

The Analysis of Guangxi Environmental Problems of Urbanization and Low-carbon Development Strategy

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Abstract The urbanization of Guangxi starts late, and it has developed rapidly, but in the process of urbanization, industrial and energy structure is irrational, resulting in the growing problem of cities and towns pollution. So changing the traditional development model of urbanization, implementing low-carbon development path is necessary. Based on the status research of Guangxi urbanization, this article analyzes the main features of urbanization in Guangxi, finding the problems of increasing environmental pollution, the construction of environmental protection facilities lag, lack of green assessment system, and other issues caused by the irrational industrial structure. This article puts forward four low-carbon development proposals: first, establishing a green GDP examination and evaluation system, strengthening supervision and restraint effect; second, adjusting industrial layout, enhancing the level of industrial development; third, improving the environmental management system, and strengthening environmental infrastructure; and fourth, using low-carbon development and sustainable development as guidance, carrying out scientific urban planning. The purpose is to promote the healthy development of urbanization in Guangxi and explore a new and sustainable, low-carbon development-oriented urbanization road.

Keywords Environmental issues · Industrial structure · Low-carbon urbanization · Pollutant emissions

1 Introduction

Now, Guangxi is in the stage of rapid development of urbanization, with an average growth rate of urbanization rate reaching 1.73 %, higher than the national average. However, the overall urbanization rate of Guangxi is lower than the national

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average (Xu 2010). Statistics shows that from 1953 to 2012, the urbanization rate increased from 8.52 to 43.53 % in Guangxi, and the urbanization rate is always lower than the national average urbanization rate of about 10 %. Guangxi urbanization rate in 2012 ranked 26th in 31 provinces and municipalities, just ahead of Henan, Gansu, Yunnan, Guizhou, and Tibet provinces.

Though it can stimulate domestic demand and promote economic growth by urbanization in Guangxi, there are also high energy consumption, high waste, high pollution, and many other hazards and environmental issues (Li 2014). Therefore, using the guidance of ecological civilization (Pan 2011), taking a low-carbon urbanization, and handling the relationship between economic development and environmental constraints has become an urgent task for us (Pan et al. 2014).

2 The Main Feature of Urbanization in Guangxi

2.1 Urbanization Has Changed Guangxi Industrial Structure, and Industry Has Become the Leading Industry

Accompanying urbanization, the industrial structure of Guangxi has changed every year; Fig. 1 summarizes the industry contribution to economy from 1978 to 2011 in Guangxi.

As can be seen from the figure, the primary industry contribution ratio to GDP is showing lower trends in Guangxi. The contribution rate was 40 % in 1978, and it dropped to 17 % in 2011; while the second and tertiary industries' contribution rate is increasing, especially the contribution rate of the secondary industry increased by about 15 % since 2002–2011. With the start and carrying out the country's Western development strategy, Guangxi has been undertaking industrial transfer from the eastern region, constructing a lot of industrial parks, and the industrial output increasing significantly; thus, the industry has been becoming the dominant

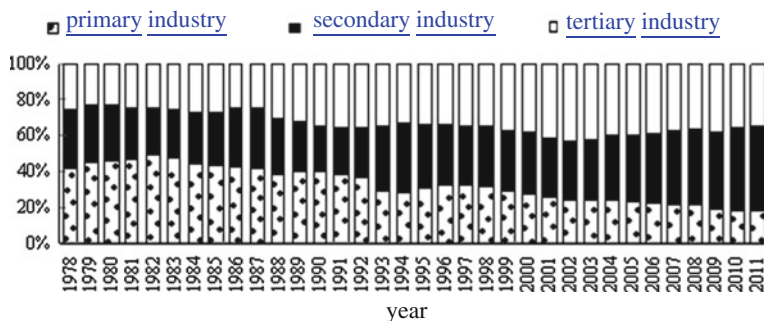


Fig. 1 Schematic of industry contribution to economy 1978–2011 in Guangxi

industry in Guangxi. Though the tertiary industry growth rate has declined slightly in the recent 10 years, the varying trends of proportion of tertiary industry are relatively stable, and the tertiary and second industry still has promoted jointly regional economic development in Guangxi.

2.2 Urbanization Changes Energy Use Patterns, Industrial Coal Increases Year by Year

1. Coal Consumption

Guangxi is still in the early stage of development of urbanization and industrialization; as technology advances, energy consumption indicators show an upward trend over a period of time, and due to a faster pace of development than the more developed regions, the total growth trend is very clear. Statistics of the rate of urbanization and energy use structure from 2003 to 2012 in Guangxi (Table 1) shows that Guangxi urbanization rate was 43.53 % in 2012, compared with 2003 increased by 54 %; the total coal consumption was 70,749,600 t, compared with 2003 increased by 2 times. Among them, due to the accelerate of growth rate of industrial output, the industrial coal consumption indicators continued to rise, and the industrial coal consumption increased by 2.2 times from 21,606,300 t in 2003 to 68,773,400 t in 2012; the life coal consumption grew by only 46 %, and basically kept stable since 2005, which is because the life coal consumption of urban residents of Guangxi used mostly liquefied petroleum gas, coal gas, natural gas, and used the lower proportion of direct fire coal.

2. Electricity Consumption

With the improvement of living standards of urbanization, per capita electricity consumption continues to increase, and with urban population growth, the total amount of electricity grows substantially. As can be seen from Table 1, with the improvement of the urbanization rate, the per capita electricity consumption of urban, rural residents in Guangxi showed a significant increasing trend. Per capita electricity consumption of urban and rural in 2012 was 434.11 and 202.13 kw h/a, respectively, just increased doubly compared with 2003.

2.3 Urbanization Changes Quantity of Pollutant Discharged, and the Environmental Pressures Continues to Increase

Table 2 summarizes the behavior of industrial pollutants emissions from 2003 to 2012 in Guangxi. By analyzing, we can see that the contradiction between urbanization development and environmental pollution was still very prominent, especially the total amount of industrial waste gas emissions continued to rise, and the regional atmospheric environment was deprecating; since 2013, the winter haze

Table 1 The changes of rate of urbanization and energy use structure in Guangxi

Statistical year	Guangxi urbanization rate (%)	Coal consumption (10,000 t)			Electricity consumption (kw h/a)		
		Total coal consumption	Life coal consumption	Industrial coal consumption	Total electricity consumption	Town	Country
2003	28.30	2,295.84	135.21	2,160.63	274.84	183.67	91.17
2004	29.06	2,828.30	150.97	2,677.33	256.29	159.38	96.91
2005	31.70	3,040.49	158.55	2,881.94	295.24	190.30	104.94
2006	33.62	3,602.76	194.83	3,407.93	330.65	217.81	112.84
2007	34.64	4,165.68	190.78	3,974.9	358.80	231.68	127.12
2008	36.24	4,511.61	168.06	4,343.55	410.42	266.24	144.18
2009	38.16	4,687.10	189.54	4,497.56	446.84	290.23	156.61
2010	39.20	5,345.55	194.99	5,150.56	462.10	300.9	161.20
2011	40.60	6,104.52	196.90	5,907.62	563.20	377.53	185.67
2012	43.53	7,074.96	197.62	6,877.34	636.24	434.11	202.13

Table 2 Guangxi industrial pollutants emissions

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Industrial waste gas emissions (hundred million standard m ³)	6,635.3	10,656.5	8,338.3	8,969	12,723.5	11,643.0	1,318.1	14,519.6	29,853.5	27,610.7
Discharge of industrial waste water (hundred million t)	11.9	12.2	14.6	12.9	18.4	20.6	16.2	16.5	10.1	11.1
Industrial solid waste emissions (10,000 t)	108.71	131.83	110.48	22.74	10.34	8.66	7.97	8.12	2.57	0.41
Sulfur dioxide emissions (10,000 t)	72.0	89.7	97.5	94.4	92.6	87.0	83.5	84.8	48.9	43.1
Ammonia nitrogen emissions (10,000 t)	3.1	5.0	5.7	3.6	2.5	2.1	1.4	1.4	0.85	0.86
Chemical oxygen demand emissions (10,000 t)	62.5	69.3	66.4	67.9	60.8	56.0	51.9	49.3	20.5	20.0

phenomenon occurred frequently, and the environmental pressures continued to increase. The total amount of industrial wastewater discharge showed a downward trend after the first rise, industrial solid waste decreased year after year, and emissions of sulfur dioxide, ammonia nitrogen, and chemical oxygen demand experienced a trend of decrease after the first increase. The reason of the above changes was that along with urbanization and rapid industrial development, industrial “three wastes” emissions increased at the same time. With the development of science and technology, “three wastes” handling capacity enhanced, and the emissions of pollutants decreased gradually which was brought from industrial development during the process of urbanization.

3 The Major Environmental Problems of Urbanization Exist in Guangxi

3.1 The Urbanization Quality is Low, Without the Establishment of Ecological Assessment System

Guangxi urbanization rate was rapid, but the urbanization quality was low, showing in 4 parts that economic targets over the desired, environmental targets was difficult to complete; development targets over the desired targets of people’s livelihood were difficult to complete; targets of number over the desired targets of quality were difficult to complete; area of land used for construction over the desired; The urban population was difficult to complete. Moreover, with only economic objectives as the focus of assessment, and the lack of a scientific and rational evaluation system, the development of environmental protection was slower than economic development (Li and Xia 2012). The phenomenon of pollution accidents occurred frequently in the process of urbanization, which has become the key factor that restricted the development of urbanization in Guangxi.

3.2 Industrial Structure is Unreasonable, and Structural Pollution is Serious

Whether the industrial structure is reasonable will directly impact the rationalization level of urbanization and the entire economic structure. In the process of economic growth, the first industry and third industry produced less pollution, and the second industry especially was the main pollution source (Li and Jiang 2009).

Urbanization and economic development of Guangxi mainly relies on industrial production. The changes of Guangxi industrial coal consumption from 2003 to

2012 display that industrial development still mainly relies on coal. Guangxi industrial base was low and no reasonable planning and control of the industrial production scale in the process of development, because that coal consumption is increasing year by year. Depending on coal resources excessively will bring the ecological problems of resource depletion, the environmental problems of atmospheric pollution, and other problems. It will restrict the development of Guangxi urbanization.

3.3 Construction of Environmental Protection Facilities was Backward, and Capital Investment was Insufficient

The urbanization of Guangxi was the traditional urbanization, the extensive development way; economic growth is too dependent on the consumption of resources and energy. The rapid development of population and industrial production, limited environmental pollution control technology and capital, and lack of environmental protection facilities have resulted in a significant increase in emissions of pollutants and urbanization rates. With the increase of the national and Guangxi emission reduction efforts, enhancing environmental protection policy, and financial and human inputs, the environmental pollution control capacity of new construction projects has improved, but the industrial pollution problems left over by history are still not resolved thoroughly.

Environmental pollution control investment accounted 1.71 % for the proportion of Guangxi GDP, which ranked 8th of nation. But according to the experience of developed countries, environmental protection investment accounted 3 % or above for GDP, and environmental quality will improve. Apparently, the Guangxi environmental protection investment is far for this target, and Guangxi environmental governance and supervision level is far below national leading level.

3.4 Lack of Technological Innovation Driving Force, the Implementation of the Strategy is not in Place

Economic transformation is the internal motivation to make the traditional urbanization to shift to a low-carbon urbanization, by promoting the application of the technology innovation in urbanization construction, which will lead to the transformation of the economy, and the new urbanization pattern will inevitably arise. Otherwise, the traditional economic growth mode which is of high cost, high energy consumption, high pollution, and resource-based will be with the traditional urbanization patterns. As a western province, relying too much on the eastern industry transfer to promote urbanization is not conducive to cultivate inner innovation drive and hinder the economic development and transformation.

Guangxi has been prepared with urban agglomerations and major cities development planning and master planning, but there are inconsistencies in goal setting and urban development orientation, which cause confusion and even obstacles to the development of urbanization. And it is lack of sufficient communication between departments, and in the urbanization strategy formation process, it has not yet considered resources and environmental factors, and the guide and binding functions from environmental objectives.

4 Countermeasures and Suggestions

4.1 Establish Green GDP Examination Evaluation System, Strengthen the Effect of the Supervision and Constraint

Based on the requirements of optimizing the land space, promote resource conservation, strengthening environmental protection and system construction; it should build low-carbon urban ecological civilization construction assessment system which includes economic development, social development, and environmental development, also it should bring into the annual performance evaluation content of government and relevant departments (Zhang 2012). In the process of assessment of urbanization, it should include considering resource and environment elements, combined with the relevant requirements of the environmental protection strategy setting, attaching great importance to the accessibility of environmental protection goal, and establishing the target system, assessment method, rewards, and punishment mechanism which meet the requirements of ecological civilization.

4.2 Adjust the Industrial Layout, Enhance the Level of Industrial Development

To adjust the industrial layout, it should be on the basis of the national energy-saving goal, establishing more stringent regional energy conservation policy (Zhou 2012). By carrying out the total target control in advance, it will implement that the total energy consumption declines ahead of time, it will reduce the dependence on the resource especially energy from development, speed up the transform and upgrade traditional industries, and limit the development of industries which make large resource consumption and serious pollution. Encourage the development of high and new technology industry and the development of low consumption and high-value-added products, actively developing service industry, and promote the development of the financial industry, insurance industry, modern circulation industry, and new services which has a significant impact on social economic life.

To synchronize to promote agricultural modernization and new rural construction, to improve the efficiency of agricultural production, to liberate rural labor will lay a solid foundation of urbanization. Attaching great importance to the integration of urban and rural development, strengthening the construction of equal social service facilities, improving the rural public service and ecological service level, and enhancing rural and agricultural ecological infrastructure construction, it will realize the organic combination for the new rural construction and urbanization. Adjusting measures to local conditions to develop small towns, it will raise the level of small town life service (Cao et al. 2011). At the same time, the feedback effect of the township enterprise, which used small towns as the carrier on the agriculture, will promote the development of agricultural modernization and industrialization, and increase farmers' income and living standard.

4.3 Improve the Environmental Management System, to Strengthen Environmental Infrastructure Construction

To strengthen the construction of township-level environment management institutions, take the environmental planning as an important part of urban planning, and use the ecological civilization to guide the urbanization development will fully embody the development of the holistic and strategic; to use the policy such as fiscal, financial, and land, strengthen the supervision and management of the environment; to carry out and comply with the environmental protection laws and regulations will enhance the awareness of the environment of the rule of law.

To increase the construction of urban environmental infrastructure, especially investment of environmental protection facilities and pipe network in medium and small towns and the old city, and improve the environmental governance ability construction of Guangxi, it will alleviate the environmental pressure of the urbanization process. To improve the disposal ability of sudden environmental accidents, and establish a perfect environment monitoring and early warning system, it will fully reflect the status of environmental monitoring quality and trends, accurately warning of various environmental emergencies.

4.4 Guided by the Low-carbon Sustainable Development, Carry out Scientific Urban Planning

Scientific and rational pattern of urban space can enhance the comprehensive carrying capacity of cities and prevent the excessive expansion of the main city, and also effectively promote the coordinated development of medium cities and towns, and to realize the division of various functional areas and its role in function (He 2013).

1. Principles of conservation, rational use of land, and space resources to implement in urban planning, construction, and management, and demonstrate the overall coordination of resources, environmental infrastructure, and urban development, it will realize for optimal allocation of resources in a larger range;
2. Reduce environmental pollution by optimization of urban space and the industry layout, optimizing space layout and industrial structure on the basis of different environmental function districts and the resource environmental bearing capacity requirements;
3. Implement the higher environmental standards in the new urban district and new town construction, so as to realize the harmonious development of economic and social development and ecological environment;
4. Increase the investment of urban environmental infrastructure and the proportion in GDP (Xiu et al. 2007); it will guarantee the healthy and fast development of new urbanization.

5 Conclusions

The central economic work conference has put forward “fully integrated the ecological civilization concept and principle into the whole process of urbanization, taking a new urbanization road of intensive, smart, green and low-carbon” in December 2012. Therefore, the development of urbanization in Guangxi should be the perspective of ecological civilization and environmental protection; optimize the industrial layout, enhance the level of industrial development, and improve the rational use of resources and energy; perfect environment management system, enhance the level of pollution control, reduce the negative effects of urbanization development on the environment, and make the harmonious development of the urbanization of population agglomeration, space utilization, economic development, and social urbanization, to avoid the one-sided pursuit of space expansion, city scale, and only on the GDP; with the economic and social development, strictly implement the national environmental policy and the related policies and requirements of constructed ecological civilization, increase the intensity of environmental protection, to avoid the load that “treatment after pollution” and at the expense of the environment for economic growth, and it will realize the healthy and low-carbon development of the urbanization construction in Guangxi.

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