Sustainable development of ecological environment in resource-based cities in Heilongjiang Province

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Abstract. Based on the specific situation of ecological environment of resource-based cities in Heilongjiang Province, this paper puts forward the development goal and key points of sustainable development of ecological environment, and puts forward the guarantee measures of sustainable development of ecological environment of resource-based cities from three levels of government, enterprise and the public.

1 Introduction

With the construction of eco-cities and balanced economic and social development as the core, we will promote modernization, informationization and sustainability in an all-round way. We should build a healthy and safe environmental maintenance system based on environmental protection to advocate industrial prosperity and build a sustainable industrial economic system with strong comprehensive competitiveness. We also should highlight the characteristics of the natural landscape of the region, the landscape protection and construction, take ecological culture as the main vein, and jointly develop material civilization and spiritual civilization. Relying on the geographical advantages, the sustainable development capacity of resource-based cities will be improved, and the harmonious goals of economic development, environmental security and social progress will be achieved.

2 Empirical study based on DEA-CCR model

The CCR model can be depicted as the following formulation:

$$\begin{aligned} h_k &= \max \sum_{r=1}^s u_r y_{rk} \\ \text{subject to } & \sum_{i=1}^m v_i x_{ij} - \sum_{r=1}^s u_r y_{rj} \geq 0 \quad \text{for } j=1, \dots, n \\ & \sum_{i=1}^m v_i x_{ik} = 1 \\ & u_r \geq 0 \quad \text{for } r=1, \dots, s \\ & v_i \geq 0 \quad \text{for } i=1, \dots, m \end{aligned}$$

A DMU is CCR-efficient, if its efficiency value is equal to 1 and its input excesses and output short falls are zero. It should be noted that the results of the CCR input-minimized or output maximized formulations are the same.

After data on GDP, energy consumption per unit GDP, employment, and various environmental impacts of 9 resource-based cities in Heilongjiang province collected over the years were substituted into the input-oriented dea-ccr model, the calculated annual ecological efficiency values of 9 prefecture-level resource-based cities in heilongjiang province were summarized and formed as shown in table 1:

Table 1. Efficiency results of sustainable development of ecological environment in resource-based cities in Heilongjiang province based on DEA-CCR

city	2015	2016	2017	2018	average
Jixi	0.602	0.586	0.572	0.627	0.619
Hegang	0.344	0.377	0.295	0.339	0.344
Shuang yashan	0.674	0.774	0.746	0.784	0.757
Qitaihe	0.271	0.394	0.481	0.499	0.426
Daqing	1	1	1	1	1.000
Heihe	1	1	1	1	1.000
Mudan jiang	0.482	0.533	0.54	0.579	0.534
Yichun	0.27	0.332	0.348	0.368	0.331
Daxing anling	0.331	0.459	0.375	0.467	0.437

It can be seen that improving the level of ecological efficiency in resource-based areas is the key to improving the overall ecological efficiency of Heilongjiang province.

3 Development objectives

3.1 Establishing a sustainable economic development system

From the original extensive transformation to a comprehensive, characteristic and technology-based efficient industrial development system, the role of

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knowledge, science and technology and other factors in the economic transformation should be enhanced, and horizontal cooperation between different regions should be strengthened to establish a sustainable economic development system with strong regional competitiveness.

3.2 Improving the sustainable social progress system

Strictly monitor the total urban population growth, maintain appropriate population density and improve population quality. To guide residents to a healthy and civilized way of life, to thrift, environmental protection transition. We will build a comprehensive social security system and a community service system, and improve the system of social progress that puts people first and is based on the harmony between people and land.

3.3 Building a sustainable resource utilization system

With scientific and technological progress as the core, we should strengthen clean production, actively improve the allocation and utilization efficiency of resources, highlight the steady growth and positive accumulation of ecological assets, and provide favorable conditions for the survival and development of the next generation^[1].

3.4 Fostering a sustainable ecological environment

We will strengthen the governance of ecological environmental pollution, improve the quality of the ecological environment as a whole, and ensure the co-existence of the development and protection of natural landscape resources.

3.5 Improving sustainable urban service functions

We will vigorously promote the construction of urban infrastructure, improve the carrying capacity of urban infrastructure, break through the deficiencies in infrastructure, and build a secure and stable regional infrastructure logistics network that meets the needs of social and economic development and People's daily lives, actively realize the regional service function of infrastructure, so that the regional logistics, energy flow, flow of people, information flow and other ecological flow smoothly.

3.6 Changing and upgrading the sustainable management system

From the traditional management system to the sustainable scientific eco-city management system to accelerate the transformation and upgrading. It carefully excavates and fully reflects the traditional cultural background, advocates urban culture and humanistic

spirit, and highlights the depth of regional culture full of poetry.

4 Development priorities

4.1 the overall coordination and classified development

The growth city refers to the cities whose resource development is in the rising stage and resources guarantee potential is great. Their economic and social development aftereffect is sufficient, thus they are our country energy resources supply and the backup base. Mature city refers to the core area of China's energy and resource security at the present stage. Decline type cities are the key and difficult areas to accelerate the transformation of the mode of economic development. Its resources are drying up. Its economy is lagging behind. People's livelihood is facing serious problems, and the ecological environment is under great pressure. Regenerative cities have basically got rid of resource dependence, and the economy and society begin to step into the track of benign development. The mature resource-based city is the affirmation of the country's sustainable development ability and resource guarantee ability. For mature resource-based cities, it is necessary to further extend the industrial chain, accelerate the cultivation of a number of resource-intensive processing enterprises and industrial clusters, actively promote the upgrading of industrial structure, and form a number of pillar alternative industries as soon as possible. For the decrepit city, it is necessary to break down the dual structure within the city, make every effort to promote the re-employment of unemployed miners, actively promote the renovation of shantytowns, and accelerate the comprehensive treatment of abandoned pits and subsidence areas.

4.2 Improving the resource guarantee capacity

It is necessary to improve the resource guarantee capacity of mature and growing cities and promote the replacement resource prospecting of declining cities. It is necessary to innovate the mechanism of geological prospecting and accelerate the pace of mineral resources exploration and exploitation. First of all, we should strengthen the basic geological work and the investigation of mineral prospect, so as to find more metallogenic prospective areas. Secondly, it is necessary to speed up the exploration of crisis mines and the exploration of key mining areas. Thirdly, we should support mining enterprises in exhausted cities to develop and utilize resources outside and abroad, and seek for raw material backup bases for the deep processing of resources in this region, so as to carry out regional cooperation and realize resource complementarity and joint development. Finally, the protection and comprehensive utilization of mineral resources should be improved, and the recovery rate, recovery rate and comprehensive utilization rate of wastes should be improved. To be specific, mining enterprises can be

supported by fiscal and taxation measures to use new techniques and methods to mine low-grade ores. To carry out special research on the technology of co-semi-genetic ore deposit, refractory ore deposit and tailings dressing. Fine management of the mining process of the waste, minimize the mining resident's living space occupation.

4.3 The diversified, long-chain and clustered development

The fundamental reason for the decline of resource-based cities is that with the exhaustion of resources and the difficulty of development, the leading industries of cities lose their competitiveness. Therefore, resource-based cities should build a diversified industrial system by optimizing and developing the deep processing industry of resources, cultivating and expanding the advantageous alternative industry, developing the industries with strong employability, vigorously developing the characteristic service industry, and reasonably guiding the industrial agglomeration and development. It is imperative for resource-based cities to promote industrial diversification, long chain and cluster development.

4.4 Green ecology and sustainable development

The idea of green mining should run through the whole process of resource development and utilization. Adhering to the basic requirements of scientific mining methods, efficient use of resources, standardized management of enterprises, environmental protection of production processes and ecological mining environment^[2]. We will promote the rational use of resources, energy conservation and emission reduction, ecological and environmental protection and harmony in mining areas, so as to achieve the coordinated and unified economic, ecological and social benefits of resource development. To be specific, we can draw up the green mine construction and development plan, carry out the green mine demonstration pilot mine, establish the perfect green mine standard system and management system, and make full use of economic, administrative and other means to form the supporting green mine construction incentive policy. For example, laws and regulations can be enacted to ensure the ecological restoration of abandoned mines and roadways while opening new mines and roadways, so as to avoid the vicious cycle of "mining interest and decline". The key projects for the resource-based cities include the restoration and treatment of the geological environment in mines, the improvement of the ecological environment in the surrounding areas of mining areas, and the land reclamation in mining areas.

4.5 Improving people's livelihood

For Heilongjiang province, first of all, it is necessary to actively establish a social security system with pension insurance, unemployment insurance, medical insurance

and urban minimum living allowance as the main contents. Secondly, we should directly increase the cash income of low-income industrial workers to alleviate their living difficulties. Again to fix the urban infrastructure, to speed up the turn shantytowns into new housing areas, and improve the living conditions. Finally, we should actively explore policies that are conducive to employment. For example, we should encourage the unemployed to start their own businesses by issuing small guaranteed loans and providing free employment and entrepreneurship training, so as to solve the income problem of laid-off workers. We will increase employment by developing labor-intensive industries, especially the tertiary industry, supporting small and medium-sized enterprises, developing the non-public sector and adopting flexible employment.

5 Measures to ensure the sustainable development

5.1 Policy support

Party and government leaders at all levels should personally focus on circular economy, study and introduce a series of policies and measures to accelerate the development of circular economy as soon as possible, and solve the problems encountered in the development and construction of circular economy.

5.1.1 Industrial policy

The design unit of all trades and professions, want to design the green production craft of this profession and its assemble mode according to the guiding ideology of circular economy, promote gradually after passing pilot, make great efforts to achieve resource consumption less, production pollution less, product quality high.

The development of alternative industries to achieve transformation has become an urgent task for the development of resource-based cities. Relying on the advantaged natural resources, developing the green food industry has become the first choice for the sustainable economic development of the resource-based cities. Shuangyashan can develop grain deep processing. Qitaihe is suitable for planting high quality grain, cash crops and breeding livestock and poultry products. Mudanjiang and Daxinganling region can vigorously develop the blueberry, edible fungus and northern medicine industries. Hegang can vigorously develop grain deep processing and meat processing industry.

Pay attention to the potential of tourism^[3]. Heilongjiang's resource-based cities can develop "summering tourism" in summer and "experiential tourism" in winter according to their own conditions. Heihe, yichun and Daxinganling region are cool and pleasant in summer, rich in forest resources and natural oxygen bars. Therefore, "migrant" tourism can be developed in these cities to provide accommodation, catering and other living services for tourists and extend their stay in summer. Winter, the ice and snow tourism

resources, like ice and snow kingdom, can develop "experiential" winter ice and snow tourism, for those who want to experience the northeast ice and snow tourist open ice snow experience area, provide the northeast local accommodation and meals, through long experience, enabling them to real life experience of the northeast winter.

5.1.2 Fiscal and tax policies

The government can use tax revenue to implement tax incentives and even tax reduction policies for industries that promote ecological and environmental protection, and impose heavy taxes and even economic penalties on enterprises that destroy the ecological environment. We can also adjust the prices of land, water, electricity and other factors, limit and control the quantity and price of the use of scarce resources, and promote enterprises to establish the mechanism of energy conservation and consumption reduction, so as to make the protection of the ecological environment, energy conservation, consumption reduction and emission reduction voluntary actions of enterprises.

5.1.3 Financial policy

Environmental protection cannot be achieved without the strong support of the financial industry. Financial support should start with support for "green finance" services. Premier Li Keqiang pointed out in this year's government work report that we will deepen the reform of the financial system and vigorously develop green finance. Developing a green financial system is an important measure to achieve green development. By building a green financial system, we will guide and encourage more public funds to invest in green industries such as environmental protection, energy conservation, clean energy and clean transportation. Many developed countries have accumulated a lot of experience in green finance, which can be used for reference.

5.2 strengthen publicity and education

First of all, through hiring experts to give lectures, holding special lectures and other forms, we should focus on strengthening the education and training of leading cadres on circular economy theory, and strive to improve the awareness of environmental resources and comprehensive decision-making ability of cadres at all levels.

Secondly, residents should be educated about ecological and environmental protection, and activities related to environmental protection should be promoted. For example, circular economy and ecological city special columns should be set up in the news media, and TV special films should be made to guide the public to establish modern ecological values, and to advocate civilized lifestyles and green consumption concepts. The typical deeds of ecological and environmental protection are publicized on the Internet, and Internet forums are set up to discuss ecological and environmental problems and

environmental knowledge competitions, so as to strengthen the interaction between netizens.

5.3 Ecological infrastructure construction

In terms of water resources utilization, increase water resources utilization efficiency, reuse rate, recovery rate, etc. In terms of building design, the proportion of green energy used and energy consumption per unit area can be added. In terms of soil pollution, pollution degree and remediation time can be added. In terms of comprehensive utilization of resources, indexes such as the proportion of total energy consumption in renewable energy and clean energy stations and the utilization rate of domestic waste resources can be added^[4].

5.4 Construction of information platform

We will promote the establishment of an information network for clean production and the utilization of renewable resources, and develop software for integrating materials, energy and water, as well as a library of integrated methods. We will gradually establish and improve urban waste registration and exchange centers to realize dynamic management and resource-based disposal of hazardous wastes. The list of environmentally friendly technologies and investment guidelines for circular economy projects shall be published regularly. We will also establish a system of resource and environmental information announcement. The state of urban resources, the quality of the urban environment and the water quality of major rivers shall be published on a regular basis^[5]. We will establish an open system for the environmental performance of urban enterprises, encourage the public to monitor their environmental protection activities, and encourage all sectors of society to participate in the recycling of resources and environmental change.

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