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Study on the Threshold Effect of Urbanization on Energy Consumption

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Abstract

Energy is an important material impetus for urbanization, while urbanization is also key factors that stimulate the energy consumption increase. The rapid development of China's urbanization in recent years has led to changes in the total energy consumption and structure, which will inevitably affect the realization of China's rapid and sustainable economic development goals. Therefore, this article was based on panel data from 2005 to 2016 of 30 provinces in China, used energy consumption as the explained variable, the urbanization rate as the core variable, GDP per capita as threshold variables, and selected GDP per capita, industrialization level, urban per capita disposable income, the density of urban population, the proportion of the tertiary industry as control variables. Meanwhile, the threshold model was used to study the threshold effect. We put focus on the nonlinear relationship between urbanization and energy consumption and the corresponding regional differences and hope to make reasonable suggestions for optimizing the industrial structure and finally realizing the coordinated development of urbanization and energy consumption in China. The results show that in the accelerated stage of economic development, the main impact of urbanization is to accelerate the increase of energy consumption. When the level of economic development enters the post-industrialization stage, the stimulation of urbanization on energy consumption becomes smaller, which means that the urbanization transformation will face great pressure on energy consumption. Therefore, this paper considered China in three areas, eastern, middle and western areas to transversely compare and analyze, and put forward three rationalization proposals: To speed up the marketization of construction, promote economic development of the western and middle region, and narrow the gap of urbanization development of areas; to coordinate urbanization development and energy consumption in the eastern and western regions, accelerate industrial restructure in the middle and western regions, and promote sound and rapid urbanization; to grasp the law of urbanization's effect on energy consumption

and control the trend of energy consumption.

Keywords

Urbanization, Energy Consumption, Threshold Effect, Regional Difference

1. Introduction

Urbanization is the inevitable result of socialized mass production and economies of scale. According to the latest data released by the national bureau of statistics, the proportion of urban population in China in 2016 was 57.35 percent of the total population, which was higher than the world average. China's urbanization has entered a period of rapid development. The acceleration of urbanization leads to the increasingly prominent contradiction between economic development and ecological construction. Energy, as a driving force for the development of human society, is the basis of the development of modern urbanization. Urbanization process not only involves a large number of rural people moved to cities, but also involves the economic transformation and upgrading of industrial structure, which inevitably lead to urban infrastructure construction of large-scale investment, resulting in a large number of energy consumption, and will eventually bring huge pressure on resource, environment and ecology. China's urban areas consume 75.15% of the country's total energy, and the per capita energy consumption of urban residents is 6.8 times that of rural residents, according to the National Report on New Urbanization. Every one percentage point increase in the urbanization rate will boost energy consumption by 80 million tons of standard coal. According to the plan, China's urbanization rate will reach 60% by 2020. This means that China's total energy consumption will increase by 240 million tons of standard coal in the next four years due to the increase of urbanization alone. It can be seen that urbanization has an important impact on China's energy consumption, and the pressure on China's green and sustainable development is mainly in urban areas. At present, China is in the middle stage of rapid urbanization development, and the problem that urban spatial layout is not compatible with the carrying capacity of resources and environment is becoming more and more prominent. The direct and indirect effects of urbanization on energy consumption are increasing, and the relationship between urbanization and energy consumption in China has drawn wide attention from many scholars at home and abroad. Under this background, it is of great significance that to make objective evaluation of urbanization threshold effect on energy consumption, to accordingly formulate corresponding policies to promote the coordinated development of urbanization, energy and environment, and to provide energy security for the sustainable development urbanization construction of our country. This paper is organized as following. First of all, on the basis of the understanding of urbanization, this paper empirically

analyzes the relationship between urbanization and energy consumption, then investigates the changes of the per capita GDP in the eastern, middle and western China based on the threshold value, and finally put forward policy suggestions giving consideration to economic development and energy conservation to reduce energy consumption, promote the coordinated development of energy and economic.

2. Theoretical Background

At present, our country is in the important stage of rapid economic development, upgrading industrial structure and accelerating the urbanization process, domestic and foreign scholars have made fruitful results about researches on relationship between urbanization and energy consumption. By collating the existing literature, Wang Lei, etc. [1] and Ma Hailiang [2] both argue that the urbanization development plays a positive role in promoting energy consumption, so as to facilitate the intensive development of the energy consumption. Madlener and Sunak [3] studied from another perspective, pointing out that the energy consumption growth of countries in the stage of rapid urbanization is more significant.

However, Liu Jianghua *et al.* [4] used scenario analysis to draw the conclusion that the two goals of domestic urbanization and total energy consumption cannot be achieved at the same time. In the Suffering from this paradox, Wang Chongmei [5], Li Bin, Cao Wanlin [6] respectively analyzed the decoupling relationship between China's economic growth and energy consumption, ecological stress, pollution. Li Posong, Zhu Tan [7] introduced the theory of energy decoupling into urban planning, put forward corresponding technical ways of urban industrial development energy-saving evaluation, and provided a reference for future urbanization development path.

In addition, Guan Xueling *et al.* [8] set up a decoupling model based on China's 1980-2012 economic growth and energy consumption in the process of the urbanization, the results show that the process of urbanization can drive economic growth and can stimulate and restrain two-way energy consumption at the same time. In order to verify the existence of two-way effect of urbanization on energy consumption, Ma Hailiang *et al.* [9] only selected provinces among the Yangtze river economic belt to establish the threshold model. The results showed that: There is a significant threshold effect on industrial energy consumption and the urbanization rate. Using the urbanization rate as threshold variable, there are two structure change points. Before the first threshold point, the urbanization rate has a inhibitory effect on industrial energy consumption. After crossing the second threshold point, the urbanization has a positive effect on industrial energy consumption. Based on China's provincial static and dynamic panel model, Li Biao *et al.* [10] demonstrated that urbanization can significantly reduce energy consumption in the short term, but its long-term impact on energy consumption is significantly positive. From what has been discussed

above, the existing researches have provided the certain theoretical basis for understanding the relationship between urbanization and energy consumption, but there are still some deficiencies: most scholars failed to consider that urbanization has both positive and negative effects, that is to say, the threshold effect, on energy consumption in different stages of economic development. About Research carrier, some of the literatures use cross-section data to compare energy consumption statically and transversely between areas and are lack of time sequence analysis of the evolution of phased energy consumption, ignoring the nature of dynamic change of urbanization.

Therefore, this paper attempts to further expand from the following two aspects: 1) Based on the provincial panel data from 2005 to 2016, this paper chooses China's 30 provinces, cities and autonomous regions as the research object, uses the per capita as a threshold variable to construct threshold model, selects per capita GDP, Level of Industrialization, Urban Population Density, the proportion of the tertiary industry, Educational Level, Per Capita Budgetary Expenditure as control variables, and conducts empirical researches on the urbanization impact on energy consumption; 2) In order to provide theoretical guidance for the linkage development of various provinces in China, this paper investigates the changes of the per capita GDP in the eastern, middle and western China.

3. Data Selection and Description

3.1. Selection of the Variables

Based on the previous research and current situation, this paper chooses data from 2005 to 2016 of China's 30 provinces, cities and autonomous regions, selects the following variables: Energy Consumption, Urbanization Rate, per capita GDP, Level of Industrialization, Urban Population Density, the proportion of the tertiary industry, Educational Level, Per Capita Budgetary Expenditure. Details are presented in Table 1.

Table 1. Reports the evaluation index of self-organization ability of regional innovation system.

Classification	Variable	Abbreviation
Explained Variable	Energy Consumption	EC
Explaining Variable	Urbanization Rate	UR
Threshold Variable	Per Capita GDP	PCGDP
Control Variable	Per Capita GDP	PCGDP
	Level of Industrialization	LI
	Urban Population Density	UPD
	Proportion of the Tertiary Industry	PTI
	Educational Level	EL
	Per Capita Budgetary Expenditure	PCBE

1) Energy Consumption: On the one hand, energy, as an important material basis for economic development and people's livelihood, plays an important role in promoting the development of urbanization. On the other hand, the problems of carbon emission and haze pollution caused by energy consumption have further increased the construction cost of urbanization. Therefore, energy consumption should put more emphasis on green and sustainability. In this paper, the total energy consumption is used to represent the energy consumption indicators. The unit is 100 million tons of standard coal.

2) Urbanization Rate: The differences in the urbanization process are closely related to the unbalanced distribution of energy consumption. The urbanization rate plays an indirect but important role in the energy consumption of a region. In this paper, it is calculated by the proportion of urban population to total population.

3) PCGDP: PCGDP can be used to measure the level of economic development in a region, while the lower level of economic development has less impact on the scale of energy consumption. With the gradual development of the economy, the impact on the scale of energy consumption will also increase. In this paper, PCGDP is used as the threshold variable to explain the impact of urbanization on energy consumption under different economic scales.

4) Level of Industrialization: The level of industrialization is expressed by the proportion of industrial added value to GDP.

5) Urban Population Density: The most prominent feature of urbanization is the change of urban population density caused by urbanization of agricultural population. It is expressed by the proportion of the number of urban population to urban areas.

6) The Proportion of the Tertiary Industry: With the continuous transformation and upgrading of population, lifestyle and consumption habits, the optimization of industrial structure can improve the level of urbanization. In this paper, it is expressed by the proportion of tertiary industry to GDP.

7) Educational Level: It is expressed by the number of undergraduate students.

8)Per Capita Budgetary Expenditure: Urbanization development brings up people's income level, accordingly, their demand for welfare of the people's livelihood and social security level will also be increased, so the government should also correspondingly increase in fiscal expenditure to realize effective supply of public products and services.

Control variables: According to the previous researches of scholars, control variables should include per capita GDP, Level of Industrialization, Urban Per Capita Disposable Income, Urban Population Density, the proportion of the tertiary industry, Educational Level, Per Capita Budgetary Expenditure.

Among them, EC represents Energy Consumption, UR represents Urbanization Rate, PCGDP represents Per Capita GDP, LI represents Level of Industrialization, UPD represents Urban Population Density, PTI represents Proportion of the Tertiary Industry, EL represents Educational Level, PCBE represents Per

Capita Budgetary Expenditure.

3.2. Data Resource

The data are mainly from the "China Energy Statistics Yearbook", "China Statistical Yearbook", "China Urban Statistics Yearbook" from 2005 to 2016. The study object is China's 30 provinces and autonomous regions and municipalities, because the data are from the yearbook statistics, are single-handed information, the reliability and validity of the data have been tested. The method adopted in it is using SPSS20.0 to replace the partial missing data by average, then making the logarithm of the data. Moreover, it needs to be noted that the sample includes panel data from 30 provinces in China, in which data on energy consumption in Tibet are missing and removed. In addition, the research range of this paper was selected from 2005 to 2016, mainly for the following reasons: 1) The availability of data. Some of the key variables used in the study do not have complete annual data until 2005, and the data for 2017 has not yet been released. 2) It is related to the research topic. This paper mainly studies the how urbanization influences energy consumption, due to the recent ten years of rapid development of regional economy, energy consumption problems caused by urbanization are much more serious than the past, so many scholars' similar researches are mainly during this time, so this paper also studies the problem of this period. In conclusion, considering the availability of variables' data and the research theme, this paper selects data from 30 provinces in China from 2005 to 2016 for research on the basis of referring to previous studies.

4. Empirical Analysis

4.1. Descriptive Statistics

First, descriptive statistics of each variable are carried out. Import the specific data of the above variables into Stata 14 and run the corresponding program to get the basic conditions of the mean, maximum, minimum, standard deviation and etc. of each variable, and Table 2 displays the descriptive statistics on all variables over 2005 to 2016. All variables have 360 observations respectively. UR is 52.38% on average, PCBE is 7997.319, UPD is 2677.69 people/km^2. The gap between extreme value of PCGDP is the largest. All these show objective realities that China's large population and large UPD, low urbanization level and so on.

4.2. Unit Root Test

Before the panel econometric model is established, this paper takes a stationarity test of various variables. If the inspection result is not smooth, directly putting variables in the model can produce spurious regression. In unit root test, the model with neither intercept nor trend term is tested first. When the test results cannot reject the original hypothesis, the sequence is considered to be unstable. In order to guarantee the robustness of the test results, this paper uses EViews

Table 2. Results of data descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
EC	360	12624.71	8020.266	822.2	38723
UR	360	52.3835	14.03263	26.87	89.6
PCGDP	360	15949.39	14361.84	543.32	80854.91
LI	360	40.21911	8.195966	11.90417	56.49161
UPD	360	2677.689	1302.604	189	6307
PTI	360	41.99421	8.712383	29.7	80.23217
EL	360	392179.2	254036.8	5385	1076753
PCBE	360	7997.319	6329.431	1133.55	44513

6.0, applies Levin, Lin & Chu t, ADF-Fisher Chi-square, PP-Fisher Chi-square to determine whether each variable has a unit root. Test results are shown in Table 3.

As can be seen from Table 3, all variables are stable sequences and meet the threshold regression modeling conditions.

4.3. Hausman Test

Panel data model can be divided into fixed effect model and random effect model. Usually, Hausman Test is used to select the model. Hausman Test hypothesis.

The null hypothesis H_0: The model is a random effect model;

The alternative hypothesis H_1: The model is a fixed effect model.

In this paper, Stata 14.0 is used for Hausman Test. When the significance level is 5%, the p value is 0.0000. Therefore, the null hypothesis H_0 is strongly rejected and the fixed effect threshold regression model should be adopted.

4.4. Estimated Results of Threshold Effect

Logarithmic processing of data can reduce the large fluctuation of data without changing the estimation trend of the model. In this paper, the data of PCGDP and UPCDI are processed by logarithm in the model, which makes the model more convincing.

As shown in Table 4, Taking PCGDP as the threshold variable, the number of "self-sampling" was 360 times, and the p values of single threshold and double threshold were 0.0000 and 0.0057 respectively, both with significant test results. However, the test results for the triple threshold were not significant. Therefore, the double threshold model is selected to analyze the relationship between urbanization and energy consumption. Through the inspection result showed in Table 5, it can be concluded that there are two threshold values, 6188.8999 and 9266.3896.The corresponding 95% confidence interval is respectively [6169.7500, 6268.0098] and [9251.1504, 9273.4600].

The results of double threshold model are shown in Table 6. When using PCGDP as threshold variable, the urbanization level is divided into three stages,

Table 3. Unit root test of variables.

Variable	Include in test equation	Levin, Lin & Chu t	Prob.	ADF-Fisher Chi-square	Prob.	PP-Fisher Chi-square	Prob.
	I & T	−2.60573	0.0046	39.5307	0.9810	23.1386	1.0000
EC	I	−7.09255	0.0000	78.5148	0.0546	142.752	0.0000
	N	11.8771	1.0000	10.4238	1.0000	1.79826	1.0000
	I & T	−2.63502	0.0042	57.2499	0.5769	78.7175	0.0529
UR	I	2.18872	0.9857	20.1766	1.0000	30.9460	0.9993
	N	21.5072	1.0000	2.98066	1.0000	1.76700	1.0000
	I & T	−3.57767	0.0002	53.9494	0.6952	81.2655	0.0352
PCGDP	I	5.14803	1.0000	13.8360	1.0000	6.50901	1.0000
	N	13.0678	1.0000	22.2088	1.0000	0.53173	1.0000
	I & T	−3.55884	0.0002	46.2384	0.9041	55.6442	0.9023
LI	I	2.29149	0.9890	27.8631	0.9999	30.0976	0.9996
	N	−7.69265	0.0000	120.104	0.0000	122.932	0.0000
	I & T	−18.2379	0.0000	214.941	0.0000	329.266	0.0000
UPD	I	13.9935	1.0000	21.114	1.0000	36.696	1.0000
	N	0.45457	0.6753	49.8334	0.8224	28.3676	0.9998
	I & T	0.76816	0.7788	21.2371	1.0000	34.7423	0.9963
PTI	I	6.11746	1.0000	22.3497	1.0000	14.4401	1.0000
	N	14.9036	1.0000	5.93457	1.0000	6.53393	1.0000
	I & T	−4.89927	0.0000	70.0775	0.3358	85.9354	0.0157
PCBE	I	10.4408	1.0000	2.78305	1.0000	2.00182	1.0000
	N	17.1322	1.0000	4.52765	1.0000	0.31215	1.0000
	I & T	23.1644	1.0000	26.783	1.0000	32.714	1.0000
EL	I	6.11746	1.0000	22.3497	1.0000	14.4401	1.0000
	N	−5.48900	0.0000	84.6593	0.0197	121.962	0.0000

I & T represents Individual Intercept and Trend, I represents Individual Intercept, N represents None.

Table 4. Threshold effect test.

Threshold	F-stat	Prob	Crit10	Crit5	Crit1
Single	10.72	0.0000	5.4375	9.9649	16.3829
Double	27.29	0.0057	9.2289	12.7753	23.3909
Triple	8.65	0.5433	14.2749	20.2289	53.7285

Table 5. Threshold estimator (level = 95).

Mode 1	Threshold	95% Conf. Interval
Th1	6188.8999	[6169.7500, 6268.0098]
Th2	9266.3896	[9251.1504, 9273.4600]

Table 6. Model estimation results.

Variable	Coef.	t	P
c.urban (Stage 1)	186.2701	6.87	0.000
c.urban (Stage 2)	290.1599	9.10	0.000
c.urban (Stage 3)	195.9759	7.41	0.000
PCGDP	0.1833797	14.66	0.000
LI	1.247673	0.08	0.000
EL	0.0048472	0.26	0.012
PCBE	0.000327	1.97	0.029
UPD	0.10407884	1.11	0.000
PTI	−61.59878	−2.83	0.005
cons	1770.808	1.12	0.007

and coefficient estimators of three stages are significant at the 0.01 level, and all are positive. But the coefficient estimators reduce with the increase of phase, which means that the increase of the urbanization rate can promote energy consumption, but the effect gradually decreased. That is to say, when using PCGDP as the threshold variable to divide the stage, the relationship curve between urbanization level and energy consumption is increasing but decreasing with the increase of stage.

By observing other control variables, we can find that: 1) LI is significant at the level of 0.01 and has a positive correlation with energy consumption. As mentioned above, China's current national conditions, urbanization is built on the basis of high energy consumption, and industry is the main force of energy consumption. 2) PCBE is positively related with energy consumption, but the results are not significant, on the one hand may be because the control index selection is not reasonable, on the other hand, maybe we have chosen PCGDP so lead to the PCBE variable influence; 3) PTI is negatively correlated with energy consumption, which is significant at the level of 0.01. The Increase of PTI means that the structure optimization of economic development, energy consumption reduction and efficiency enhancement, which may have inhibitory effect on energy consumption.

In order to facilitate analysis, this paper took one year every three years for all provinces except Tibet. The statistics are divided into east, middle and west to find out the threshold crossing value. The empirical results are in Table 7, the threshold for the first stage (less than 6188.8999 yuan per person), there was an obvious trend of echelon in the eastern and western regions at this stage in 2005. The western provinces in this stage are the largest, the middle second, the east the least. In the same year, in the second (between 6188.8999 yuan and 9266.3896 yuan per person) and three phases (more than 9266.3896 yuan per person), there is still a trend of echelon, however, in contrast to the trend of the first stage, the eastern provinces in these two stages are the largest, the central

Table 7. Eastern, middle and western provinces across the threshold value.

Interval / Year	PCGDP ≤ 6188.8999	6188.8999 < PCGDP ≤ 9266.3896	PCGDP > 9266.3896
2005	East: Hainan, Tianjin, Middle: Anhui, Jiangxi, Jilin, Shanxi, Heilongjiang West: Gansu, Qinghai, Ningxia, Chongqing, Guizhou, Yunnan, Shaanxi, Xinjiang, Guangxi, Inner Mongolia	East: Beijing, Fujian, Shanghai, Liaoning Middle: Hubei, Hunan West: Sichuan	East: Guangdong, Hebei, Jiangsu, Zhejiang, Shandong Middle: Henan
2008	East: Hainan West: Gansu, Qinghai, Ningxia, Chongqing, Guizhou, Yunnan, Xinjiang	East: Tianjin Middle: Shaanxi, Jilin, Anhui, Jiangxi, Heilongjiang West: Shaanxi, Guangxi, Inner Mongolia	East: Zhejiang, Shanghai, Shandong, Liaoning, Jiangsu, Hebei, Beijing, Fujian, Guangdong Middle: Henan, Hubei, Hunan West: Sichuan
2011	East: Hainan West: Gansu, Guizhou, Ningxia, Qinghai	West: Xinjiang, Yunnan	East: Zhejiang, Shanghai, Shandong, Liaoning, Jiangsu, Hebei, Beijing, Fujian, Guangdong, Tianjin Middle: Shanxi, Jilin, Anhui, Jiangxi, Henan, Hubei, Heilongjiang, Hunan West: Chongqing, Sichuan, Shaanxi, Guangxi, Inner Mongolia
2014	East: Hainan West: Ningxia, Qinghai	West: Gansu	East: Zhejiang, Shanghai, Shandong, Liaoning, Jiangsu, Hebei, Beijing, Fujian, Guangdong, Tianjin Middle: Shanxi, Jilin, Anhui, Jiangxi, Henan, Hubei, Heilongjiang, Hunan West: Chongqing, Sichuan, Shaanxi, Guangxi, Yunnan, Guizhou, Inner Mongolia, Xinjiang

second, the western least, and the number of provinces across the third stage is smaller.

In 2008, the number of provinces in the first phase was greatly reduced, and most of which were western provinces. Most provinces were in the third stage in 2011. In 2014, Xinjiang and Yunnan were in the third stage, and Gansu passed from the first stage to the second stage. The situation in 2016 was almost the same as that in 2014, so we did not put it in Table 7. As can be seen from the above, the urbanization process of the country has a trend of echelon, with the eastern provinces developing the fastest, the middle region second, and the western region the slowest. There are significant differences in the urbanization

development in different areas. China should allocate regional resources reasonably so that three regions can develop in a coordinated manner.

Combined with results of Table 6, it also can be seen that many provinces achieved a phase-crossing in 2008, so 2008 is the point of a structural change. Moreover, the relationships among economic growth, urbanization and energy consumption are: 1) Before 2008, the urbanization and economic growth are complementary to each other, and with the rise of energy-intensive industries, energy consumption is increasing; 2) After 2008, the urbanization and economic growth still have a positive effect on each other. Although there is still an intensive degree of energy consumption, it does slow, which shows that China's industrial structure has been adjusted, and proves that the country's macro-policies such as energy conservation and emission reduction industrial structure optimization have certain effects.

5. Conclusions and Implications

In this paper, the provincial panel data from 2005 to 2014 of 30 provinces were analyzed, PCGDP was used as threshold variable, using the method of fixed point for threshold. The relations between urbanization rate and the energy consumption were discussed. Hope the result can provide some supporting materials and advices for further studies.

This paper examines the threshold effect of urbanization on energy consumption; however, due to the limitation of data resource and conditions, the research is still insufficient and needs to be further explored. The research object of this paper is mainly the total energy consumption, and not related to energy efficiency, energy consumption elasticity coefficient index, which need to be strengthened in the future study. In addition, the research of this paper is just based on a macro level to get a national economic threshold value. Given that the regional economic development and energy consumption of large differences, it still should study the actual threshold value according to local actual condition. And it is of more practical value for the development through researches of how to determine the actual economic growth rate and energy consumption growth rate by the actual threshold value of each region.

5.1. Conclusions

The country was divided into the eastern and western regions according to PCGDP, and the conclusions were as follows.

1) At different stages of economic development, urbanization promotes energy consumption.

2) Combined with the specific parameter estimation results, the double threshold effect is significant. When PCGDP is used as the threshold variable, the two threshold values are 6188.8999 yuan and 9266.3896 yuan respectively.

3) There are obvious regional differences in China's urbanization development. The urbanization level of eastern provinces is significantly higher than

that of the middle and western regions. The urbanization level in the middle region is different from that in the east, but it is also better than that in the west. The urbanization development in western China is relatively slow and the level is relatively low. The urbanization level between regions performs in a form of echelon.

5.2. Policy Advice

To sum up, the following suggestions are proposed.

1) Accelerate the coordinated development of all provinces and narrow the differences in urbanization development. In the allocation of resources, the market plays a decisive role in automatically adjusting the coordinated development of economy, population and energy. To coordinate eastern, middle and western urbanization and energy consumption, all provinces should pay attention to complementary resources and industrial advantages, the western region should introduce advanced technology and equipment, and the eastern takes the best of its natural resources and labor advantages, etc.

2) Promote the upgrading of industrial structure and the development of urbanization with low energy consumption. Optimize the industrial structure, accelerate the development of high-tech industries and services, appropriately increase the share of the tertiary industry, improve energy utilization efficiency, advocate the enterprise introduces the high efficiency and energy saving equipment, reduce the traditional high energy consumption industries such as coal, and promote development of new and high technology industries such as software and information services.

3) Grasp the law of urbanization's effect on energy consumption and control the energy consumption trend. When the urbanization rate has not passed the first threshold value, on the premise of controlling the total energy consumption, we should pay attention to the speed of urbanization development and give full play to the positive role of urbanization in the economy. When urbanization rate breaks through the second threshold value, we should pay attention to the development of the urbanization rate quality, improve the efficiency of energy use, as far as possible to prevent the development of urbanization have serious negative effect on energy consumption.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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