An Empirical Study of Low-carbon Lifestyle

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Abstract-This paper mainly organizes the theory of lifestyle from the fields of sociology and consumer behavior, it also outlines the situation of domestic scholars on the study of the low-carbon lifestyle. Then this paper does an empirical research, with the method of structural equation, on low-carbon lifestyle in which residents of Dalian are the objects of study. And it defines low-carbon lifestyle as a sustainable way of life which includes low-carbon public behavior, daily low-carbon behavior, social behavior, environmental attitude and low-carbon acknowledgment. This paper also finds out that the environmental attitude and low-carbon acknowledgment affect people's low-carbon behavior, includes low-carbon public behavior, social behavior and daily low0carbon behavior. In the end of the paper, it puts forward the limitations of this study as well as a research direction for lifestyle in the future.

Keywords-lifestyle; low-carbon lifestyle; low-carbon economy

I. INTRODUCTION

The research of lifestyle comes from the higher pursuit of people for the richer material life, and the basis of survival is the development of the economy, the civilization of human history not only brings people to material wealth but also affects people's lifestyle. From the early days of the industrial revolution to the post-modern industrial civilization, then to the modern era of low-carbon economy, people's lifestyle has also changed dramatically. Different social background and the change of lifestyle make scholars pay much more attention to the research of lifestyle. They have also explained lifestyle from different perspectives. What is a low-carbon economy? What will happen to people's way of life in the background of low-carbon economy? This paper makes the analysis of definition and methods of measurement of low-carbon lifestyle on the basis of a comprehensive review of lifestyle and low-carbon lifestyle research.

II. LIFESTYLE-RELATED LITERATURE REVIEW

A. Lifestyle Study in the Field of Sociology

1) Lifestyle Study in Foreign Countries

The lifestyle study started in the Western countries, the initial study comes from the field of sociology. In early studies, Marx and Engels had discussed the close relationship and distinction between the mode of production and lifestyle and they also thought lifestyle as a important indicators to distinguish the class in the book called "The German Ideology". Their research lays the foundation for subsequent research.

Weber is one of the researchers with a strong interest on the lifestyle, following Marx, the core of his research is the study of class, status and powers. Weber thinks the class is divided on the basis of their relationship with the commodity production and commodity getting, 'status groups' are divided in accordance with the law of commodity consumption. Weber's important contribution is that he began to study lifestyle in the perspective of consumption which has opened up a new approach of the research. Veblen follows Weber's consumption perspective to study lifestyle, he makes the lifestyle as the tool to describe class status. He has also detailed in the book called "Theory of Leisure Class". The famous French sociologist Pierre Bourdieu comprehensives subjective and objective factors to study lifestyle, he thinks that ha-bit or habits (habitus) reflects the results of the operations of an organization, it is individual social behavior, and ultimately the formation of a specific lifestyle.

2) Lifestyle Study in China

In the field of sociology Scholars in domestic early mainly around the issue of social class to study lifestyle, and it does not form a separate scientific discipline, in real life, it always appears in these nouns which follows the background, such as "bourgeois lifestyle". After the reform and opening up, most of the articles focused on answering "how to live", but it still did not form a in-depth theoretical system, and it had little applied research, and most of them only described a surface phenomenon. This period, Scholars did not concern about the study of lifestyle.

Until the 20th century, along with the changes in the social environment, the people gradually increase the attention on lifestyle. To sum up, the research of the domestic sociology scholars mainly as followings:

Firstly, Most scholars believe that the definition include broad definition and narrow definition, and the broad definition includes all the activities for the survival and development; narrowly, lifestyle refers to all aspects of people's daily life activities under the background of history and social environment (Wang Yezhou[1], 2002; Wu Huanwen[2], 2002; Sun Wenying[3], 2010).

Secondly, Wu Huanwen summed up the conclusions of three domestic lifestyle index system: "making well-off indicator system as alternative indicators of

lifestyle, making the quality of life as the evaluation system, making an independent indicator system". On this basis, he proposed a new system of indicators, including subjective indicators, objective indicators and behavioral indicators, they reflect the lifestyle status from the level of life, life satisfaction, life reasonable degree three aspects.

Finally, the relationship between the lifestyle and class: consistent with the view of Western scholars, the domestic scholars also believe that the social class makes people's lifestyles being different, and the formation of new classes can consolidate the differences (Li Chunling[4], 2004). Studies suggest that along with some of the new social classes gradually formed, the differences among the various sectors of socio-economic status and lifestyle, identity of interests is increasingly obvious.

B. Lifestyle Study in the Consumer Behavior Field

Compared to sociology, lifestyle study in the consumer behavior field is late, and the majority of research has focused on exploring the definition and types of lifestyle, methods of lifestyle's application research.

1) The Research of Lifestyle Definition

Early Western scholars studied from the view of the consumption, such as the British scholar, Earl in his book "The lifestyle economics: consumption behavior which stir the world" used consumption to analyze lifestyle. Some scholars even directly use the concept of consumption to alternative lifestyle.

Unlike previous scholars, William Lazer (1963) researched that lifestyle impacts on social class stratification, initially applied in the field of marketing and he thought that "lifestyle is the performance of the difference of a unique class or social group with others."[5]. People of different social strata will exhibit different lifestyles and people of the same class have similar characteristics.

Subsequently, scholars analysis the definition of lifestyle from the content and structure. Plummer[6](1974) believed that lifestyle is the in-depth research which contains the individual details of life, attitudes and self-awareness. Finland J. Ross (1980) generalized lifestyle is decided by the living conditions, but at the same time "lifestyle's formation depends on the body itself, and it is directly related to the main point and the value of the target system"[7]. Some domestic scholars believe that under the influence of certain environmental, cultural and social class, lifestyle includes all the material aspects and spiritual level of life activities (Jin Xiaochuan[8], 1997; Yuan Maoshuan[9], 2009). In addition, the existing research conclusions emphasized people's live values is also one of the constitute of lifestyle (Li Ling[10], 2011).

Scholars in the field of economics also think that people between different social classes have different lifestyle, but different from sociology scholars, scholars in the field of economics emphasis much more on the uniqueness of individual lifestyle, and they also think lifestyle not only includes people's activities of life but

also the values of the individual and attitudes of self-consciousness.

2) Research on the Lifestyle Types

Another aspect of lifestyle study is the research of lifestyle types, most scholars analysis people in different places by empirical analysis, eventually making them to be integrated into different type of lifestyle. Generally speaking, the research of lifestyle type is reflected in the following three aspects.

a) **The relationship between lifestyle and buying behavior or product decisions:** it makes the survey of buying behavior of the crowd as the basis to divide the type of people's lives. In 1973, Japanese sociologist Iseki Leeming and Horiuchi Shiro analyzed that Tokyo housewife had seven kinds of lifestyle type by their buying behavior survey: "active life expansion type, negative stagnation type, industrious and frugal type, leisure time and hedonic type, conservative public, lockout and caring nothing, and self-planning type." Stephen C. Cosmas[11] (1982) analyzed activities, interests and ideas(AIO) of women's groups, he concluded that consumer' shopping and service type is the mirror image of their lifestyle, and he also divided lifestyle groups and product groups. Wassana Suwanvijit[12] (2009) researched lifestyle and shopping behavior of the residents of Songkla Province. However, because of the variability of the subjective attitude of consumers and diversification of product selection, it sometimes is not stable enough to make the relationship between lifestyle type and consumer behavior.

b) **From the activities of life:** by surveying food, clothing, daily consumption of the activities of life, American sociologist Mitchell(1979) divided the American lifestyle into four types of nine kinds with the investigation of the activities of people's lives: "need-driven (the alleys and maintain), extroverted tendencies type (type of wealth attribution, struggle, success type), introverted tendencies Type (arbitrary type, experience-based, social consciousness Type) integrated inside and outside". J. Ross (1980) through the analysis of Vantaa City residents, he pointed out four kinds of lifestyle: "really happy multi-faceted, traditional, modern without content and very unfortunate type".

c) **Different quantitative comparative analysis:** using the VALS and LOV which are more common quantitative methods to study consumer behavior to research and analysis lifestyle. Lynn R. Kahle, Sharon E. Beatty, and Pamela Homer[13](1986) made 193 students of the University of Oregon as the research sample, he also pointed out that the respective advantages of the two methods. LOV has nine values: the self-esteem, safety and harmonious social relationships, a sense of accomplishment, self-satisfaction, a sense of belonging, respect, entertainment and stimuli. By empirical analysis results of these scholars (Mitchell, Kahle), finally, LOV had much more advantages than VALS in studying classification. The research of lifestyle not only includes the basic necessities of life but also consumption habits, and people's values.

C. *Domestic Research on Low-carbon Lifestyle*

Stepping into new century, the social background has changed from industrial civilization to the pursuit of sustainable development, which means the era of low-carbon economy. In China, scholars also have researched the low-carbon lifestyle with theoretical research methods in recent years, they proposed the definition of low-carbon economy and low-carbon lifestyle. The general view: a low-carbon economy is under the guidance of the concept of sustainable development through technological innovation, system innovation, industrial restructuring, new energy development and other means, as far as possible to reduce the energy consumption of high-carbon resource like coal, oil, reduce greenhouse gas emissions, to achieve economic and social development and the protection of the ecological environment win-win of economic development patterns (Sun Zhiping, Mu Zhiyun[14], 2010; Han Zhihong[15], 2011; Wang Liqun[16], 2011; Zhang Cuihua[17], 2011). Many domestic scholars study the definition of low carbon lifestyle. Some scholars believe that the "low-carbon life is a sustainable way of life" (Wu Shanghong[18], 2011), which embodied in the activities of businesses and residents living in the energy-saving behavior. Otherwise scholars believe that the "low-carbon lifestyle means to reduce energy consumption, thereby reducing carbon, particularly carbon dioxide emissions".
Some scholars think the way of human's life under the background of low-carbon economy, people have the survival guidelines: promote conservation, combat waste away from luxury, moderate consumption, Nature, inaction, healthy and civilized, shaping the cultural. (Cheng Yunlei[19], 2011).

In summary, the lifestyle experiences the process from just be used as a research tool to as an independent scientific concepts. Scholars, in different areas, present different definitions. Due to imperfection of the lifestyle theory system, it is difficult to form a standardized concept. Because of the direction of investigators, different measurement methods, and the instability of attitudes of individual or groups of people, it makes different types of lifestyle. Low-carbon economy era of the 21st century affects people's lifestyle, which also makes the low-carbon lifestyle different from the previous lifestyle.

Low-carbon lifestyle is a sustainable way of life, and it is reflected in all aspects of life, including daily low-carbon activities, social behavior, attitudes of low-carbon behavior or low-carbon.

III. RESEARCH DESIGN

A. *Questionnaire Design*

Questionnaire items used in this study are the results of the interviews and modifiability of the scales of predecessors (Table 1, Table 2).

Firstly, the initial contents of the questionnaire are the basic necessities of life, leisure, attitudes towards the environment and entertainment.

TABLE I. SCALE OF QUESTIONNAIRES

Dimensions	Author	Original Items	Modified Items
LSW	Wassana Suwanvijit（2009）	With friends, not lonely	LSW2. I am willing to stay with friends.
	Thomas P. Novak Bruce Macevoy	Contact distant relatives	LSW3. I often contact distant relatives, no matter how far it is.
	Stephen C, Cosmas	Have been serving two or more service organizations	LSW4. I have joined one more service organizations at least.

TABLE II. SCALE BASED ON THE INTERVIEW

Dimensions	Questions	Modified Items
LLA	What do you think of the concepts of low-carbon and low-carbon consumption?	LLA1. I think low-carbon life is important.
		LLA2. I am familiar with low-carbon life.
	What's your attitude to low-carbon consumption?	LLA6. I will take it into practice after I know more about low-carbon life.
		LLA8. I will propagate the knowledge of low-carbon to others.
EA	Please talk about daily low-carbon activities.	EA5. I think most of the takeaway foods are over package.
		EA6. I think it should reduce the use of paper textbooks.
		EA7. I think it's too wasteful to use disposable tableware resources which should be moderately disabled.
DLL	Please talk about low-carbon behavior of buying clothes.	DLL8. I like natural clothes more.
	Please talk about low-carbon behavior of living.	DLL22 .I often use water in recycle.
		DLL23. I put the used batteries in recycling.
		DLL24. I often print in two sides.
LBC	Please talk about daily low-carbon behavior.	LBC1. I will actively stop the behavior of wasting resources.

Secondly, it has a interview with 12 undergraduate students for two hours under the principle that if there isn't any new words appearing, then the interview stops. This paper modifies the questionnaire by the result of the interview. Then we discuss it with 10 postgraduate students, ultimately the questionnaire is determined.

Finally, considering the views of teachers, the final questionnaire is divided into seven parts, the first part is Low-carbon Lifestyle Acknowledge (LLA), including nine question items; second part is daily low-carbon lifestyle (DLL), including 25 questions about the daily behavior; the third part is about low-carbon behavior conditions (LBC), including four questions; the fourth part is about the environmental attitude(EA); the fifth part is about low-carbon way of leisure (LWL), mainly discussing arrangement of people's leisure time; the sixth part: it's a supplement to the study of low-carbon lifestyle, mainly about interpersonal relationships. Finally, there is the personal information, including age, sex, occupation, average monthly income and so on. Likert five-scale and SPSS17.0 are used in this paper.

B. Data collection and data analysis

1) Data Collection and Sample Overview

Investigating objects of this study are the residents of Dalian, it has delivered 400 copies in total, of which 260 were returned, 65% response rate, of which 244 valid questionnaires. The survey sample is shown in Table 3.

2) Scale Purification and Explore Factors Structure

a) Reliability testing. Reliability is used to test the stability and consistency of the scale. This paper uses the Cronbach a coefficient to measure it, and in basic research, it should reach at least 0.80, then the scale would be accepted; in exploratory study, the reliability can reach 0.70. Some scholars believe that, in practice, the Cronbach a coefficient should be 0.60.

b) Exploratory factor analysis. The KMO value is used to assess model, this study's KMO value is 0.718 (over 0.70), and Bartlett's test of sphericity ($p < 0.0000$), which show that the factor analysis condition is moderate; this study follows principal component analysis and variance maximization orthogonal rotation to select data. In the end, there are five factors: Low-carbon Public Behavior(LPB), Daily Low-carbon Activities(DLA), Social Behavior(SB), Environmental Attitudes(EA) and Low-carbon Acknowledgment(LA). And it has 15 items totally which are shown in Table 1,Table 2. Reliability analysis and exploratory factor analysis results are shown in Table 4 and Table 5.

It shows in Table 5 that the values of reliability are all over 0.60. In the results of factor analysis, the factor loading of each of the items in each dimension is 0.50 or more, the interval of factor loading is 0.512-0.866. In addition, there is not the phenomenon of cross-loadings, which shows that the scale has a good discriminant validity. The result shows it's reasonable to divide low-carbon lifestyle into five dimensions. In this study, low-carbon lifestyle is defined as a sustainable lifestyle for all aspects of life activities, including the low-carbon public behavior, daily low-carbon activities, social

behavior, environmental attitudes, and low-carbon acknowledgment.

c) Confirmatory Factor Analysis

LISREL8.70 is used in this study for confirmatory analysis, and the results are as follows:

TABLE III. BASIC INFORMATION

Demographics		Percentage	Demographics		Percentage
Sex	Male	47.5%	Average monthly income (RMB)	No income	49.1%
	Female	52.5%		Less or equal 2000	10.7%
	18	2.5%		2001-5000	21.3%
	19-22	41.0%		5001-10000	8.2%
Age	23-26	20.5%		>10001	10.7%
	27-35	13.1%	Marital status	Unmarried	60.7%
	36-50	17.2%		Married with children	32.0%
	Over50	5.7%		Married with no children	7.3%

TABLE IV. CITC AND RELIABILITY ANALYSIS

Dimensions	items	CITC	Alpha if deleted	Cronbach's Alpha
LPB	LPB1（LLA6）	.611	.614	.737
	LPB2（LLA8）	.595	.653	
	LPB3（LBC1）	.538	.686	
DLA	DLA1(DLL8)	.406	.680	.690
	DLA2(DLL22)	.429	.652	
	DLA3(DLL23)	.505	.605	
	DLA4(DLL24)	.580	.564	
SB	SB1(LSW2)	.455	.566	.651
	SB2(LSW3)	.508	.495	
	SB3(LSW4)	.435	.607	
EA	EA1(EA5)	.495	.486	.641
	EA2(EA6)	.442	.560	
	EA3(EA7)	.451	.571	
LA	LA1(LLA1)	.463	-	.618
	LA2(LLA2)	.463	-	

TABLE V.   RESULTS OF EXPLORATORY FACTOR ANALYSIS

Dimensions	Items	Factors				
		1	2	3	4	5
LPB	LPB1		.803			
	LPB2		.785			
	LPB3		.775			
DLA	DLA1	.579				
	DLA2	.624				
	DLA3	.777				
	DLA4	.766				
SB	SB1			.751		
	SB2			.815		
	SB3			.685		
EA	EA1				.684	
	EA2				.512	
	EA3				.866	
LA	LA1					.840
	LA2					.720

TABLE VI.   RESULTS OF CONVERGENCE ANALYSIS

Dimensions	Items	Standardized Factor Load	T Value	Standardized Error	SMC	AVE
LPB	LPB1	0.75	-	0.44	0.563	
	LPB2	0.74	8.70	0.45	0.548	0.509
	LPB3	0.64	8.19	0.58	0.410	
DLA	DLA1	0.52	-	0.73	0.270	
	DLA2	0.61	6.32	0.62	0.372	0.375
	DLA3	0.59	6.21	0.65	0.348	
	DLA4	0.71	6.75	0.49	0.504	
SB	SB1	0.59	-	0.65	0.348	
	SB2	0.69	6.02	0.52	0.476	0.395
	SB3	0.60	5.94	0.64	0.360	
EA	EA1	0.70	10.14	0.51	0.490	
	EA2	0.63	9.12	0.60	0.397	0.376
	EA3	0.49	6.87	0.76	0.240	
LA	LA1	0.62	7.95	0.62	0.384	0.466
	LA2	0.74	9.06	0.45	0.548	

Table 6 shows the standardized factor loadings of items generally approximate to or greater than 0.70. In addition, the average variance extracted (AVE value) of each dimension is from 0.375 to 0.509, the value is lower than the critical value of 0.5, But the dimensions validity has a significant effect (Table 7). Each dimension of the square root of the AVE value (the diagonal values in the table) is greater than the correlation coefficient between the various dimensions (correlation coefficient maximum only 0.355).

TABLE VII. CORRELATION COEFFIENT AND THE SQUARE ROOT OF AVE

Dimensions	LPB	DLA	SB	EA	LA
LPB	**0.713**				
DLA	0.286	**0.612**			
SB	0.250	0.343	**0.628**		
EA	-0.040	0.355	0.050	**0.613**	
LA	0.227	0.268	0.124	-0.039	**0.682**

C. The Proposed Model and Hypotheses Development

The previous factor analysis shows that the low-carbon lifestyle including five dimensions, low-carbon public behavior (LPB), daily low-carbon activities (DLA), social behavior (SB), environmental attitudes (EA), and low-carbon acknowledgment (LA). Wells pointed out that attitude measurement is still the most useful when you can't predict behavior, in addition, George Katon (1965) found that consumer behavior is the result when attitude, possible conditions and unexpected situations work at the same time[20]p43. In this sense the following hypotheses are formulated:

H1: People's environmental attitude (EA) affects people's low-carbon public behavior (LPB).

H2: People's environmental attitude (EA) affects people's daily low-carbon activities (DLA).

H3: People's environmental attitude (EA) affects people's social behavior (SB).

H4: People's low-carbon acknowledgment (LA) affects people's low-carbon public behavior (LPB).

H5: People's low-carbon acknowledgment (LA) affects people's daily low-carbon activities (DLA).

H6: People's low-carbon acknowledgment (LA) affects people's social behavior (SB).
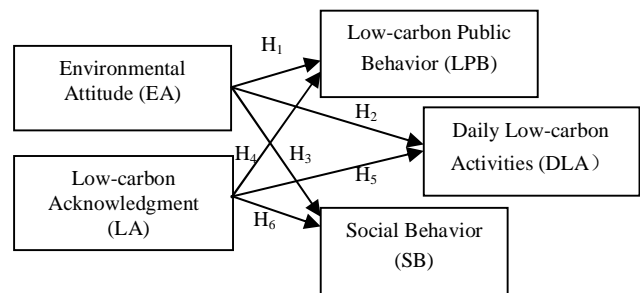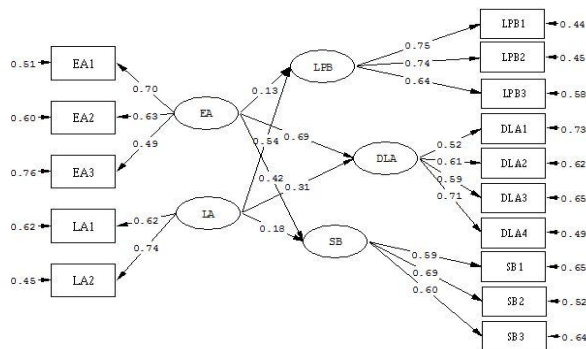
And the proposed model in this study is as follows:

Figure 1.   Theoretical model used in this study

D. Results

χ²/df	GFI	AGFI	CFI	NFI	RMSEA	RMR
3.02	0.88	0.83	0.87	0.82	0.091	0.056

Figure 2.Results of the Final Analysis of the Structural Equation

The results of the data analysis shows that previous assumption holds, that people 's environmental attitude and low-carbon acknowledge have a certain impact on people's low-carbon behavior. Figure 2 shows the significant impact of environmental attitudes on people's daily low-carbon behavior and social behavior. It also shows the less significant impact on low-carbon public behavior. But it does not mean they are unrelated. Low-carbon acknowledgment has more effect on the low-carbon public behavior and daily low-carbon behavior than on social behavior.

IV. CONCLUSIONS AND FUTURE RESEARCH LINES

This study combines theoretical and empirical analysis of low-carbon lifestyle to define it and it also shows the factor structure and the relationship between these factors. But the empirical analysis of this study is still insufficient, such as the sample size is too small, the scale should be improved, the future, you can consider increasing the emotional aspects of the content of the low-carbon lifestyle. In addition, according to the conclusions of the research, the government can strengthen the education and promotion of low-carbon lifestyle to improve people's environmental attitudes and awareness of low-carbon lifestyle, finally, people will practice low-carbon life by themselves.

REFERENCE

[1] Wang Yezhou. The Talking about Lifestyle's the implication and structure [J]. Theory Journal, 2002 (1):90 - 93.

[2] Wu Huanwen. Lifestyle Indicators System Preliminary Study [J]. Shandong Normal University, 2002, 47 (5):80 - 83.

[3] Sun Wenying. Lifestyle Changes and Chinese Culture [J]. Lingnan Journal, 2010 (2):130 - 134.

[4] Li Chunling. Social Stratification and the New Trends of Lifestyle in China [J]. Scientific socialism, 2004 (1).

[5] Laer William. Life Style Concepts and Marketing Toward Scientific Marketing，Stephen Greyser，ed[C]. Chicago: American Marketing Assn, 1963:140 - 151.

[6] Plummer Joseph T. The Concept and Application of Life Style Segmentation [J]. The Journal of Marketing, 1974, 38 (1):33 - 37.

[7] Tao Ye. The Study of Lifestyle Type in Developed Countries [J]. The sociology, 2006:117 - 120.

[8] Jin Xiaochuan. Lifestyle Guide: the Important Aspect of Spiritual Civilization [J]. The Yunmeng Journal, 1997 (1):12 - 13.

[9] Yuan Maoshuan. Sense of the Value of Science and Civilization of Modern Lifestyle [J]. Beijing Social Sciences, 2009 (6):44 - 48.

[10] Li Ling. Lifestyle and Ecological Civilization Discussion and Analysis [J]. Theoretical study and explore, 2011:85 - 87.

[11] Stephen C. Cosmas. Life Styles and Consumption Patterns [J]. Journal of Consumer Research, 1982 (6):453 - 455.

[12] Wassana Suwanvijit. The Insight Study of Consumer Life-styles and Purchasing Behaviors in Songkla Province, Thailand [J]. International Jurnal of Marketing Studies, 2009 (1):66 - 73.

[13] Lynn R. Kahle, Sharon E. Beatty, Pamela Homer. Alternative Measurement Approaches to Consumer Values: The List of Values (LOV)and Values and Life Style (VALS) [J]. The Journal of Consumer Research, 1986 (13):405 - 406.

[14] Sun Zhiping, Mu Zhiyun. Low-carbon Economy Calls for Low-carbon Lifestyle [J]. The Theoretical Research, 2010:28 - 30.

[15] Han Zhihong. The Context of Low-carbon Economy, College Students Scientific and Civilized Way of Life of Building [J]. Colleges of Shanxi Social Science, 2011 (5):73 - 76.

[16] Wang Liqun. Advocate Low-carbon Lifestyle, Advancing Low-carbon Economy [J]. Shanxi Institute of Socialism, 2011(3):60 - 62.

[17] Zhang Cuihua, Fan Xiaozhen, Shi Minmei. Changes in The Lifestyle of The Rural Production of Low-carbon Era [J]. Reform Strategy, 2011, 27 (1):96 - 97.

[18] Wu Shanghong Low-carbon Lifestyle to Achieve a Low-carbon Ecocity Planning in Ideological [J]. Construction, 2011, 37 (27):1 - 2.

[19] Cheng Yunlei. Ecological Criteria of Human Lifestyle [J]. Economic Research Guide, 2011 (34):251 - 252.

[20] William D. Wells. Attitude and Behavior: Lessons from the Needham Life Style Study [J].Journal of Advertising Research, 1985(25):40-44.

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