

# Chongqing low-carbon economic development study

## —Focus on fiscal and taxation policies

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**Abstract-** Developing low-carbon economy has become the only way to achieve sustainable development for a region, and is also the only way to deal with global warming. Developing low-carbon economy is helpful for Chongqing to achieve national strategy, alter the extensive economic growth mode and promote the building of “Five Chongqing”. The development of low-carbon economy cannot do without the guidance and support of the fiscal policy. This article analyzes the current situation of implementing supporting policies of financial expenditure and income which can promote energy conservation and new energy development. And it also compares with fiscal policies for supporting low-carbon economic development in developed countries. From that, we can get some problems of Chongqing to develop low-carbon economy, they are: lack taxes which is special for low-carbon economy, lack systematicness, the limited coverage of the policy, attention paid on low-carbon is not enough, lack of inter-organic complexes. Finally, this article promotes that the local fiscal and taxation policies promoting low-carbon economic development of Chongqing should focus on: developing a detailed low-carbon tax system, expand saving sectors’ taxes preferential scope, such as VAT, corporate income tax, giving personal income tax relief for their acts of low-carbon, increasing financial subsidies to support the development and utilization of new energy, enhancing public awareness of low-carbon and start universal low-carbon.

**Keywords-** low-carbon economy; fiscal policies; tax incentives

Low-carbon economy is an economic model based on low energy consumption, low pollution and low-emission. Developing low-carbon economy is a major initiative to implement the scientific concept of development and build a socialist harmonious society, and has important and far-reaching significance for adjusting economic structure, changing the growth mode, improving the quality of life of the people and safeguarding the long-term interests of China. As an

economic tool controlling by the government directly, the fiscal and taxation policies has a very important role in compensating for market imperfections and reflecting government policy. Chongqing is a low-carbon economy pilot city designated by the State, and itself also proposed a goal to developing into the country’s first low-carbon city, so the support of perfect-and-systemic fiscal policy is essential to promote the development of low-carbon economy in Chongqing. Therefore, exploring

a fiscal-support-policies and fiscal and taxation system which is suitable for the low-carbon economic development model of Chongqing has great practical significance for the development of low-carbon economy of Chongqing.

**1. The connotation of low-carbon economy**

"Low-carbon economy" was first seen in the 2003 Energy White Paper "Our energy future: Creating a low-carbon economy" in government documents of Britain. In this White Paper, the British Government established a clear goal for the development of low-carbon economy: reducing carbon dioxide emissions by 20% at the level of 1990 in 2010. In 2006, the "Stern Report", leading by the former World Bank Chief Economist Nicholas Stern, noted that global input GDP1% per annum, then can avoid GDP5%-20% loss annually in the future, then called on the world transfer to low-carbon economy.

Low-carbon economy is under the guidance of the concept of sustainable development to reduce the energy consumption of coal, oil and other high-carbon as far as possible by technological innovation, system innovation, industrial restructuring, new energy development and other means, to reduce greenhouse gas emissions, and achieve a win-win economic development patterns between the economic-social development and the protection of the ecological environment. Low-carbon economy advocated to achieve economic development goals by less greenhouse gas emissions emphasized the coordination of economic development and environmental protection. Low-carbon economy, from the technical point view, is naturally to improve energy efficiency and develop clean energy. The core is energy

technology innovation and institutional innovation, it is the mode of economic development, is the mode of energy consumption, is a new reform of human way of life, is a economic model based on low energy consumption, low pollution and low emission, and is also another major forwarding step in human society after the agricultural civilization and industrial civilization. Developing low-carbon economy , on the one hand, is committing to environmental responsibility positively, and is the requirement of completing national energy saving targets, on the other hand, is to adjust economic structure, improve energy efficiency, develop new industries and construct ecological civilization. It is a realistic way and is the inevitable choice to achieve a win-win situation of economic development and environment protection to reject past development mode of pollution firstly, treatment later, low-end firstly, high-end later, and extensive firstly, intensive later.

**2. The development status of low-carbon economic of Chongqing**

**2.1 The development evaluation of low-carbon economy of Chongqing**

Currently there are a lot of methods to evaluate low-carbon economy in academic circle. This paper evaluates Chongqing City's low-carbon economy development in a nutshell by drawing lessons from some relative scholars' evaluation model and evaluation index system (Figure 1). This article will not amply introduce the model and index system. This article will use Factor Analysis model to evaluate the low-carbon economic development of Chongqing.

**Table 1.** Evaluation index system of low-carbon city

Evaluation index system of low-carbon city	Technical and economic indicators	The Reciprocal of million Yuan of GDP CO2 emission	1
		The Reciprocal of billion Yuan of GDP SO2 emission	2
		Per capita GDP ( Yuan/person)	3
		The Compliance rate of industrial wastewater and slops emission	4
		The comprehensive utilization rate of industrial solid waste	5

		The proportion of tertiary industry	6
	Air environmental indicators	The reciprocal of annual average of SO2 concentration	7
		The reciprocal of annual average of NO2 concentration	8
		Air quality rate	9
		The percentage of environment protection investment in GDP	10
	Urban construction indicators	Green coverage rate of built area	11
		The bus number of million people	12
		The treatment rate of life garbage	13

**Table 2.** factor loading matrix

Indicators' name	factor loading matrix		
	1	2	3
The Reciprocal of million Yuan of GDP CO2 emission X <sub>1</sub>	0.873	-0.244	0.343
The Reciprocal of billion Yuan of GDP SO2 emission X <sub>2</sub>	0.963	0.057	0.198
Per capita GDP ( Yuan/person) X <sub>3</sub>	0.859	0.213	0.442
The Compliance rate of industrial wastewater and slops emission X <sub>4</sub>	0.732	-0.286	0.535
The comprehensive utilization rate of industrial solid waste X <sub>5</sub>	0.586	-0.482	0.565
The proportion of tertiary industry X <sub>6</sub>	0.881	-0.390	-0.183
The reciprocal of annual average of SO2 concentration X <sub>7</sub>	-0.083	-0.036	-0.868
The reciprocal of annual average of NO2 concentration X <sub>8</sub>	-0.160	0.536	-0.763
Air quality rate X <sub>9</sub>	0.521	0.091	0.640
The percentage of environment protection investment in GDP X <sub>10</sub>	0.296	-0.362	0.776
Green coverage rate of built area X <sub>11</sub>	-0.093	0.956	0.009
The bus number of million people X <sub>12</sub>	0.365	-0.819	0.395
The treatment rate of life garbage X <sub>13</sub>	0.088	0.966	-0.106

According to the load value (weight value) of various indicators in the factor loading matrix, we can calculate factor score of F1, F2 and F3. And we can construct evaluation model of urban low-carbon economy based on every factor's weight value and score.

$$F=(W1F1+W2F2+W3F3)/(W1+W2+W3)$$

Note: Wi is the variance contribution rate of the i-th

factor. According to the reference model, we can get W<sub>1</sub>=35.550%, W<sub>2</sub>=27.084%, W<sub>3</sub>=26.964%.

We can get every indicator's data for 2001 to 2010 by checking past Statistical Yearbooks of Chongqing, and according to the above method we can also calculate every factor's score and the score of low-carbon city level for 2001 to 2010 (table 3).

**Table 3.** The table of factor scores of Chongqing from 2001 to 2010

Year	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	F
2001	-4.84	-0.25	-3.36	-3.01
2002	-5.50	0.65	-4.96	-3.48
2003	-2.98	-0.76	-1.91	-1.99
2004	0.15	-2.39	2.07	-0.04
2005	-0.86	-1.36	-0.83	-1.00
2006	0.99	-1.70	0.22	-0.06
2007	0.10	0.00	0.52	0.20
2008	2.00	0.96	2.08	1.71
2009	4.71	2.14	2.56	3.29
2010	6.23	2.70	3.61	4.37

This score table just indicates the relative data, not the absolute score of low-carbon level based on sample data. If the score is a positive number that means this sample's low-carbon economy level is greater than the average, then we can get the opposite side result. From the above table, we can get that the level of low-carbon of Chongqing is constantly improving on the basis of their own original one in the longitudinal comparison. The data shows that per capita GDP of Chongqing reached 27600 Yuan in 2010 from 5700 Yuan in 2001, Air quality rate raised to 85% in 2010 from 60% in 2001, Green coverage rate of built area is from 17% up to 39%, and particularly the treatment rate of life garbage is from 65% up to 96%. Therefore, from Technical and economic indicators, Air environmental indicators and Urban construction indicators, we can get that Chongqing's economic level has improved, and the rate of enhance is increasing year after year. But after further analysis, we can easily get that it is not enough the development level of low-carbon economy of Chongqing, it is still in its infancy, for example the proportion of tertiary industry there is a declining trend from 43% in 2001 to 36% in 2010, comparing Shanghai and Beijing, they are also municipalities, their proportion of tertiary industry in 2010 has reached 58% and 75% partly. And the data shows that 70% of carbon emission comes from the secondary industry, so they are effective ways to become a low-carbon city to transport economic growth mode positively and rely on the tertiary industry to drive economy. Chongqing still has a long way to go on the road of low-carbon economy. There is a great room for improvement whether it is on the technical level, or on the level of environmental protection or even on the level of urban construction, various indicators are significantly

weak compared to other cities.

## 2.2 problems of developing low-carbon economy of Chongqing

### 2.2.1 Resource endowment constraint

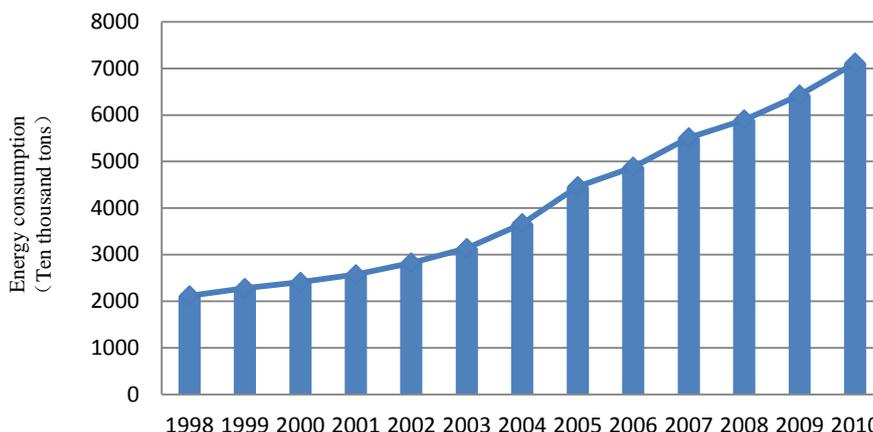
Chongqing is a place which is rich in coal, less gas and short of oil. Affected by resource constraints, the energy structure of Chongqing is dominated by coal, and the selection of low-carbon energy resources is limited. In electricity, hydropower only accounted for about 20%, while thermal power accounted for more than 77%, "high-carbon" is absolutely accounting for the dominance place. Coal is an important resource for the development of Chongqing. This kind of high-carbon energy structure cored with coal is a constraint factor for Chongqing to transport to a low-carbon development model. Chongqing utilizes natural gas just accounting for 12% in total energy consumption, which has less pollution for air, not to say pollution-free energy – water energy, wind energy, solar energy and nuclear energy. If Chongqing want to reduce energy consumption with high pollution and reduce emissions with harmful substances, it should increase the development and utilization of new energy.

### 2.2.2 The energy demand increases

With the rapid economic development of Chongqing and the continuous progress of industrialization, urbanization and modernization, Chongqing mainly develops infrastructure construction vigorously such as transportation, and construction, and together with the continuous improvement of living

standards of urban and rural residents, the demand of resources, especially energy, is increasing day after day. Especially after being a municipality, the energy consumption of Chongqing straight up, and the total energy consumption increased from 2119.46 tons of

standard coal in 1998 to 7117.41 tons in 2010, increased more than three times, compared to 91.71 tons during 1949, increased more than 77 times. The energy demand increase directly results the enormous pressure of the ecological environment.



**Figure 1.** The trend graph of Chongqing’s annual total energy consumption from 1998 to 2010  
The data comes from Chongqing Statistical Yearbook, the same below.

**2.2.3 The imbalance of industry structure**

As one of the six old industrial bases of China, Chongqing’s traditional industries, especially has a great proportion of high carbon emission and heavy chemical industries, Chongqing has a wide range and a great amount of industrial pollution sources, the economic growth has obvious extensive features. View from three industries’ contribution to the GDP of Chongqing in recent years, the contribution of the first industry reached more than 10% before 2005, from 2006 to 2010 it’s just about 10%, even in 2010 only be 8.6%, while the secondary industry’s and the tertiary industry’s contribution is about 40%, and the secondary industry’s has an increasing trend (Figure 2). The industrial economic structure of Chongqing is seriously irrational. And the proportion of light and heavy industry are

unreasonable, and the light industry developed relatively slow. In 2010, the output value of light industry is just only in 12.4%of the heavy industry’s total output value, especially the three pillar industries, machinery industry mainly consists of automotive and motorcycle, chemical industry mainly consists of natural gas chemical industry and pharmaceutical & chemical, and metallurgical industry mainly represented by the high quality steel and high quality aluminum, they all belong to the heavy industry. In addition, the development of traditional industries and high-tech industries is uncoordinated; the development of high-tech industries is slow. The secondary industries’ development need to consume a lot of energy, and emit large quantities of greenhouse gases. The energy consumption of the secondary industries of Chongqing had increased year by year after it became a municipality (Figure 3).

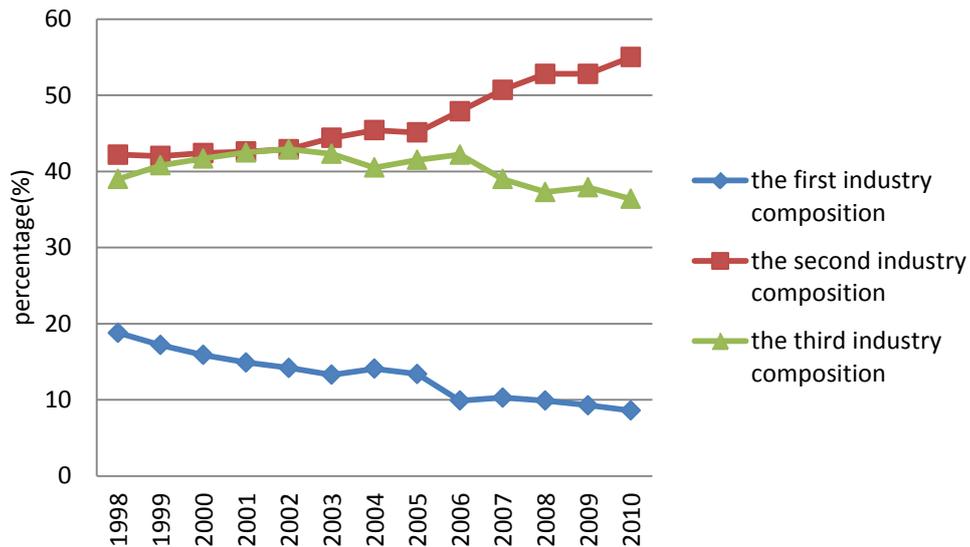


Figure 2. The trend graph of three industries' composition of Chongqing from 1998 to 2010

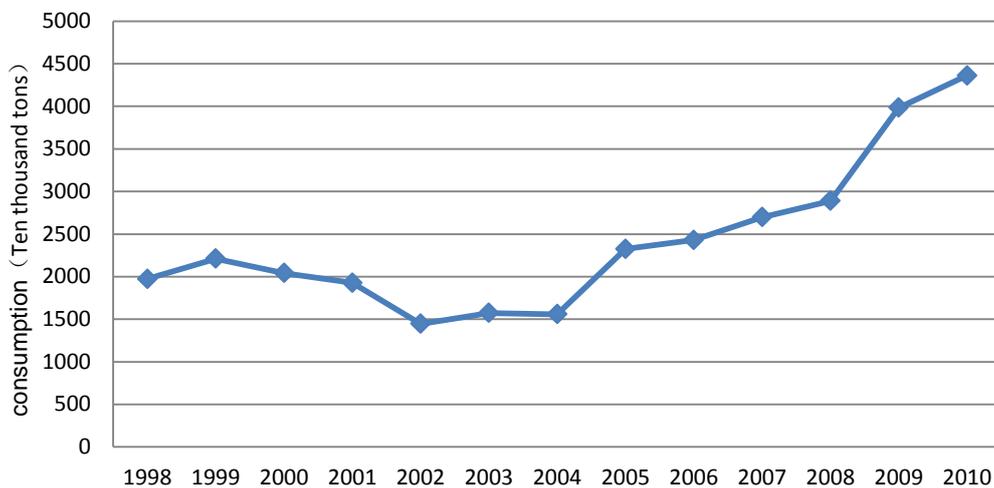


Figure 3. The energy consumption trend graph of the second industry of Chongqing from 1998 to 2010

### 2.2.4 Severe environmental pollution

For a long time, Chongqing views coal as the main energy, the urban air pollution is serious because of continually expanding the scale of the main city and the construction of the main city, as well as the rapid growth of the motor vehicle ownership. If the authorities want to reverse the current situation, it need take a long time to improve. After the water storage of the Three Gorges Reservoir, the velocity of flow became slow, the water self-purification capacity is reduced, the shore of pollution is widened, and the water environmental capacity is smaller. Meanwhile, the main secondary rivers are also contaminated, resulting in watershed pollution and regional pollution. In the main city, the large number

of emissions of industrial sewage and life sewage cause a big trouble to the residents' lives, and made the environmental pollution is more serious. And Chongqing take treatment in the end as the main way to govern the environment, this kind of governance is difficult to fundamentally ease the pressure on the environment. On the one hand, enterprises are lack of the enthusiasm to sustain because of large investment, high costs, long construction period and low economic returns. On the other hand, the way of treatment in the end tend to make the pollutants from one form into another one, such as governing emission will produce wastewater, governing wastewater will produce sludge, and governing solid waste will produce emission and so on, so it's difficult to fundamentally eliminate pollution.

### 3. Comparative analysis of fiscal policies of Chongqing develops low-carbon economy and external fiscal policies

#### 3.1 the existing fiscal policies comparison

Been formally proposed the term “low-carbon economy” by the British government in 2003, governments have taken measures to achieve its

low-carbon development, and have proposed and implemented fiscal and taxation policies to promote low-carbon economic development which are suitable for their own country’s development. Chongqing responded to the national call, it proposed some low-carbon economic policies which are suitable for its areas’ development by itself in addition to implement country’s policies. The following is a sample list of fiscal policies of Chongqing and abroad (Table 4).

**Table 4.** Comparison table of low-carbon fiscal policies of Chongqing and abroad

	Chongqing	Overseas
The same fiscal and tax policies	<ul style="list-style-type: none"> <li>① increase fiscal capital expenditures for energy conservation</li> <li>② implement government subsidies policy</li> <li>③ implement preferential taxation policies</li> <li>④ invest in the development of new energy and renewable energy</li> </ul>	
Different fiscal policies	<ul style="list-style-type: none"> <li>① financial assistance policies for Chinese Government’s Consumer Electronics Subsidy Program and Trade-in</li> <li>② arrange special funds, “use incentives rather than subsidies”</li> </ul>	<p>British: enacted a special bill to support low-carbon development, implement climate tax, launch a climate-change agreement institution</p> <p>Japan: implement subsidies for home solar</p> <p>United States: implement green-procurement plan in government</p> <p>Others: tax on motor vehicles by displacement size, take a different tax rate on oil, gas and coal for private, industrial users and utilities</p>

#### 3.2 The insufficient points of fiscal measures to promote the development of low-carbon economy in Chongqing

We can easily get from table 4, there are some insufficient points in the fiscal and taxation policies to promote the development of low-carbon economy in Chongqing. Specifically:

##### 3.2.1 lack taxes just for low-carbon economy

At present, China doesn’t have the specific taxes levy on carbon dioxide or other greenhouse gas emissions. The absence of such taxes limits the efforts to control the emission behavior of greenhouse gas. It is difficult to

form special funds for low-carbon development, and weak the role of tax aspects in the environmental protection. In China’s tax system, there are only some of taxes with the nature of the greenhouse gas emission reduction; they are corporate income tax, VAT. As a developing country, China’s rapid economic development will certainly lead to a large number of energy consumption and huge greenhouse gas emissions. We cannot go the old way of “pollution first, treatment later” the developed countries went. We should take advantage of the advantage of developing behind, change the mode of economic growth, and develop low-carbon economy, and open a green road of sustainable development. However, setting specialized taxes is essential for the development of low-carbon economy.

### **3.2.2 lack of systemic and limits of policy coverage**

At present, China is lack of systemic policies and regulations to support low-carbon economic development, and the existing policies and measures are all concentrated on the energy saving. Although Chongqing has taken some tax incentives to support energy conservation and emission reduction as well as the development of new energy, these policies are more scattered, and not form a comprehensive supporting policy system. In addition, the coverage of Chongqing local fiscal policy is limited, just include technology change for energy-saving in industrial enterprise, eliminate backward production capacity, building energy efficiency, sulfur dioxide emission reduction, and new energy development and production. While, there is not clear tax support policies for energy conservation service industry and residents' low-carbon consumption.

### **3.2.3 tax policies didn't pay enough attention to low-carbon , and lack of organic complexes between them**

Although the relevant taxes have given tax support to the implementation of low-carbon economy, and also made appropriate provisions, such as corporate income tax, VAT, consumption tax and vehicle purchase tax, on the whole, these measures are far from sufficient to fully support carbon economic development, in other words the support to the low-carbon economy is not enough, only a very small portion of the policy measures can really play a role in promoting the development of low-carbon economy. Second, the existing taxes which is self-contained and relatively independent, does not establish a green tax system, is not enough for the integrity of the tax system, and does not form a compact tax system to promote sustainable economy and social development. If we want to achieve the goal of energy saving and emission reduction, we need organize coordination among the various tax policies.

## **4. Fiscal and tax policies recommendations for the development of low-carbon economy in Chongqing**

### **4.1 develop a detailed low-carbon tax system**

Chongqing should develop appropriate policies and regulations, so that the implementation of low-carbon economy is legalization, and also make it more authoritative. Chongqing and even the country should develop a comprehensive tax system to promote the development of low-carbon economy, for example eco-taxes, setting resource tax, fuel tax, waste disposal tax and environmental pollution tax in that tax system, so that it can ensure enterprises or individuals can implement energy conservation. Furthermore, the development of low-carbon tax incentives program will comprehensively reflect the tax incentives which promote the development of low-carbon economy, and it also can inspire enterprises and individuals to consciously product in low-carbon.

### **4.2 expand saving sectors' taxes preferential scope, such as VAT, corporate income tax**

Expand the VAT, corporate income tax or other taxes promotions range of energy saving in Chongqing. At present, there are few green tax items in VAT, corporate income tax or other taxes which can promote low-carbon development. VAT is mainly concentrated in the comprehensive utilization of resources, and the relevant provisions in corporate income tax is more less, and it is not conducive to the development of low-carbon industry and new energy industry. To promote the development of low-carbon economy, it is necessary to expand the scope of tax incentives, such as exempting or abating VAT from recycling economic equipment which can promote energy saving, and sales of environmental monitoring and research instruments, gradually reduce the VAT rate of low-carbon industry and new energy industries, or implement tax exemption and tax reduction of front-end retreat, and implement high rate of VAT for those products or technology which are not conducive to the development of low-carbon economy. The corporate income tax could carry out exempting or halving tax to promote the development of low-carbon economy. And it is also necessary to expand the range of tax incentives of others taxes.

### **4.3 give personal income tax relief for their acts of**

### **low-carbon**

The taxpayers in the current carbon tax program are just only enterprises and units which directly discharge carbon dioxide to nature. From the view of promoting people's livelihood, carbon dioxide emissions from the use of coal and natural gas in personal life should also include in the scope of carbon taxpayers. Therefore, to promote low-carbon universally in Chongqing, in the personal income tax, the government could make Chongqing as a pilot of the personal income tax incentives, and give Chongqing authorities in setting tax cuts. For example, individuals who replace high-power cooling and heating equipment with low-power devices and who purchase energy-saving or environmentally vehicles or electric vehicles, can get individual income tax return in a certain proportion in total expenditure.

#### **4.4 increase financial subsidies to support the development and utilization of new energy**

Vigorously developing wind, solar, geothermal, biomass, hydrogen and other renewable energy sources; under the premise of using the most safe and most advanced technology to develop nuclear power actively; relying on the Three Gorges Dam, developing water-power, strongly promoting clean coal technology and promoting low-carbon of energy structure on the basis of protecting ecological environment. Giving those enterprises large financial subsidies and tax breaks or locate financial funds directly who develop or utilize above energy.

#### **4.5 enhance public awareness of low-carbon and start universal low-carbon**

Energy conservation is a universal cause and need common concern and active participate of whole society. Chongqing should actively carry out energy conservation publicity and education to raise public awareness of energy conservation. Chongqing also should actively organize "Energy Conservation Week" activities, vigorously promote energy saving work, carry out campaigns for energy saving, and constantly improve whole society's awareness of energy conservation. This also reduces resistances of low-carbon economic

development and achieves all parties' support.

### **References**

- [1] Wang Yan, Li Wu, Review of low-carbon economy, Journal of Inner Mongolia University (philosophy and social sciences), 2010(03)
- [2] Deng Zhong, Li Rui, Zhao Fang, Literature review and commentary of research on the theory of low-carbon economy, Download Center of Chinese Papers, 2011-04-27
- [3] Financial Highlights Research Group of Guangxi, Fiscal and tax policies research to promote the development of low-carbon economy in Guangxi, 2010-11-12
- [4] Wu Kai, Wu Yan, Research on the status quo of low-carbon economy and sustainable development of Chongqing—Base on the accounting system of integrated green GDP, Resources and Development, 2011 27(03)
- [5] Wang Hao, Zhao Aifeng, Path analysis of Chongqing to develop low-carbon economy, Economic Research, 2010(11), 41-42
- [6] Zhao Aifeng, Research on tax policies of Chongqing to develop low-carbon economy, Chinese HowNet Digital Library, 2011-07-12
- [7] Admin, Summary views of academic Salon on developing low-carbon economy and fiscal policy, Zhejiang Normal University, Zhejiang Finance Society, 2011-11-16
- [8] Ma Mingyuan, Eleventh Five development of recycling economy in Chongqing, Journal of Chongqing University, 2007-06-01
- [9] Jiang Yunting, Strategy analysis of foreign countries developing low-carbon economy and enlightenment, Low-carbon economic network of Chinese urban, 2011-07-29
- [10] Guo Yin, Wang Minjie, Experience of international low-carbon economic development and Implications for China, Reform and Strategy, 2009(10)
- [11] Wu Guodong, Wang Xiang, Ecological tax design to develop recycling economy in Chongqing, Contemporary Economy, 2008(08)
- [12] Ma Xinru, Ma Yan, China's low-carbon economy and government decision-making, Low-carbon economic network of Chinese urban, 2011-06-13

[13] Zhao Ti, Suggestions for low-carbon economic development of Chongqing, Operators and Managers, 2010(05)

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