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Review

Factors affecting low-carbon consumption behavior of urban residents: A comprehensive review

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ABSTRACT

In recent years, with the increasing concern about environmental problems, the influencing factors of low-carbon consumption behavior of urban residents have become a research hotspot. Therefore, it is very important to review the existing research results in this field to grasp its research status. In this paper, drawing on a large number of relevant literature, twenty-four popularly studied predictors of urban residential low-carbon consumption behavior are summed up based on the review of classical theories and the research methods in this field. These factors are classified into self-factors (including psychological factors and demographic factors), family factors and situational factors for further carding and analysis. Then on the basis of classical theories, the general interrelationship and latest findings of these influencing factors are concluded, the application suggestions for practitioners are proposed, and the future research directions are suggested in three aspects: the specific issues to be further explored, the further extensions of classical models, and studies on controversial influential factors. Finally, the full text is discussed.

1. Introduction

With the global increasing attention to environmental issues, the impact of residential energy consumption, which is the terminal link of national energy consumption, on environment has aroused widespread concern of researchers. In fact, the energy consumption of residents now has become the important source of global energy demand growth and carbon emissions growth (IEA, 2016; IEA, 2017; Nejat et al., 2015). Therefore, the research on low-carbon consumption behavior of residents has become a hotspot in recent years. At present, studies on residential low-carbon consumption behavior are mainly around two terms: the affecting factors of low-carbon consumption behavior of inhabitants and the solutions on how policies effectively guide residents to consume in a low-carbon way, and this article take the former as an angle of view. The low-carbon consumption behavior of residents refers to those inhabitant consumption behaviors contributing to reducing carbon emissions, including the purchasing choice of energy-saving products or facilities, the application of green energy, the energy savings in daily life and other consumption behaviors helpful for less emission. That is to say, the low-carbon consumption behavior of residents covers energy-saving behaviors and other consumption behaviors beneficial to decrease carbon emissions. In addition, the intersection among the low-carbon consumption behavior, green consumption behavior and pro-environmental behavior make the research on the latter two kinds of behavior also worth studying.

In the study of residents low-carbon consumption behavior, the research object is usually divided into urban residents and rural residents (Ding et al., 2017), which is mainly due to the different living conditions, economic situation, policy environment, culture settings and social control of urban and rural areas. However, most western research on residents' low-carbon behaviors focuses on towns and cities. Besides, in China, the energy consumption of urban residents, with a sustained and rapid growth, accounts for a significant higher proportion of the national inhabitant energy consumption than that of the rural (Zhou et al., 2009). Therefore, the research object of this article is focused on the urban residents, just called "residents".

Although most of the research on the factors influencing the low-carbon consumption behavior of urban residents is based on classical behavior theory frameworks (such as Theory of Planned Behavior, Value-Belief-Norm Theory and ABC Theory, which have been studied and proved in large amount of research as detailed in the following section), research findings seem so varied according to different periods, situation and samples that the previous conclusions are difficult to be widely referenced and applied, and therefore it is significant to systematically review the existing research results in this field to grasp its research status and therefore find its research gaps. In this case, the contributions of this article can be concluded as follow: (1) classical theories in this field were combined and reviewed; (2) those most

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popularly studied influences on the low-carbon consumption behaviors of habitants were selected and the interrelationship of these influences and related latest findings were elaborated and combed; (3) research methods in this field were reviewed and clarified; (4) the general interrelationship of these affecting factors and the latest research achievement in this field were summarized; (5) the future research directions for researchers and application suggestions for practitioners were proposed. A discussion on this article is made in the final section.

2. Theoretical foundation reviews on influencing factors of urban residents' low carbon consumption behavior

At present, the research on the influencing factors of urban residents' low carbon consumption behavior is mainly based on several classical behavior theories and models.

The first one is Theory of Planned Behavior (TPB), which is put forward on the basis of Theory of Reasoned Action, TRA, adding the variable, Perceived Behavioral Control, PBC (Azjen, 1991). In 1975, American scholars Fishbein and Ajzen jointly put forward Theory of Reasoned Action whose core concept is about behavioral intention (Fishbein and Ajzen, 1975). Behavioral intention refers to the extent of willingness of an individual to engage himself/herself in a particular action and the extent of efforts he/she has planned to make, being a function of behavioral attitude and subjective norm (Fishbein and Ajzen, 1975). Behavioral attitude is a person's positive or negative emotional tendency towards particular behavioral (Fishbein and Ajzen, 1975). Besides, it is also the function of outcome evaluation as well as behavioral beliefs. The former refers to the evaluation of the consequences of a particular behavior based on reason while the latter refers to the evaluation of the possibility for the consequences to occur (Azjen, 1991; Ajzen and Fishbein, 1980; Han et al., 2010). Subjective norm refers to an individual's perception of how the important people (including relatives, close friends, colleagues and business partners) think whether he/she should do a certain thing, and this kind of perception forms a kind of social pressure to have an impact on an individual's decision to do the certain thing or not (Azjen, 1991). In addition, it is the function of normative beliefs and motivation to comply. The former refers to an individual's perception of how the important people think whether he/she should perform a behavior while the latter refers to an individual's motivation to comply to his/her important people (Ajzen and Fishbein, 1980). According to Theory of Reasoned Action, during the process when people are making decisions, oftentimes they have a high degree of thought control and control their behavior subject to their willingness (Ajzen and Fishbein, 1980). However, in real life practice, a person's behavior is also under the influence of factors (such as money and time) that are not related to thought, which will make applicability of Theory of Reasoned Action questionable (Ajzen, 1985). Therefore, in 1985, Azjen (1991) revised the Theory of Reasoned Action, adding a new variable, perceived behavioral control, PBC, to the original theory framework. Perceived behavioral control refers to the degree of difficulty an individual perceives about performing a particular behavior (Azjen, 1991), being the function of control beliefs and perceived power. The former refers to the perceived factors promoting or hindering the performance of a particular behavior, including convenience, price, time, etc., while the latter refers to the degree of impact these factors have on the performance of a particular behavior (Azjen, 1991; Ajzen and Madden, 1986). According to theory of planned behavior, behavior intention determines an individual's behavior and it is determined by three aspects including behavioral attitude, subjective norm and perceived behavioral control. The last one also has a direct impact on an individual's behavior. The model framework of theory of planned behavior is shown in Fig. 1.

The second theory which has been widely used in research on residents' low carbon consumption behavior is value-belief-norm theory put forward by Stern P.C. This theory is advanced and improved based on a combination of Value Theory, Norm Activation Theory and New Ecological Paradigm, NEP (Stern et al., 1999; Stern, 2000). Value-belief-norm theory comprises three parts: value (V), belief (B) and norm (N) (Stern et al., 1999; Kiatkawsin and Han, 2017). Schwartz (1992) defined value as "a desirable traps-situational goal varying in importance, which serves as a guiding principle in the life of a person or other social entity". Based on Universal Theory of Human Values put forward by Schwartz, Stern advances in the VBN model three kinds of environmental values, the altruistic value (a value that is centered on the interests of others), the ecological value (a value that is centered on the interests of biosphere) and the egoistic values (a value that is centered on self-interest) (Stern et al., 1999; Stern, 2000). According to VBN model, these three kinds of values is the starting point of the causal chain of the whole model. The second part of VBN model is belief, which is also comprised of three parts. The first part is the New Ecological Paradigm advanced and revised by Dunlap and Van Liere (1978) and Dunlap et al. (2000). What the New Ecological Paradigm scale measures is people's general view on the relationship between humankind and biosphere (Kiatkawsin and Han, 2017). Dunlap et al. (2000) defined NEP as "beliefs about humanity's ability to upset the balance of nature, the existence of limits to growth for human societies, and humanity's right to rule over the rest of nature". According to VBN theory, new ecological paradigm is influenced by three kinds of values and acts on awareness of consequences. The second construct of belief in the VBN framework is awareness of consequences. Awareness of consequences refers to an individual's belief that the environment condition has threats on other people, other species as well as the biosphere (Stern et al., 1999). According to the VBN model, awareness of consequences is influenced by new ecological paradigm and acts on ascription of responsibility. Ascription of responsibility is the third part of belief in VBN model and it refers to an individual's belief that his/her own behavior leads to (exacerbate) the deterioration of the environment condition (Stern et al., 1999). In the model of the causal chain of VBN theory, personal norm is the third part after value and belief. Personal norm refers to feelings of personal obligation related to an individual's self-expectation (the expectation that one's own behaviors are in conformity with its personal values) (Stern et al., 1999), the embodiment of internalization values. Personal norm, awareness of consequences and ascription of responsibility all belong to the Norm Activation Theory put forward by Schwartz (1977). Being the core of Norm Activation Theory, personal norm has a direct impact on behavior under the influence of awareness of consequences and ascription of responsibility (Schwartz, 1977). Behavior in the VBN Theory refers to pro-environment behavior which is divided by Stern into four groups. They are activism, non-activist public-sphere, private-sphere and behaviors in organizations (Kiatkawsin and Han, 2017; Stern, 2000; Stern et al., 1999). In Stern's opinion, only there is a widespread change of the behavior of these groups can serious public issues such as environment are solved (Stern et al., 1999; Stern 2000). VBN theory provides an explanation of the causal chain for the forming of pro-environment behavior (Fig. 2): The altruistic value, the ecological value and the egoistic values being the starting points, then thoughts about the relationship between humankind and biosphere are invited (New Ecological Paradigm); then thoughts about the influence of environment condition on other people, other species as well as the biosphere (Awareness of Consequences) and thoughts about the ascription of responsibility for environment condition exacerbated (Ascription of Responsibility) are invited; and then personal norm is inspired; finally, personal norm has a direct impact on four groups' environmental behavior. Value-Belief-Norm Theory identifies the effect of the relationship of subjective psychological variables such as values, beliefs, and personal norms on pro-environmental behavior, which is an empirical theory basis for the research on the forming of the public's environmental behavior. There are two points need to be paid attention to when comparing Theory of Planned Behavior and Value-Belief-Norm Theory. The first is that the model of Theory of Planned Behavior can be