention to save energy, thereby affecting energy consumption behavior.

2.2.2. Subjective Norms

Subjective norms refer to people's belief in whether others think they should do such behavior. Others refer to those who have important preferences for people's behavior in this field. Subjective norms are used to evaluate the social pressure on individuals whether to perform a specific behavior [36]. The degree of influence of relevant social groups on residents will significantly affect whether rural residents choose to use clean energy. Subjective norms are significant predictors of behavioral intentions [39], that is, if most people who are important to them encourage them to perform a certain behavior, then they are more likely to be willing to perform the behavior.

2.2.3. PBC

Perceived behavioral control (PBC) is defined as the degree of control individuals have over their actions [33–35]. Beliefs relate to whether people can successfully obtain the necessary resources and opportunities to perform the completion behavior. Weighted by the perception ability of each factor to promote or inhibit behaviors, the perception of factors that may promote or inhibit behavior performance is called control belief, which includes internal (e.g., information, skills, and emotions) and external (e.g., opportunities, dependence on others, and obstacles) control factors [34]. PBC has been applied in many studies as the determinant of individual intention and behavior. Numerous studies have found that PBC has a significant positive impact on individual behavioral intention [40].

2.2.4. Habits

Individuals' past behaviors or experience habits may also affect their intention to perform behaviors [34]. Towler and Shepherd (1991) added perceptual behavior control and habit measurement indicators to the TRA model and found that habit has independent influence on behavioral intention [41]. Godin et al. (1993) also found that habit is the most important predictor of executive behavior [42].

3. Research Hypotheses

In order to study the influencing factors of rural households' intention to consume commercial energy and their influencing relationships, this study adopts the TPB. Based on the TPB, five psychological factors, namely, attitude, subjective norms, perceived behavioral control (PBC), behavioral intention, and habit, were selected in this study. Attitude, subjective norms, PBC, and habits affect intention. This study considered that attitude, subjective norm, PBC, and habits as antecedents that affect behavior. Habit affects attitude, subjective norm, and PBC. The relationship hypothesis is shown in Figure 3.

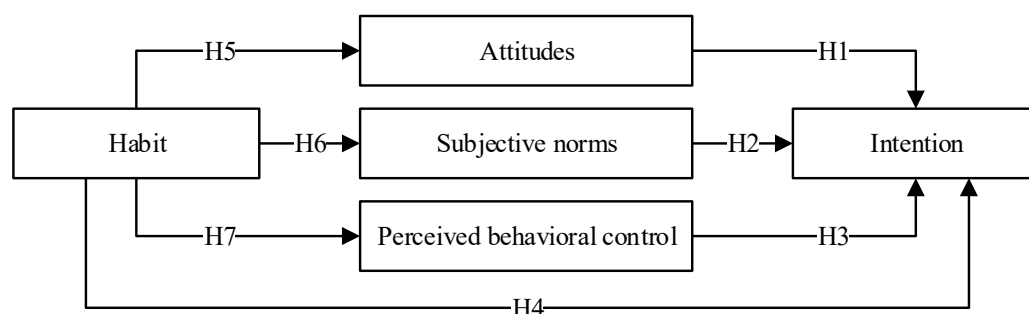


Figure 3. Theory of planned behavior (TPB) extension theory model.

Hypothesis 1. (H1): Attitude has a significant effect on behavioral intention.

Hypothesis 2. (H2): Subjective norms have a significant effect on behavioral intentions.

Hypothesis 3. (H3): PBC has a significant effect on behavioral intention.

Hypothesis 4. (H4): *Habit has a significant effect on behavioral intention.*

Hypothesis 5. (H5): *Habit has a significant effect on attitudes.*

Hypothesis 6. (H6): *Habit has a significant influence on subjective norms.*

Hypothesis 7. (H7): *Habit has a significant effect on PBC.*

4. Research Methodology

4.1. Structural Equation Modeling (SEM)

This study adopts the SEM method for analysis to verify the theoretical model and research hypothesis of the extended TPB proposed above. The principle of SEM involves using some observable variables (measurement variables) to measure an unobservable variable (potential variable). It can use various indicators to measure the fitting degree of the model [43]. A complete structural equation model includes two basic models, namely, measurement and structural models. The measurement model consists of potential and measurement variables that describe the relationship between the two. From the perspective of mathematical definition, the measurement model is a linear function of a group of measurement variables. The formula of the measurement model is as follows [44]:

$$x = \Lambda x \xi + \delta, \quad (1)$$

$$y = \Lambda y \eta + \varepsilon, \quad (2)$$

where x is a vector composed of exogenous indexes, y is a vector composed of endogenous indexes, ξ is an exogenous potential variable, η is an endogenous potential variable, Λx is the relationship between exogenous indexes and exogenous potential variables and is the factor coincidence matrix of exogenous indexes on exogenous potential variables, Λy is the relationship between endogenous index and endogenous potential variable and is the factor load matrix of endogenous index on endogenous potential variable, δ is the error term of exogenous index x , and ε is the error term of endogenous index y .

Structural model is also called causal model, potential variable model, and linear structural relationship. The structural model describes the relationship between potential variables, that is, the causal relationship model between potential variables. It can be expressed as follows:

$$\eta = B\eta + \Gamma\xi + \zeta \quad (3)$$

where B is the relationship between endogenous potential variables; Γ is the influence of exogenous potential variables on endogenous potential variables, and ξ is the residual term of the structural equation, which reflects the part of the endogenous potential variables η that cannot be explained in the equation.

Based on the previous theoretical models and assumptions, this study uses AMOS21.0 software platform to establish a structural equation model and selects maximum likelihood (ML) estimation to estimate the theoretical model of extended (TPB). The functional relation of the ML method is as follows:

$$F_{ML} = \log|\Sigma| - \log|S| + tr\left(s \sum^{-1}\right) - \rho, \quad (4)$$

where ρ is the number of measured variables ($p + q$), Σ is the estimate population covariance matrix, and S is the covariance matrix of the sample observation data.

4.2. Sample Selection and Data Collection

This study is mainly focused on rural Chengdu in the Sichuan province in performing an empirical research. The interviewees were permanent heads of new rural families.

Based on TPB and the existing relevant research literature [45], the questionnaire design mainly includes six parts. The first part is the sociodemographic information of the interviewees and their families. The second part is the residents' attitude toward energy-saving behavior. The third and fourth parts are the residents' subjective norms and PBC on life energy-saving behavior, respectively. The fifth part is the residents' habits of life energy-saving behavior. Finally, the sixth part is the intention of rural residents to energy-saving behavior. Many studies based on TPB are measured by a five-point Likert scale. Attitude, subjective norm, and PBC are assessed by the degree of consent of the interviewees to the statement questions (1 point indicates strongly disagree, and 5 points indicate strongly agree). Behavioral intention is judged by the degree of intention of the interviewees to state the problem of energy-saving behavior (1 point indicates very unwilling, and 5 points indicate very willing). Habits are judged by the interviewees' degree of achievement in the past energy-saving behavior statement (1 point means never done, and 5 points mean done regularly).

Due to the huge rural area and the large number of villages in China, and limited by research resource, it is impossible to conduct random sampling research on all villages. Therefore, the top 100 representative villages in Sichuan Province ranked by economic level were selected as the overall sample range in this study. This study took the new countryside of Chengdu as the research object. To explore the wishes of rural residents to save energy, the research group randomly selected 10 contact sample villages according to the sampling ratio of 10%: Qun'an Village, Qing gang shu Village, Jin ning Village, Liang he Village, Tian du Village, Wu xing Village, Xinghua Village, Gao yuan Village, Hua guo Village, and Li ming Village. The research group established contact communication with 10 contact sample villages, and investigated the attitude of the village cadres of the contact sample villages toward the research group's questionnaire survey on entering villages and households and the villagers' willingness to participate in a face-to-face questionnaire survey. In the end, the villagers had a strong desire to participate, and the village cadres also welcomed the five demonstration villages as research samples, namely, Jin ning Village, Tian du Village, Wu xing Community, Hua guo Village, and Li ming Village. Figure 4 shows the distribution of the final 5 sample villages in Chengdu.

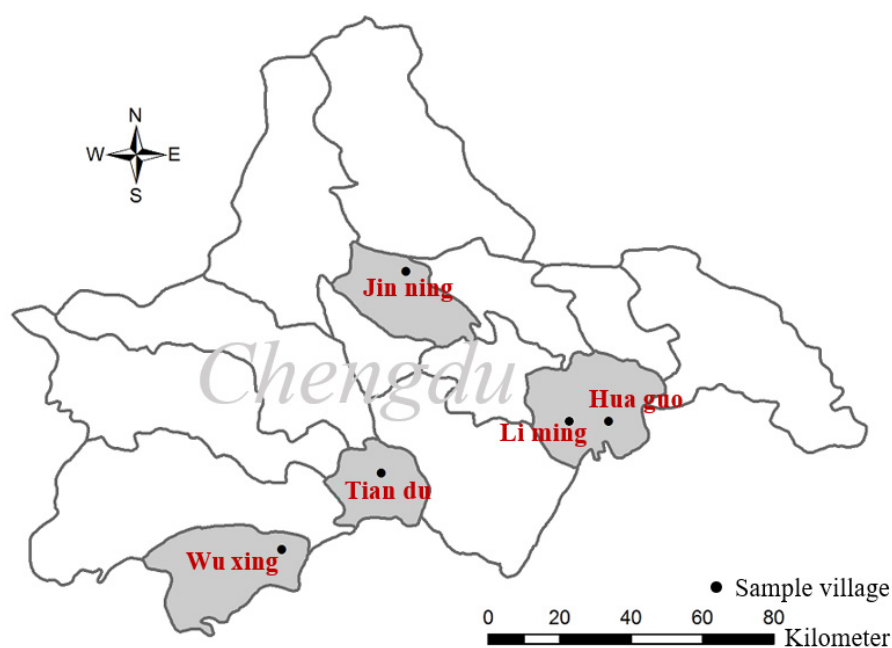


Figure 4. Location of the sample villages.

To obtain effective research data, the research group conducted continuous data collection from November 2017 to August 2018. The data collection went through four complete

and rigorous stages. From November to December 2017, the first draft of questionnaire design was formed according to the research literature. In January 2018, a questionnaire test was conducted, and face-to-face questionnaires and interviews were conducted at random in villages and households. From February to June 2018, according to the questionnaire test data, the validity and consistency of the questionnaire were tested, the questionnaire was revised, and the selection and contact of sample villages would be performed simultaneously. From July to August 2018, a formal questionnaire survey was organized, and a face-to-face questionnaire survey was conducted in villages and households. Through face-to-face, on-the-spot questionnaire survey of the 5 sample villages, 200 questionnaires were distributed and 181 questionnaires were completed. After a preliminary statistical analysis of the validity of the questionnaire, two invalid questionnaires were discussed. The final number of valid sampling questionnaires was 179, and the proportion of valid samples was 89.50%. Table 1 shows the basic situation of the sample village and the distribution of the sample.

Table 1. Questionnaire survey sampling.

Village	Total Population (Person)	Total Households (Households)	Valid Samples	Sampling Proportion (%)
Jin ning	2004	621	39	6.28
Tian du	4038	1376	52	3.78
Wu xing	1982	554	32	5.78
Hua guo	2548	781	36	4.61
Li ming	3770	1155	20	1.73

According to preliminary statistics, in terms of individual demographic characteristics, the number of women in this study far exceeds the number of men, with women accounting for 66.5% of the total. The age distribution is mainly among the middle-aged and elderly groups, with 36–45 years old accounting for 19.0%, 46–55 years old accounting for 27.9%, and 56–65 years old accounting for 24.0%. Thus, the elderly and women are the majority of the rural population, which is also a feature of rural China. Most of the younger people or men work in cities. As shown in Table 2, Li ming Village has the highest average family population and resident population, with 4.8 and 4.4, respectively, whereas Hua guo Village has the lowest average family population and resident population, with 4.0 and 3.1, respectively. The difference between the total family population and the resident population can reflect the situation of the migrant population. Particularly, the difference between the total family population and the resident population in the five-star community is the largest, the migrant population is the largest, and Li ming Village is the least. The income situation can reflect the family living standard. Tian du Village has the highest annual income of 52,000 yuan, followed by Wu xing Community with 51,000 yuan. The sample village with the highest personal annual income (18,000 yuan) is the five-star community. The living standards of Wu xing Community and Tian du Village are higher than those of the other three sample villages. Table 2 presents the detailed demographic information on the interviewees and their families.

Table 2. Demographic information of sample villages.

Index	Jin Ning	Tian Du	Wu Xing	Hua Guo	Li Ming
Average total household population (person)	4.2	4.7	4.6	4.0	4.8
Average household resident population (person)	3.6	4.2	3.6	3.1	4.4
Average household working population (person)	2.1	2.3	2.4	2.1	2.0
Per capita income (¥10,000)	1.1	1.1	1.3	1.2	1.0
Total household income (¥10,000)	4.2	5.2	5.1	4.5	4.1

5. Results

5.1. Reliability and Validity Analysis

To ensure the reliability of the questionnaire, Cronbach's alpha coefficient was used to measure the reliability of the questionnaire, as shown in Table 3. The research generally considers that the reliability of the questionnaire can be accepted when the coefficient is greater than 0.6. The analysis results show that the coefficients of the five factors are 0.662, 0.730, 0.849, 0.796, and 0.759, which are all greater than 0.6; thus, the sample data can be considered reliable.

Table 3. Results of reliability and validity analysis.

Factors	Index	Factor Load	α	Sources
ATT	ATT1: I pay more attention to the comfort of life than energy saving.	0.690	0.662	(Ajzen, 1991) [35] (Yue ting, 2014) [23] (Wang et al., 2017) [46]
	ATT2: I don't pay much attention to energy. I can use it whenever I want.	0.855		
	ATT3: Turn on the air conditioner when you feel a little hot in summer.	0.766		
SN	SN1: Always consider the type of role you play in society.	0.763	0.730	(Ajzen, 1991) [35] (Yue T., 2014) [23]
	SN2: Family members, relatives, friends, or neighbors influence energy behavior.	0.795		
	SN3: I often refer to the behavior of groups similar to myself.	0.858		
PBC	PBC1: When I encounter difficulties in implementing energy-saving actions, I can always finally solve them.	0.863	0.849	(Ajzen, 1991) [35] (Yue T., 2014) [23]
	PBC2: When implementing energy conservation, even if I feel there are obstacles, I will not give up.	0.878		
	PBC3: When implementing energy conservation, if I feel very troublesome, I will try my best to overcome it.	0.887		
HA	HA1: When purchasing lamps, you will choose energy-saving lamps.	0.862	0.796	(Ajzen, 1991) [35] (Chen, L.S., 2009) [46]
	HA2: When purchasing household appliances such as air conditioners, refrigerators and washing machines, energy-saving models will be preferred.	0.843		
	HA3: When purchasing household kitchen and toilet facilities, you will choose energy-saving products.	0.873		
	HA4: Turn off the lights whenever you leave the room.	0.740		
	HA6: When accessing items from the refrigerator, the refrigerator door will be opened less.	0.613		
BI	BI1: Changing daily living habits to reduce energy saving and consumption.	0.867	0.759	(Ajzen, 1991) [35] (Yue T., 2014) [23] (Mi, L.Y., 2016) [45]
	BI2: Purchase high efficiency and energy saving household appliances.	0.767		
	BI3: Become a low carbon and energy saving advocate in the community.	0.834		

This study used factor analysis to measure the validity of the questionnaire. First, whether the original index is suitable for factor analysis was determined, and Bartlett sphericity test and KMO (Kaiser-Meyer-Olkin) test were adopted. The KMO value of the

sample data was analyzed by SPSS23.0 is 0.819, which was greater than the limit value of 0.7 and suitable for factor analysis. The p value of Bartlett sphericity test was 0, which is less than the limit value of 0.05. The original hypothesis of unit correlation matrix is rejected, indicating that factor analysis is suitable. Then, SPSS23.0 was used to analyze the psychological factors, and the factor load of each index was obtained. The index with a factor load of less than 0.5 was excluded until all factor loads were above 0.5. Finally, HA5 (0.450) and HA7 (0.484) were excluded. The final indicators are shown in Table 3. Habit factors excluded two indicators, and the rest are the same as the initial construction dimensions. Therefore, the questionnaire data can enter the next analysis through reliability and validity tests.

5.2. Structural Equation Model Fitting Results

Table 4 shows the fitting results of the initial model. From the table, RMSEA (Root Mean Square Error of Approximation) and NFI (Normed Fit Index) have not reached the ideal standard values, which indicates that the hypothesis theoretical model previously proposed in this study is not highly consistent with the actual survey data. The path hypothesis should be removed, and the fitting degree of the model should be readjusted. Table 5 shows the estimation results of SEM and path assumption. Through hypothesis testing, except for H4c and H4e being invalid, the influences of other residual variables are significant. Hence, H4a, H4b, H4d, H4f, and H4g are all valid. As shown in Table 5, habit has no significant influence on attitude and attitude on behavioral intention in the SEM assumption. The attitude factor should thus be removed in the expanded TPB model before fitting.

Table 4. Fitting results of structural equation model.

Model Fitting Index	Standard Values	Model Fitting Values	Result Judgment
CMIN/DF	<2.0	1.823	satisfy
P	<0.05	0.000	satisfy
RMSEA	<0.05	0.079	dissatisfy
NFI	>0.9	0.857	dissatisfy
CFI	>0.9	0.928	satisfy
IFI	>0.9	0.930	satisfy
PGFI	>0.5	0.635	satisfy
PNFI	>0.5	0.693	satisfy
PCFI	>0.5	0.751	satisfy

Table 5. Hypothesis test results of structural equation model.

Research Hypothesis	β	P	Sig.	Inspection Results
H4a: HA→PBC	0.790	0.002	**	accept
H4b: HA→SN	0.820	0.007	**	accept
H4c: HA→ATT	−0.300	0.175	—	reject
H4d: HA→BI	0.410	0.009	*	accept
H4e: ATT→BI	−0.030	0.536	—	reject
H4f: SN→BI	0.240	0.001	*	accept
H4g: PBC→BI	0.480	0.000	***	accept

— $P > 0.100$, * $P < 0.050$, ** $P < 0.010$, *** $P < 0.001$.

After removing the “H4c: HA→ATT” and “H4e: ATT→BI” path, the final structural equation model and path relationship are shown in Figure 5. The final Chi-square of the model is 117.840, and the degrees of freedom is 70. Table 6 shows the fitting results of the model. From the table, the indexes of the model have reached the standard values, which shows that the hypothetical model of this study is in good agreement with the actual survey data.

5.4. Analysis of the Influence of PBC on Behavioral Intention

PBC is the main factor affecting rural residents' energy-saving intention. PBC also has a direct positive influence on behavioral intention, with the largest impact coefficient (0.533) and a p value of 0.000, indicating that the impact degree is particularly significant. Therefore, the study assumes that H4b is fully accepted. In other words, the stronger the belief of rural residents in overcoming the difficulties of energy-saving behavior is, the more willing they will be to save energy, which is consistent with the research conclusion of Yue (2014) on the influencing factors of energy-saving behavior of urban residents. In the questionnaire, the three indicators for measuring this factor are PBC1 (When I encounter difficulties in implementing energy-saving behaviors, I can always finally solve them), of which 59.7% of the residents chose 4 or 5 (more or very much agree); PBC2 (When implementing energy conservation, even if I feel there are obstacles, I will not give up), of which 59.7% of the residents chose 4 or 5 (more or very much); and PBC3 (When implementing energy conservation, if I feel troubled, I will try my best to overcome it), of which 64.3% of the residents chose 4 or 5 (more or very much agree). Chinese rural residents have strong beliefs to overcome the difficulties of energy conservation, and the intensity of beliefs is affected by many factors, such as income.

5.5. Analysis of the Influence of Habit on Behavioral Intention

The influence coefficient of habit (HA) ($= 0.204$) is also large and positive, and the p value (0.008) is far less than 0.010. Therefore, past energy habits have a significant positive impact on the behavioral intention of rural residents. Thus, H4d should be tested further. In the questionnaire, habits are mainly divided into purchasing and usage habits. Purchasing habits are mainly measured by three indicators: HA1 (Energy-saving lamps will be selected when purchasing lamps), of which 82.7% of the residents chose 4 or 5 (mostly or every time); HA2 (Energy-saving models will be preferred when purchasing household appliances, such as air conditioners, refrigerators, and washing machines), of which 81.0% of the residents chose 4 or 5 (mostly or every time); and HA3 (When purchasing household kitchen and toilet facilities, they will purchase energy-saving products), of which 80.5% of the residents chose 4 or 5 (mostly or every time). This result indicates that the residents who buy energy-saving appliances frequently are more willing to save energy. Usage habits are measured by two indicators (the original item has four indicators, but after the validity test, HA5 and HA7 were deleted): HA4 (Turn off the lights at any time when leaving the room), of which 93.3% of the residents chose 4 or 5 (mostly or every time); and HA6 (When accessing items from refrigerators, the refrigerator door will be opened less), of which 84.4% of the residents chose 4 or 5 (mostly or every time). Thus, most of the residents in Chengdu rural areas save energy continuously, thereby having a positive impact on residents' intention to save energy. This result is consistent with that of Wang et al. (2017) [46]. Past habits (purchasing experience) thus have a positive and significant influence on behavioral intention.

In the questionnaire, behavioral intention is mainly measured by three indicators: BI1 (Changing daily living habits to achieve energy conservation and consumption reduction), of which 83.3% of the residents chose 4 or 5 (more willing or very willing); BI2 (Purchase high-efficiency and energy-saving household appliances), of which 86.0% of the residents chose 4 or 5 (more willing or very willing); and BI3 (Become a low-carbon, energy-saving propagandist in the community), of which 86.0% of the residents chose 4 or 5 (more willing or very willing). Thus, most of the rural residents in Chengdu are willing to save energy and are willing to publicize energy conservation to the surrounding groups.

5.6. Analysis on the Influence of Habit, Subjective Norm, and PBC Variables

According to Table 7, H4a, H4b, H4c, H4d, and H4e are all valid. The influence coefficient of habit on subjective norm (SN) and PBC is large and positive, and the p value is 0. Hence, habit and PBC, and habit and subjective norm have a positive and significant influence.

The influence coefficient of habit on PBC (0.338) is large, and the p value (0.002) is less than 0.05. The residents' energy use habits will positively affect their belief in overcoming energy use difficulties. In other words, the more residents who have taken energy-saving measures in the past, the stronger their belief in overcoming energy-saving difficulties will be. The influence coefficient (0.273) of subjective norm (SN) and habit (HA) is small, but the p value (0.008) is less than 0.05, indicating that the positive influence between subjective norm and habit is significant. In other words, the residents who used to have the habit of energy-saving measures feel greater social pressure of their surrounding groups.

To sum up, five hypotheses were accepted, and two hypotheses were rejected. Rural residents' energy consumption influenced by subjective norms, perceived behavioral control, and habits. The attitude does not affect other factors. Habits is the most important influence factors of the energy consumption. Habits not only directly affect the energy consumption behavior, but also affect the SN and PBC.

6. Conclusions

The innovation of this study is to apply TPB to analyze rural resident commercial energy consumption from individual residents' perspective. This study also initially establishes a model of influencing factors of rural residents' intention to consume commercial energy through literature research and proposes relevant research assumptions. Taking the countryside in Chengdu as an example and through the principle of random sampling, a questionnaire survey was conducted in five sample villages. Based on social survey data and SEM, this study discusses the influences of subjective norms, PBC, habits, and behavioral intention factors on rural residents' intention to consume commercial energy based on TPB. Then, this study proposes corresponding policy suggestions for new rural construction according to the research conclusion.

According to TPB, individual psychological factors include subjective norms, PBC, habits, and behavioral intentions. Through SEM analysis, subjective norm, PBC, and habit variables have significant influence paths on behavioral intention variables. Most of the rural residents in this survey feel the social pressure brought by their surrounding groups, thereby affecting their own behavioral intentions. That is, if everyone around them saves energy, then the residents will be willing to join the energy-saving team. The stronger the belief of rural residents in overcoming the difficulty of energy-saving behavior is, the more willing they will be to save energy. Most of the rural residents who participated in the survey kept the habit of saving energy. The research results showed that the residents who had the habit of saving energy were more willing to join the energy-saving team. This conclusion is significantly different from the survey results of urban residents. Personal characteristics have the most important influence in urban residents' intention of consumption [47]. Therefore, in new rural construction, rural residents are the main body and participants of energy consumption. Local government departments should make reasonable plans for the local area according to the needs and characteristics of the residents, continuously improve the commercial energy infrastructure, improve the service level, and further strengthen farmers' attitude and satisfaction toward commercial energy. At the same time, they should increase publicity and education on commercial energy, advocate green housing, and promote energy conservation, consumption reduction, and sustainable development in the new countryside.

This study also has the following shortcomings. First, the scope of the questionnaire survey is limited and the sample size is small. Given the limited survey conditions, the final valid questionnaire for this study is 179, however, it also meets the minimum sample size requirements for statistical analysis. The scope of the survey is also limited to Chengdu, with certain limitations in regional distribution and fewer sample villages. Second, the accuracy of energy consumption data is limited. Energy consumption is calculated based on the energy consumption cost provided by the residents, which may deviate from the actual situation. Hence, the accuracy is limited. Third, the screening of influencing factors and questionnaire design has certain limitations. This study screens the influencing factors

of rural households' commercial energy consumption and designs questionnaires based on the comprehensive literature on relevant theoretical basis and model. However, research has certain limitations and may ignore some important factors. In the next step of the study, it can be considered to expand the sample area and increase the influencing factors in the questionnaire to obtain more accurate results.

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