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The Analysis of Correlation between Urban Residents` Behavior and Low-carbon Economic Development

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Abstract

Based on the evaluation index system, this paper evaluates the developing status of Shandong's low-carbon economy, pointing out that city people's behavior and low-carbon economic development are closely related. And we try to use theory of planned behavior as guidance for the purpose of analyzing the necessity of regulating the behavior of urban residents. At the same time, we put forward some feasible suggestions from the aspect about how to make residents` behavior normative to promote the development of low-carbon economy.

Keywords: City`s low carbon economy; Theory of planned behavior; Residents` behavior criterion

1. The analysis of correlation between low-carbon economic development and urban residents` behavior in Shandong province

1.1. AHP low-carbon economy evaluation index system

Low-carbon economy evaluation index system of analytical hierarchy process (ahp) is put forward and developed by Professor Thomas L•Saaty. Say simply, this method is to decompose a complex whole one into several small pieces, weigh up the relative importance of each part, then analyze that the priority of each one. AHP provides a useful way of complex decision-making, which is widely used in many domains.

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According to professor Thomas L•Saaty`s analytic hierarchy process, we constitute an evaluating index systemagainst low-carbon economy such as table 1.1.

Table 1.1 index system based on the AHP low-carbon economy evaluation

Secondary indexes	Three-stage indexes	Index attribute
Carbon emissions	Total Carbon emissions	Quantitative
	Per capita emissions (carbon footprint)	Quantitative
	Energy intensity	Quantitative
	The carbon intensity	Quantitative
Carbon sources control	Fossil energy consumption quantity	Quantitative
	Coal in the energy consumption structure of ratio	Quantitative
	Renewable energy in the energy structure represents a ratio	Quantitative
Carbon convergence construction	Forest coverage ratio	Quantitative
	Urban greening coverage ratio	Quantitative
Low-carbon industry	Low-carbon industry output proportion	Quantitative
	Low-carbon technologies	Quantitative
	Low-carbon products are exported to foreign service amount	Quantitative、qualitative
Carbon trading and cooperation	Carbon single quantity transaction amount	Quantitative

（material source：Zhu youzhi. Develop low-carbon economy and deal with climate change-low-carbon economy and its evaluation index J China's national conditions and strength 2010(1):6）

In order to further illustrate that the standard behavior of residents plays an important part in the development of Shandong's low-carbon economy, we can use table 1.1, which mentions the AHP evaluation index system, to make a concrete analysis on Shandong's development of low-carbon economy and a comprehensive evaluation about its developing situation.

1.2. Shandong's development of low-carbon economy and the assessment of urban residents` behavior

1.2.1. Carbon emissions - using energy consumption per unit of GDP as an example

Kaya calculation formula about the total carbon emissions: Total carbon emissions = population * unit of GDP per capita * energy usage of unit GDP (energy intensity) * carbon emissions of unit energy usage (the carbon intensity). The products of the former two indexes are for GDP value, and the increasing trend of it year by year is inevitable. In order to reduce carbon emissions, it is with more practical meaning to analyze the last two indexes. In recent years, Shandong province has adopted a series of effective measures on the aspects of reducing energy consumption, energy saving and emission reduction. As a result, it has made great achievements in the work of low-carbon economic development. The gap of all trades and professions in energy consumption indicators between Shandong province and countries around the world as well as domestic outstanding provinces is getting smaller.

1.2.2. Carbon source control --using constitution of energy consumption as an example

In the evaluation of carbon source control index, we adopt the ratio of coal in the energy consumption structure to undertake concrete analysis. Its computation formula is: the ratio of coal in the energy consumption structure = coal consumption quantity / energy consumption quantity.

In the energy consumption structure of Shandong province, a coal remains the main force, and this is also conforms to China's energy structure status: rich coal, lack of gas, less oil. And clean energy usage is

insufficient; what's more, the actual application of renewable energy sources is not optimistic, such as hydropower, nuclear energy, and wind power and so on. Until now, Shandong still relies on coal and petroleum mainly in the energy utilization structure. So Shandong province has a long way to go in improving energy consumption structure and lower coal consumption percentage.

1.2.3. Carbon convergence construction --using green coverage as an example

The forest coverage rate is an important indicator, which reflects the breadth of forest coverage and the balance situation of ecological environment in a country or region. According to the world resources report, world forest coverage rate: Japan is 67%, South Korea for 64%, Norway for about 60, Sweden for 54%, Brazil for 50-60%, Canada was 44%, Germany for 30%, American 33%, France was 27%, India is 23%, China to 16.5%. Shandong's average forest coverage rate is 23% (arrangement of the world resources reports and Shandong statistical yearbook data).

Theoretically only when green coverage area accounts for more than 25% of a certain area, the forest in this area can effectively play its role in the protection of the natural environment. As we know, the forest coverage rate in Shandong province, 23%, is still low, then the direct consequence is when the air is polluted heavily, forest cannot effectively play the function of adopting harmful substances. Furthermore air purification can't be realized and bacteria can get off to cause, affecting people's physical and mental health.

1.2.4. Low-carbon industry – using renewable energy utilization for example

The proportion of a country or region's renewable energy accounting for energy consumption is large, the technology of development and utilization is high, and then the output will also be increased accordingly. Moreover, such energy is low-carbon emission energy, even carbon emissions to zero. Therefore, the use of renewable energy influences the development of low-carbon industry deeply.

Review Shandong's present situation of low-carbon industry: Financially, establish earmarks and give financial rewards to counties government which develop low-carbon economy with significant achievement. In addition, so far, the number of Shandong province's biomass power projects is at least one in six of the whole country. By 2010, Shandong province has given great support to low-carbon economic development in aspects such as financial capital, tax policy, and cost control and so on.

1.2.5. Carbon trading and cooperation in Shandong province

Low-carbon economy is a new model of economic development, the development of low-carbon economy has given birth to many new economic growth points. Relying on economic entity, low-carbon economy could achieve energy conservation and emission reduction targets with technical innovation and system transformation. And this process can not be realized totally by enterprises, individuals voluntarily or government forcedly. So low-carbon economic development is inseparable from the introduction of market mechanism. The existence of carbon markets gave birth to a new capital type: carbon capital. Carbon trading is actually a kind of financial activities which makes carbon capital closer with the entity economy.

From the current circumstance, Shandong's development of low-carbon economy is still at the beginning stage, so the shortages includes as following: On the one hand, relevant laws, regulations and policy guidance is neither clear nor Anacreon tic enough; on the other hand, development measures and the development environment is imperfect. Participating approach in carbon trading should be further improved. At present, Shandong province should strengthen the government's role as a guide, driving and guiding enterprises and research institutes to develop low-carbon economy. Moreover, the government can active carbon trading market and regulate the transaction procedures to give safeguard to urban residents` funds flowing to carbon markets. At last, improve residents' enthusiasm to participate and promote carbon trading and cooperation.

1.3 conclusions: urban residents` behavior has great effect on low-carbon economic development

1.3.1. Shandong's growing situation of urban energy consumption

Since reform and opening-up in 1978, China characteristics socialism construction undertaking has been developing rapidly and the realistic society has undergone earth-shaking changes. 2008 is the 30th anniversary of reform and opening-up, summarizing the achievements of the reform and opening up: first is the rapid development of economy, people's living standards has been improved markedly and the comprehensive national strength increases greatly. However, with the rapid development of economy and society, the resident's consumption level enhances unceasingly, as a result, the environmental pollution has become serious increasingly, the issues about energy and resources has become increasingly important. Here we select data of the two five-year period: at the beginning of the reform and opening and 30 years later as an example to show the growing situation of urban residents` energy consumption in Shandong province.

Table 1.2 year 1978-1982 annual energy production quantity in Shandong Tons BiaoZhunMei

year	1978	1979	1980	1981	1982
Energy production volume	5901.83	6075.07	5873.37	5392.54	5505.80

Table 1.3 year 2004—2008 annual energy production quantity in Shandong Tons BiaoZhunMei

year	2004	2005	2006	2007	2008
Energy production volume	14394.61	13995.62	14083.4	14616.67	14615.32

Data sources: Shandong statistical yearbook - 2009

1.3.2. Urban residents` behavior influences low-carbon economic development of Shandong province.

In 2008 global financial crisis makes people turn to the low-carbon economy, paying more attention to the low carbon economy. In fact, the fossil energy consumption brings serious pollution problem and ecological destruction. And the most important restrictive factor is non-renewable problem. But developing low-carbon economy can boost employment and economy to go through difficult economic times in a short period. What's more, it is a way of sustainable development, which can realize the true meaning of the resource recycling and economic sustainable development. Long term, in order to fulfill the target of sustainable development, we must realize economic model transformation, developing low-carbon economy firmly.

It is necessary for Shandong to reduce energy consumption, alleviate the pressure of environment protection, and realize the energy saving and emission reduction in order to reach the target of developing low-carbon economy. This needs to invest a lot of capital, technology as well as policy support. Even though exist many difficulties to develop low-carbon economy, it is urgently needed.

The reason is as followed: if Shandong province chooses urbanization road, which increases energy consumption at the cost of environmental pollution, then, with the influx from the rural to the city, the contradictions among population, resource, energy and environment will arise sharply, impeding or even restricting the development of the city.

Therefore, in the process of urbanization, Shandong province must take the contradictions between the rapid growing demand of resources as well as energy and environmental protection as major issues.

2. Standardize city residents` behavior to promote low carbon economic development

Theory of Planned Behavior was put forward in 1985 by Ajzen. On his opinion, people's behavior is not always of total voluntary, but is affected, even controlled by external factors. This theory can help us understand how people change their behavior patterns. According to TPB, when conduct a concrete

analysis about people's behavior, we should mainly inspect three factors: (1) the Attitude factor, namely the individual's positive or negative comments on something, or whether you like it or not [4]. (2) The Subjective Norm factor means the pressure one can feel from society when taking a certain action. (3) The Perceived Behavioral Control factor, namely the controlling degree individual can expect in taking some behavior.

Theory of Planned Behavior holds that attitude, subjective norms and perceived behavioral control may jointly predict behavior intention. The biggest significance of combining the influences of these three factors is to do systematic research. This theory has been widely applied in different professions, such as information system, investment decision, etc.

While using the theory, many scholars find that: TPB is suitable for the study of human's complex behavior. In many cases this theory can accurately predict possibilities of behavior occurrence, such as forecasting staff's willingness to accept the business process reengineering. Besides, TPB is also applied to the acceptance of the enterprise information and network shopping etc.

According to the theory of planned behavior, the behavior of people is voluntary mostly. However, in some cases, the occurrence of behavior is not controlled completely by individual's willingness, but is affected by many external factors. Therefore, the behavior of people in these cases is not entirely voluntary.

In this article, we choose the three factors which decide the behavioral intention. On the one hand, we analyze the necessity to regulate urban residents` behavior; on the other hand, we analyze the influence that the external factors have on behavior, and propose some suggestions about how to regulate residents` behavior at the same time.

2.1 From the attitude, improve urban residents` consciousness of low-carbon life style

Attitude is the first decisive factor of the behavioral intention, also the first step of behavior. For the development of low-carbon economy, firstly, it is necessary to enhance the consciousness, establish residents` positive attitude and make the residents have the willing to participate in energy saving activities. As for urban residents, the subject crowd of high-energy consumption model, the government should pay more attention to them, improve their understanding and urge them to change consumption style effectively in order to make city residents play a main role in energy saving activities.

2.2 The subjective norm, form urban residents` habit of low-carbon life style

Subjective norm is the second decisive factor of the behavioral intention. It will produce constraint on residents` behavior. While formulating relevant policy, it is useful for the government to make energy consumption reduction and low-carbon life style become a constraint. The target is to transfer this restriction to the sense of responsibility and mission. Specifically, the government can make the low-carbon life idea go deep into people's minds from two aspects simultaneously: ethics and the system guarantee.

First of all is the ethics. Thrift is Chinese nation's traditional virtue. Now we return to tradition, advocating thrift, because we want to be harmony with nature, and we need the consciousness of protecting the earth. Therefore, we develop the low-carbon economy and advocate low carbon life concept.

The second is the system guarantee. As we know, this moral norm cannot be formulated naturally. It still needs a certain system guarantee while system guarantee could only play a security role if there were corresponding measures.

2.3 From Perceived Behavioral Control, make urban residents go into low carbon life era smoothly

Perceived behavioral control is the third decisive factor of behavioral intention. From the point of perceived behavioral control, Shandong province can consider the following two points to reduce energy consumption, especially energy saving problem in daily life:

Firstly, it is important to enhance residents` consciousness of doing something. Many citizens believe that low carbon belongs to high-tech, so it is scientists` work and has nothing to do with ordinary people. In fact, the truth is just the opposite. Low carbon and every one of us are closely linked.

Secondly, create convenience for residents to live a low-carbon life. The government should provide corresponding measures at the time when encouraging and advocating low-carbon life. The measures includes: encouraging policies, consulting services, consumer atmosphere, technical support, etc. Make sure that people could find a way to live a low-carbon life whenever they want.

3. Conclusion

It is an arduous and complicated engineering to develop low-carbon economy, which needs the joint efforts of the whole society. Urban residents are as the subject crowd of high carbon life, so their change in consumption style will play a crucial role in the development of low carbon economy. Based on the AHP low-carbon economy evaluation index system, this paper evaluates and summarizes the developing status of low-carbon economy in Shandong province. We hope that it would give some significant guidance about orientation of urban residents` behavior. According to the theory of planned behavior, the formation of low-carbon life habits can't depend entirely on individual citizens. The government and related departments may take proper measures to guide the popularization and promotion of low carbon life concept and method. This article chooses from three points: the attitude, subjective norms, perceived behavior control and proposes countermeasures and suggestions about how to regulate residents` behavior: Firstly, from the attitude, enhance the city residents` consciousness of low carbon life. Secondly, through the subjective norm, form urban residents` low carbon life style. Thirdly, make full use of perceived behavioral control and make urban residents` go into low carbon life era gradually.

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