The Study Investigates the Synergistic Effect of Pollution Reduction and Carbon Mitigation in Industrial Parks: A Case Study of Yunnan Province

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Abstract: The industrial park serves as a crucial spatial aggregation form for regional economic development, while simultaneously acting as the primary source of pollutants and carbon emissions.Using Yunnan Province as a case study, this paper examines the synergistic impact of pollution and carbon reduction in its key industrial parks through the research approach of status-feature-problem-suggestion.The key industrial parks in Yunnan Province develop with a spatial layout of "one core, one belt, and multiple points". The key industries for coordinated pollution reduction and carbon reduction are new materials, processing and manufacturing, metallurgy, logistics, and building materials.The collaborative development of park carbon reduction faces four main challenges: accurate calculation of park carbon emissions, quantification of park carbon reduction potential, limited adoption of pollution and carbon reduction measures by key enterprises in the park, and difficulty in designing collaborative emission reduction paths and mechanisms for the park.Suggestions were proposed in four areas: clarifying the park's statistical system, specifying the calculation method for carbon reduction potential, promoting pollution and carbon reduction measures for key enterprises in the park, and supporting pollution and carbon reduction through multi-scenario decision-making.

***Keywords*:** industrial parks, reduction of pollution and carbon emissions, Yunnan

1. Introduction

Nearly 200 parties to the United Nations Framework Convention on Climate Change reached the Paris Agreement at the Paris Climate Change Conference, and the issue of global climate change has become a key concern for the sustainable development of humankind. During the Fourteenth Five-Year Plan period, the construction of ecological civilization in China has entered an important period in which the focus is on the strategic direction of reducing carbon emissions, promoting synergies in reducing pollution and reducing carbon emissions and promoting a comprehensive green transformation of economic and social development. It is an important period for promoting a comprehensive green transformation of economic and social development.

The issuance and implementation of the Opinions of the CPC Central Committee and State Council on Comprehensively Promoting the Construction of a Beautiful China, the Opinions of the CPC Central Committee and State Council on Completely and Accurately and Comprehensively Implementing the New Development Concepts and Doing a Good Job of Carbon Peak Achievement and Carbon Neutrality, as well as the Policies on the Implementation Plan for Carbon Reduction and Synergistic Efficiency have made it clear that the future goals and specific tasks of the work on carbon reduction and synergistic efficiency are clear. As a place of high-density industrial agglomeration, industrial parks are closely related to local economic development, and are an important form of spatial agglomeration for regional economic development, industrial adjustment and upgrading, and have a series of important missions, such as gathering innovative resources, fostering new industries, and promoting the construction of urbanization. At the same time, industrial parks are also the main area of pollutants and carbon emissions, according to Yang Rupu et al. study, China has formed a total of 2,543 various types of industrial parks [1], these industrial parks contribute to more than 50% of the country's industrial output [2], but also emits more than 30% of the country's carbon dioxide, the parks in the energy infrastructure of sulfur dioxide and nitrogen oxides emissions accounted for the country's 12% and 15% [3], industrial parks are the main position in China to promote the realization of pollution reduction and carbon synergy. At present, there are fewer studies on the synergistic effect of pollution reduction and carbon reduction in industrial parks in provincial areas, but for each province, industrial parks are a powerful engine of economic development, an important platform for industrial agglomeration, and a major carrier of economic double-cycle, so the study on the synergistic effect of pollution reduction and carbon reduction in industrial parks in provincial areas is of great significance.

2. Methodolody

2.1 Methods

2.1.1 Analysis method

Adopting the research idea of status quo-features-problems-suggestions, we statistically analyze the situation of pollution reduction, carbon reduction and synergistic efficiency of the industrial parks that will be the focus of development in Yunnan Province in 2025, put forward the current problems faced by the development of pollution reduction, carbon reduction and synergistic efficiency of industrial parks in Yunnan Province, and explore and put forward the corresponding countermeasures to solve the problems.

2.1.2 Calculation and analysis method of carbon emission data

With reference to the National Development and Reform Commission of the People's Republic of China in 2011 issued the "Provincial Greenhouse Gas Inventory Guidelines" [4] in the sector, fuel type, fuel consumption and the corresponding emission factors and other parameters are calculated and analyzed to obtain the carbon emissions data, the calculation formula is specifically expressed as follows:

$$\text{GHG Emissions} = \text{åå}(EF_{i,j,} \times \text{Activity}_{i,j,}) \quad (1)$$

Where EF, Activity, i, j denote emission factor (kg/TJ), fuel consumption (TJ), fuel type, and sectoral activity, respectively.

The calculation and analysis of carbon emission data for the aluminum smelting, iron and steel, and building materials industries refer to the instructions for filling in the corporate greenhouse gas emission accounting and reporting for aluminum smelting, iron and steel production, and cement clinker production in the "Notice on Doing a Good Job in Reporting and Verifying Greenhouse Gas Emissions of Enterprises of Selected Key Industries in the Years 2023-2025" [5], which was issued by the Ministry of Ecology and Environment of the People's Republic of China.

2.2 Data

The distribution area and number of key industrial parks in Yunnan Province come from the "14th Five-Year Plan for the Development of Industrial Parks in Yunnan Province (Draft)" [6], and the data on the types of key industries included in the industrial parks come from the publicly released news reports and enterprise information of the industrial parks.

3. Results

3.1 Distribution of Key Industrial Parks in Yunnan Province

According to the "14th Five-Year Plan for Industrial Park Development in Yunnan Province (Draft)", two development zones with revenues exceeding 200 billion yuan, five development zones with revenues exceeding 100 billion yuan, eleven development zones with revenues exceeding 50 billion yuan, and thirty-two development zones with revenues exceeding tens of billions of dollars will be built during the 13th Five-Year Plan period in Yunnan Province (Figure. 1). The number of development zones accounted for 4%, the number of development zones with over 100 billion revenue accounted for 10%, and the number of development zones with over 50 billion revenue accounted for 22%.

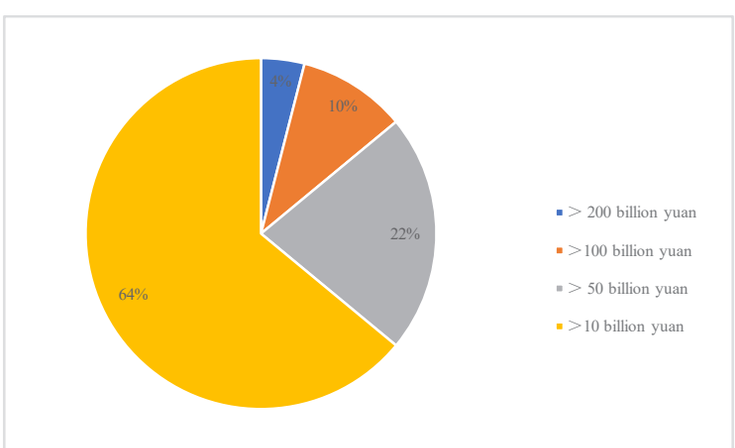

Figure 1. The number of development zones completed in Yunnan Province during the 13th Five-Year Plan period exceeded 10 billion

Yunnan Province, the main industrial parks during the 14th Five-Year Plan period, mainly in accordance with the "a core, a belt, multi-point" spatial layout for development, of which the "core" region in Kunming, the development of the maximum number of parks for 9, Qujing, Chuxiong and Honghezhou northern 7 counties and cities are three; The number of regional industrial parks in the "belt" region is relatively even, with a maximum of 4 in Lincang, and 2 in Baoshan, Puer, Wenshan and Dehong; the development of industrial parks in the "multi-point" region is mainly concentrated in Zhaotong, with a number of 3 (Figure. 2a, b, c). The number of industrial parks in the "multi-point" region is mainly concentrated in Zhaotong, with 3 (Figure 2a, b, c).

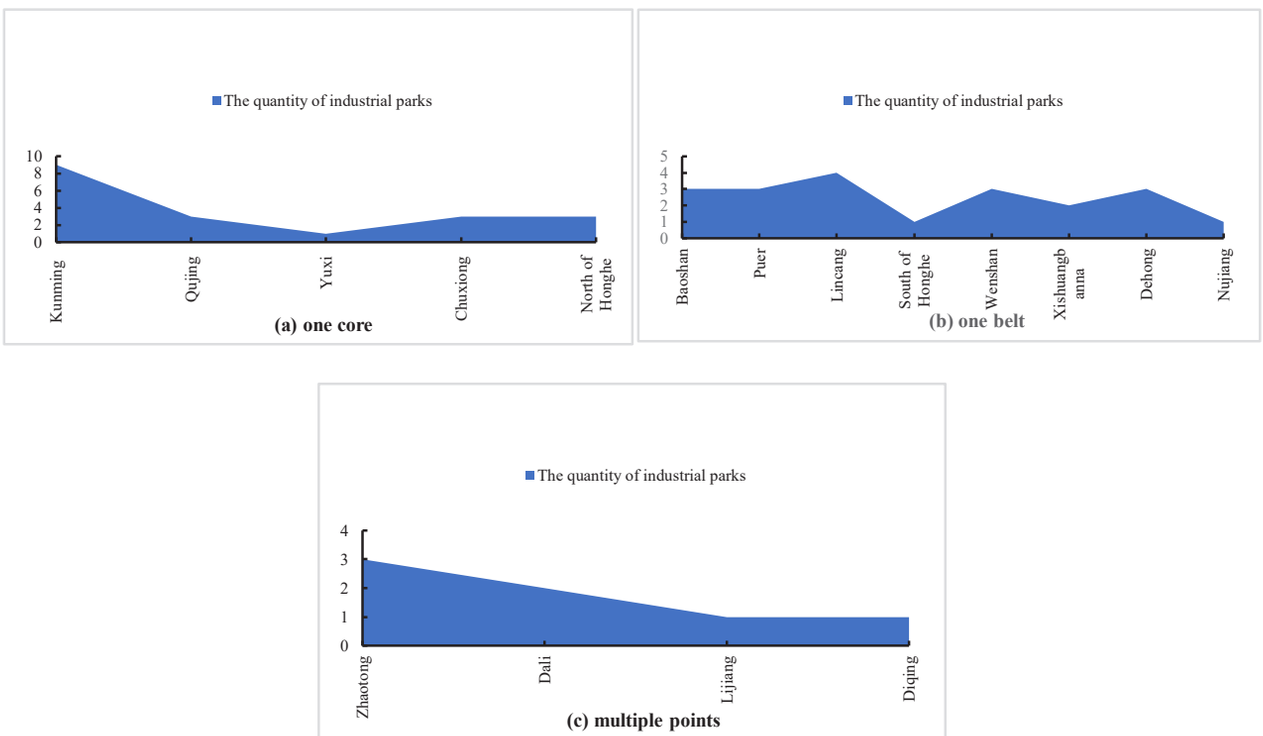

Figure 2. Development of industrial parks in Yunnan's "one core, one belt, and more" areas

3.2 Low-carbon development of industrial parks in Yunnan Province

In March 2022, the Yunnan Provincial Department of Industry and Information Technology, the Provincial Development and Reform Commission and other seven departments jointly issued the "Yunnan Three-Year Action Plan for Green and Low-Carbon Demonstration Industrial Parks", aiming to build a batch of green and low-carbon demonstration industrial parks with demonstration effect, and to explore the path of green and low-carbon development of the industry, and nine provincial-level low-carbon industrial parks have been recognized, which are mainly concentrated in the regions of Kunming and Pu'er (Table 1). At a time when there is no standard for the construction of zero-carbon parks in the country, Yunnan, in order to explore the construction of zero-carbon parks, has formulated the "Work Program for Promoting the Construction of Zero-Carbon Parks in Yunnan Province" and its evaluation index system, exploring the construction of zero-carbon parks where production, life and ecology are integrated in depth, which was publicly released on May 28, 2024. The first five zero-carbon zones, of which the remaining three zero-carbon zones except Qujing Economic and Technological Development Zone and Yunnan Xiangyun Economic and Technological Development Zone, are green low-carbon demonstration industrial parks (Table 2).

Table 1. List of low-carbon industrial parks in Yunnan Province

Area	Name of industrial park
Kunming	Kunming High Tech Industrial Development Zone
	Kunming Ecnomic And Technological Development Zone
	Yunnan Anning Industrial Park
	Yunnan Chenggong Industrial Park
Dali	Dali Ecnomic And Technological Development Zone
Chuxiong	Chuxiong High Tech Industrial Development Zone
Puer	Yunnan Jinggu Industrial Park
	Yunnan Simao Industrial Park
Yuxi	Yuxi High-Tech District

Table 2. List of zero-carbon parks in Yunnan Province

Area	Name of industrial park
Kunming	Yunnan Anning Industrial Park
Qujing	Qujing Economic and Technological Development Area
Yuxi	Yuxi High-Tech District
Chuxiong	Chuxiong High Tech Industrial Development Zone
Dali	Yunnan Xiangyun Economic and Technological Development Zone

3.3 Pollutants and Carbon Emissions of the Relevant Industries in Major Industrial Parks in Yunnan Province

CO_2 emissions mainly come from fossil fuel consumption, non-renewable energy power generation and industrial process emissions, fossil fuel combustion and industrial process emissions will also produce SO_2, NOX, PM2.5, VOCs, CF4, C2F6 and other air pollutants, at present, the key industrial parks in Yunnan Province, CO_2 and pollutants emitted by more industries are new materials, processing and manufacturing, metallurgy, aviation, services, new energy batteries, real estate economy, logistics, tobacco processing and ancillary products, chemicals, iron and steel, built and paper 12 industries. Services, new energy batteries, real estate economy, logistics, tobacco processing and ancillary products, chemical industry, iron and steel, built and paper 12 industries, of which the main development of new materials, processing and manufacturing, metallurgy, logistics, building materials industry parks accounted for 76% of the number of key development of the number of parks (Figure 3), metallurgical industry in the iron and steel industry of the carbon emissions and the main air pollutant emissions accounted for more than the industrial sector emissions, and synergistic emission reduction potential is greater. The iron and steel industry in the metallurgical industry accounts for more carbon emissions and emissions of major air pollutants than the industrial industry, and has a greater potential for synergistic emission reduction[7].

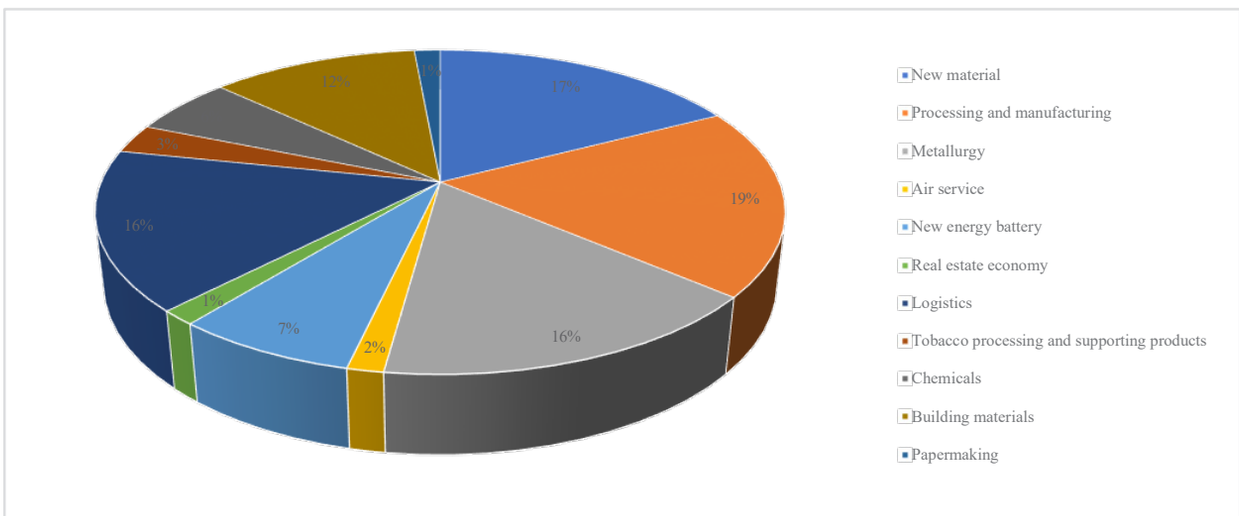

Figure 3. The proportion of industries with high pollutants and carbon emissions in key industrial parks in Yunnan Province

3.4 Synergistic Efficiency of Pollution Reduction and Carbon Reduction in Main Types of Industrial Parks in Yunnan Province

3.4.1 Demonstration of Parks with New Materials and Processing and Manufacturing as Major Industries

Kunming Hi-tech Industrial Development Zone, which has new materials as its main industry, has 9 green factories and 2 green supply chain management demonstration enterprises. In terms of green production, it actively guides the key enterprises in the park to clean production, and at present, the implementation rate of clean production audits of Kunming Guiyan Platinum Company Limited, Kunming Precious Metals Catalyst Limited Liability Company, and Southwest Copper Branch of Yunnan Copper Company Limited is 100%. Ltd. and Yunnan Copper Co., Ltd. and other enterprises such as cleaner production audit implementation rate of 100%, at present, the high-tech zone green low-carbon park has a total of 11 construction projects, of which the park facilities supporting the greening of the project 4 [8], mainly to carry out the park centralized sewage treatment, centralized heating, digital economy clustering area and other green low-carbon infrastructure transformation.

Songming Yanglin Economic and Technological Development Zone with equipment manufacturing as the main industry, continues to carry out the promotion of low-carbon energy substitution for high-carbon energy, and has now built a natural gas gate station, the intensity of carbon emissions decreases year by year, and at the same time, encourages enterprises to actively carry out cleaner production audit work and energy audits, and establishes energy management systems of key energy-consuming enterprises, and the energy output rate of the park's industrial enterprises in 2022 will increase compared with that of 2019 by 0.13%, the utilization rate of clean energy is increased by 44.33% compared with 2019, the energy efficiency is significantly improved, and the comprehensive energy consumption in 2022 is 82,947.28tce, of which 63,852.30tce is clean energy, accounting for 76.98% of the total energy consumption [9].

3.4.2 Demonstration of parks with steel and building materials as major industries

With iron and steel as the main industry, Yunnan Anning Industrial Park has the largest iron and steel enterprise in Yunnan Province, Kunming Iron and Steel Holding Co. The park continues to optimize and adjust the energy system, and the 250 MW photovoltaic power generation project in the park has completed the construction of distributed photovoltaic of 14.6 MW, with an addition of 210 million kWh of green power. Park vigorously promote the recycling of industrial solid waste, make full use of industrial resources comprehensive utilization base, chemical slag, metallurgical slag, fly ash, industrial waste materials and other industrial solid waste, sustainable use of treatment, the implementation of 33 recycling transformation projects [10].

Building materials as the main industry Chuxiong National High-tech Industrial Development Zone to Dianzhong nonferrous Isa furnace waste heat boiler steam as a heat source, the construction of steam pipe network, temperature and pressure reduction facilities, Taoyuan area, Zhaojiawan area of the two parks as a whole, the use of Chuxiong Dianzhong Nonferrous Metals Limited Liability Company's surplus heat for the park enterprises to provide superior steam [11], to achieve both effective improvement in the use of energy efficiency of waste heat recovery In addition, it can reduce the energy cost of enterprises using gas in the park, realize the gradient utilization of waste heat resources in the park, greatly reduce the energy consumption and carbon dioxide emissions in the park, and increase the green expansion space in the park.

3.4.3 Demonstration of parks with logistics as the main industry

Kunming Economic and Technological Development Zone, with building materials as the main industry, has implemented 28 “green projects”, with an average annual reduction rate of 3.97% in carbon dioxide emissions per unit of industrial added value, and an air quality excellence rate of 99.45%; it has built three eco-industrial chains of industrial solid waste, and the comprehensive utilization rate of industrial solid waste will reach 87.13% in 2021, and will be 24.47% higher than the standard limit of 70%. 87.13% and improved by 24.47% from the standard limit of 70%. The construction project of “energy monitoring platform + industrial solid waste comprehensive utilization platform” will be implemented between 2021 and 2025 [8].

3.4.4 Demonstration of Parks with Aluminum Industry as the Main Industry

The aluminum industry is not included in the key industry statistics category in the previous section, mainly due to the fact that the aluminum industry in Yunnan region mostly adopts green energy, and the carbon emissions generated by the use of clean electricity are not much compared with those of other industries, but from the perspective of carbon peak and carbon neutrality, the aluminum industry belongs to the key carbon-emitting industries. For Yunnan Yanshan Industrial Park, where aluminum industry is the main industry, the annual output of 1.93 million tons of low-carbon aluminum construction project of Yunnan Honghe New Materials Co., Ltd. is the “chain master”, combined with upstream aluminum fluoride, anode carbon, downstream automotive lightweight parts, aluminum strip, foil, auto parts to create a low-carbon aluminum industry clusters. The production line of Honghe Company, the “chain master” enterprise in the park, adopts the most advanced

international aluminum electrolysis technology jointly developed with Northeastern University, and the power consumption per ton of aluminum is more than 500 kWh lower than the national average level of the same industry [12]. Park supporting photovoltaic, wind power plant, can generate 10.4 billion kilowatt-hours, the rest of the purchase of hydropower from Yunnan Province, photovoltaic new energy power to supplement, the entire project hydropower new energy power accounted for 92.8%. The park adopts the whole industry chain construction in the planning and layout, forming a small pattern of economic cycle in the park, which saves a lot of energy and reduces emissions [13].

4. Discussion

4.1 Synergistic situation of pollution reduction and carbon reduction in key industrial parks in Yunnan Province

During the 14th Five-Year Plan period, major industrial parks in Yunnan Province were mainly developed in accordance with the spatial layout of "one core, one belt and multiple points", of which Kunming has the largest number of industrial parks, and the number of industrial parks in the "one belt" region is relatively even. At present, nine provincial low-carbon industrial parks have been recognized, of which Yunnan Anning Industrial Park, Yuxi High-tech Industrial Development Zone, Chuxiong National High-tech Industrial Development Zone, Yunnan Xiangyun Economic and Technological Development Zone in 2024 was recognized as the first batch of zero-carbon park. The key industrial parks in Yunnan Province that emit more CO_2 and pollutants are new materials, processing and manufacturing, metallurgy, aviation services, new energy batteries, real estate economy, logistics, tobacco processing and ancillary products, chemical industry, iron and steel, built and paper 12 industries, of which the number of parks that mainly develop the new materials, processing and manufacturing, metallurgy, logistics, building materials industry accounted for 76% of the number of key development parks.

4.2 Difficulties in the collaborative development of pollution reduction and carbon reduction in industrial parks in Yunnan Province

4.2.1 Difficulty in accurately measuring carbon emissions in parks

The main bodies involved in the development and operation of industrial parks, including the government, enterprises, and real estate developers, are multi-party complexes, so it is difficult to clarify and unify their internal physical boundaries, management boundaries, economic statistics boundaries, and flow analysis boundaries, which makes it difficult to accurately measure carbon emissions.

4.2.2 Difficult to quantify the carbon emission reduction potential of the park

There is a lack of systematic carbon emission reduction data statistics for the three-level measurement system in the park, which is mainly based on enterprises, workshops and teams, and a lack of relevant carbon reduction potential analysis data for Yunnan's local characteristics. For example, Yunnan's unique green aluminum industry uses most of the electricity for production from clean energy sources, but when calculating the carbon emissions from its purchased electricity, apart from the amount of electricity that can be provided with proof of purchase of green electricity, the calculation of carbon emissions from the rest of the electricity will lack the carbon emissions characteristic of Yunnan's green energy use. There is a lack of emission factors that characterize Yunnan's green energy use.

4.2.3 The application of pollution reduction and carbon reduction measures by key enterprises in the park has not been popularized.

Currently, the key industries publicly included in the national carbon emissions trading are only the power generation industry, and high emission industries such as cement and iron and steel have not yet been explicitly included publicly, so their related enterprises do not pay much attention to the research and development and application of pollution reduction and carbon reduction measures, and the funds required for the development and application of pollution reduction and carbon reduction measures are relatively high, so the enterprises do not actively carry out the development and implementation of these measures based on the consideration of the cost of running the business.

4.2.4 Difficulty in designing cooperative emission reduction paths and mechanisms in parks

The synergistic mechanism of relevant stakeholders in the park and the synergistic mechanism of government and enterprises have not yet been fully established, and most of the pollution control in the park mainly focuses on the end-of-enterprise treatment, lacking a unified whole-process synergistic emission reduction control system from the planning of the park, the source control, the process control, and the end-of-enterprise treatment, and it is difficult to match the most suitable carbon reduction technology with the target.

5. Conclusions and Suggestions

5.1 Conclusion

The key industrial parks in Yunnan Province are developed in a spatial layout of “one core, one belt and multiple points”, in which the key industries for the collaborative development of the parks' pollution reduction and carbon reduction are new materials, processing and manufacturing, metallurgy, logistics and building materials. There are four main difficulties faced by the collaborative development of industrial parks in terms of pollution reduction and carbon reduction, namely, the difficulty of accurate measurement of carbon emissions in the parks, the difficulty of quantifying the potential of carbon emission reduction in the parks, the lack of popularization of the application of pollution reduction and carbon reduction measures by key enterprises in the parks, and the difficulty of designing collaborative emission reduction paths and mechanisms in the parks.

5.2 Suggestions

5.2.1 Clarify the park statistical system

Clarify the application objectives of accounting results, delimit the boundaries of the scope of accounting work, establish the principle of defining multiple boundaries of zones, carry out the analysis of material flow, energy flow, and value flow based on clear boundaries, and then form the pathway of carbon flow in the whole life cycle, so as to realize the comparability of the total amount and intensity of material, energy, and carbon emissions between zones. A multi-flow and multi-node analysis model is established to finely portray material, energy and value flows at three levels: enterprise, infrastructure and park as a whole, and to account for the park's carbon emissions from the perspective of the whole life cycle.

5.2.2 Clarify the calculation method of the park's carbon reduction potential

Relying on the greenhouse gas accounting inventory, carbon emission data verification, CCER methodology and other calculation methods, standardize the calculation methods of the park's carbon reduction potential, promote the development of localization of basic data, accurately measure the carbon emissions of various departments and enterprises in the park, explain the key process of the accounting work, dig deeper into the potential of application of the results of the accounting, and promote the effective convergence of the results of the regional-park-enterprise accounting.

5.2.3 Promote the development and application of pollution reduction and carbon reduction measures for key enterprises in the park

Optimize industrial and spatial layout, carry out source control, and establish a system of industrial entry and exit lists oriented to regional environmental quality improvement and carbon peaking targets. Select synergistic emission reduction measures, actively promote the substitution of raw fuels in the cement industry, and lead the upgrading of the technical equipment level of the cement industry with the “second-generation cement” technical standard. Optimize the layout of iron and steel to encourage short process technology, optimize the raw fuel structure of iron and steel, strengthen the research and application of “low coke ratio and high coal ratio smelting technology” and “reducing fuel ratio smelting in blast furnace”, optimize the charge structure of blast furnace, and adopt ultra-high-percentage or global regiment smelting, and fully explore the use of new energy and renewable energy in iron and steel enterprises, and actively promote the substitution of raw fuel in the cement industry. Fully explore the potential of new energy and renewable energy utilization in iron and steel enterprises, promote the ultra-low emission transformation of iron and steel enterprises, and encourage the innovation of top gas recycling oxygen blast furnace smelting, blast furnace hydrogen-rich smelting, hydrogen vertical furnace direct reduction, hydrogen-based molten reduction ironmaking and other technologies. Explore carbon financial businesses such as carbon futures, carbon options and quota pledge financing, and support collaborative projects for pollution reduction and carbon reduction.

5.2.4 Multi-scenario decision-making support to assist the development of pollution and carbon reduction in parks

Build a green channel for patent application and approval, a platform for transforming information on pollution and carbon reduction technologies, support the development of services for transforming the results of pollution and carbon reduction technologies, establish a two-way feedback mechanism between the research and development of pollution and carbon reduction technologies and industrialization, accelerate the transformation of innovation results, incorporate relevant indicators into aspects such as project construction, acceptance and review of enterprise reward and subsidy support measures, formulate policies on emission reduction in parks, evaluate carbon reduction performance, and carry out a pilot study on the evaluation of the degree of synergy between pollution and carbon reduction in parks. Evaluate and pilot research on synergistic degree.

References

[1] Yang R P, Li L P. (2024) Synergic Reduction of Pollution and Carbon Emissions in Industrial Parks: Connotation and Pathway. Environmental Protection, 52(07):24-27.

[2] Zhang J Y, Zhang Y Q.(2022) Impact of High-speed Railway on Industrial Green Total Factor Productivity: A Case of 11 Provinces along the Yangtze River Economic Belt. Areal Research and development, 39(04):24-28,47.

[3] Yang G, Lu Y Z, Yan kun et al.(2021) Low-Carbon Development Pathways of Industrial Parks in China.,13(1): 49-58.

[4] National Development and Reform Commission.(2011) Guidelines for the preparation of provincial GHG Inventories (Trial). Beijing.

[5] Ministry of Ecolagy and Environment of the Peaple's Republic of China. Notice on the report and verification of greenhouse gas emissions of enterprises in some key industries from 2023 to 2025. https://www.mee.gov.cn/xxgk2018/xxgk/xxgk06/202310/t20231018_1043427.html, 2023-10-18.

[6] Department of Industry and Information Technology of Yunnan Province.(2021) Yunnan Province "14th Five-Year Plan" Industrial Park Development Plan (Draft for Comment). Yunnan.

[7] Yang J W, Chen Y X, He y. (2023) Analysis of synergistic effect of carbon dioxide and air pollutant control in Yunnan Province. Environmental Science Survey, 42(5):11-16,20.

[8] Bureau of Industry and Information Technology of Kunming. Four parks in Kunming were rated as provincial green low-carbon demonstration industrial parks. Industrial transformation and upgrading carbon road green development. [EB/OL]. https://gxj.km.gov.cn/c/2023-07-13/4753946.shtml, 2023-07-13.

[9] Song Ming financial media. Songming Yanglin Economic Development Zone "Adhere to high-quality development, create 2+N low-carbon park". [EB/OL]. https://mp.weixin.qq.com/s?__biz=MjM5MzUxNzk1OA==&mid=2650777242&idx=3&sn=2e94bee6618833354b4ae14cc221f019&chksm=be9ede7389e9576591076b4bfea5513fb10c13729d9a389e1b207fc62091f998cc68a43e864d&scene=27, 2024-05-28.

[10] Kunming News. Be a pioneer in carbon reduction with green counterparts. [EB/OL]. https://mp.weixin.qq.com/s?__biz=MzIxMjk1NzA0Ng==&mid=2247633305&idx=1&sn=807ca72bde3caabc1cb59ddb97794b5e&chksm=96308eeed907d15f85a635138d7a4db145c959b72f4c06c947e2b5dfc428af61e407d08fe06f&scene=27, 2024-06-11.

[11] Chuxion Yi Autonomous Prefecture Development and Reform Commission.Typical experience of energy saving and carbon reduction: Committed to energy saving and emission reduction, creating a green park - Chuxiong High-tech Zone waste heat recovery and central heating construction project. [EB/OL]. https://fgw.cxz.gov.cn/info/1493/15591.htm, 2023-07-14.

[12] Wang D. Relying on energy and resource advantages, Yunnan takes the initiative to undertake the production capacity transfer of aluminum industry -- Building a "Green Aluminum Valley in China". Yunnan Daily. 2023-08-27.

[13] Yunnan Investment Association. Green and low carbon become the "main tone" of Yunnan Park Economic Development. [EB/OL]. https://mp.weixin.qq.com/s?__biz=MzIwMzg5OTI2MA==&mid=2247508698&idx=3&sn=9b0df4a33dd9a66f620e3f3e57261489&chksm=96ca8ac9a1bd03df2a0ce25a5fa1834520ae8852b43ca0614ff86ce6cb549511886d5abbfd19&scene=27, 2023-02-02.