

Research on Pathways to Enhance Carbon Asset Management Capabilities of Yibin Baijiu Enterprises

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Abstract: In the context of achieving the strategic goals of carbon peak and carbon neutrality, traditional energy-intensive industries are facing increasingly stringent carbon emission constraints and pressures for industrial transformation. As a major production base for Chinese Baijiu, Yibin's liquor production processes involve substantial energy demands and generate significant greenhouse gas emissions. Data indicates that the local Baijiu industry's annual energy consumption exceeds 1.5 million tons of standard coal equivalent, with total carbon dioxide emissions surpassing 4 million tons [4]. Consequently, enhancing carbon asset management has become a crucial measure for promoting the industry's green and low-carbon transformation. This paper systematically analyzes the key challenges in carbon asset management faced by Yibin Baijiu enterprises and proposes a comprehensive capacity-building plan, focusing on management awareness, accounting methodologies, technological upgrades, industrial chain integration, market operations, and policy support. Research suggests that by adopting scientific carbon asset management measures, the Yibin Baijiu industry could potentially reach its carbon emission peak before 2030. Furthermore, by 2035, the carbon emission intensity per unit product is projected to decrease by over 35% compared to the 2020 baseline. This study provides a reference implementation paradigm for the green transformation of regional characteristic industries.

Keywords: Yibin Baijiu Enterprises, Carbon Asset Management, Carbon Emission Accounting, Green Transformation, Low-Carbon Development.

1. Introduction

With the continuous improvement of the global climate governance system, China's carbon peak and carbon neutrality goals are driving profound adjustments across various industrial sectors [1]. The Baijiu industry, a traditional and characteristic industry in China, features production processes with high energy intensity and has been identified as a key area for emission reduction. Industry data shows that in 2022, the total energy consumption of China's Baijiu manufacturing industry reached approximately 16 million tons of standard coal, with estimated total carbon emissions exceeding 40 million tons of CO₂ equivalent [4]. Benefiting from unique natural conditions and a long history of brewing, the Yibin region has developed a Baijiu industrial cluster represented by Wuliangye. Industrial statistics for 2023 indicate that the operating revenue of Yibin Baijiu enterprises surpassed 150 billion RMB, accounting for nearly 50% of the city's total industrial output value [5]. However, as the industry continues to expand, the environmental pressures associated with traditional production methods are becoming increasingly apparent. Significant carbon emissions are generated throughout the entire production chain, from raw material processing to product distribution, with the distillation process being particularly energy-intensive, accounting for over 60% of total production energy consumption [7]. The concept of carbon assets examined in this paper encompasses carbon emission allowances, certified emission reductions and their derivatives, as well as potential economic benefits arising from the implementation of emission reduction measures. Effective carbon asset management requires enterprises to systematically investigate,

assess, plan, allocate, operate, monitor, and trade carbon emission rights and related resources. For instance, leading enterprises in the industry, by establishing standardized carbon asset management systems, have generated annual carbon trading revenues reaching tens of millions of RMB, demonstrating the feasibility of achieving coordinated environmental and economic benefits [8].

2. Analysis of the Current Status of Carbon Asset Management in Yibin Baijiu Enterprises

Although some key enterprises have initiated environmental protection measures, the overall carbon asset management capabilities of Yibin Baijiu enterprises remain in their infancy. Survey data from over 30 Baijiu production enterprises in the Yibin region reveals that only about 25% have established specialized carbon management organizations, and less than 40% have completed systematic baseline surveys of their carbon emissions [4]. The main challenges are as follows:

2.1. Outdated Management Concepts and Unclear Strategic Positioning

Survey data indicates that over 80% of enterprises perceive carbon emission reduction as a cost burden rather than an opportunity for value creation [7]. This perception is particularly prevalent among small and medium-sized enterprises (SMEs), approximately 90% of which have not integrated carbon management into their strategic planning. Specifically, apart from a few leading enterprises that have established dedicated carbon management departments, most

SMEs lack clearly defined carbon management responsibilities. This cognitive gap results in carbon management efforts often being reactive and lacking systematic planning.

2.2. Weak Data Foundation and Imperfect Accounting Systems

Carbon emission accounting is fundamental to effective management, yet enterprises generally lack robust monitoring and statistical systems [2]. The survey found that nearly 75% of enterprises fail to accurately define emission boundaries for different scopes. In practice, only about 30% have installed online monitoring equipment at key energy-consuming points, and data collection still relies primarily on manual records, with error rates typically exceeding 10%. For example, a medium-sized enterprise reported a 20% deviation in its 2022 carbon emission accounting, significantly impairing the accuracy of emission reduction decisions.

2.3. Difficulties in Technological Upgrades and High Retrofit Costs

In traditional brewing processes, the distillation stage is the primary source of energy consumption, accounting for 60%-70% of total energy use [6]. The thermal efficiency of existing coal-fired boiler systems is generally below 80%, while retrofitting to natural gas boilers requires an investment of 8-15 million RMB, and adopting electric boiler solutions necessitates 15-25 million RMB. For SMEs with annual operating revenues below 500 million RMB, such investment pressures are substantial. Moreover, promoting process innovation while maintaining stable product quality poses significant challenges; one enterprise's annual R&D investment for developing low-carbon brewing technology exceeded 25 million RMB.

2.4. Insufficient Industrial Collaboration and Limited Systemic Benefits

Carbon emissions permeate the entire industrial chain, from raw material cultivation to product distribution [9]. Statistics show that the raw material cultivation stage accounts for 15%-20% of the entire chain's carbon emissions, while packaging, storage, and transportation contribute 20%-25%. However, effective coordination among different segments of the industrial chain is currently lacking; only about 20% of enterprises have established green procurement partnerships with suppliers. For instance, carbon emissions from the glass bottle production process account for over 60% of the packaging stage emissions. Yet, due to the absence of unified management standards, emission reduction achievements in one segment are often offset by high emissions in others.

2.5. Low Market Participation and Challenges in Realizing Asset Value

Despite the expanding national carbon trading market, over 80% of enterprises lack professional carbon trading expertise [8]. The survey shows that only about 15% of enterprises understand the China Certified Emission Reduction (CCER) mechanism, and less than 10% have participated in carbon trading. One enterprise, through technological transformation, could generate an annual surplus of 15,000-20,000 tons of carbon allowances. However, due to unfamiliarity with trading rules, it missed out on potential revenue of

approximately 800,000 RMB over three years.

2.6. Insufficient Policy Support and Lack of Guidance Mechanisms

Currently, local governments have not yet introduced specialized carbon management policies tailored to the Baijiu industry [1]. Among the surveyed enterprises, about 85% reported a lack of specific technical guidance and accounting standards, and nearly 80% expressed the need for clearer fiscal and tax incentives. This policy gap results in insufficient motivation for enterprises to reduce emissions and slows the overall improvement of the industry's carbon efficiency.

3. Implementation Pathways for Enhancing Carbon Asset Management Capabilities

3.1. Strengthen Strategic Guidance and Deepen Management Awareness

Enterprise management should fully recognize the potential value of carbon assets [7]. A phased promotion strategy is recommended: achieve comprehensive management training coverage within the first year, fully integrate carbon management into strategic planning by the second year, and achieve a professional management organization establishment rate exceeding 80% within three years. Practices of leading enterprises show that establishing a carbon management committee can improve carbon efficiency by over 15% within two years, generating economic benefits exceeding 40 million RMB. Simultaneously, leveraging the demonstrative role of leading enterprises is crucial; it is recommended to organize at least three industry exchange activities annually to share advanced experiences and enhance motivation for carbon management implementation.

3.2. Improve Accounting Systems and Consolidate the Data Foundation

Systematically conduct carbon emission inventories in accordance with national accounting standards [2]. Implementation can be divided into three phases: first, complete accurate accounting of direct emissions and energy-related indirect emissions within six months; second, establish a statistical framework for other indirect emissions within one year; and finally, achieve full life cycle carbon footprint accounting within two years. Apply information technologies such as IoT and big data to build digital carbon management platforms. Deploying intelligent monitoring equipment at key emission points is recommended, upgrading data collection frequency from monthly statistics to real-time monitoring. Enterprise practices demonstrate that digital management can increase accounting accuracy to over 90% and improve management efficiency by approximately 35%.

3.3. Promote Technological Upgrades and Optimize Production Processes

Accelerate the optimization of the energy structure, aiming to increase the proportion of clean energy use to over 25% within three years [6]. Specific measures include: promoting the application of biomass energy; implementing distributed photovoltaic projects, with an estimated annual power generation exceeding 40 million kWh; advancing energy-

saving technological transformations, focusing on waste heat recovery projects expected to reduce steam consumption by 15%-20%; and researching and developing high-efficiency distillation equipment targeting a thermal efficiency increase to over 80%. Regarding circular economy development, enhance the resource utilization of waste, striving to achieve a comprehensive utilization rate of distiller's grains exceeding 95%, leading to an annual emission reduction of over 60,000 tons.

3.4. Promote Industrial Synergy and Build a Green Supply Chain

Extend management upstream by constructing green raw material bases and promoting ecological planting models [9]. Plan to establish 400,000 mu of low-carbon planting demonstration zones within three years, aiming to reduce the carbon footprint per unit of raw material by over 12%. Optimize downstream logistics and packaging systems by promoting packaging lightweighting, targeting a reduction in packaging material weight by over 15% and logistics carbon emission intensity by over 12% within three years. Establish a green supply chain management system, requiring core suppliers to complete carbon inventory work within two years and achieve an 8% improvement in carbon efficiency within five years.

3.5. Deepen Market Participation and Innovate Financing Methods

Strengthen capacity building for the carbon market; it is recommended to train at least 40 professional carbon trading personnel annually [8]. Form carbon asset development teams focused on developing China Certified Emission Reduction (CCER) projects, with estimated average annual revenue per project reaching 1.5-4 million RMB. Explore carbon financial innovations, actively developing businesses such as carbon allowance pledge financing and carbon insurance. One enterprise, through carbon financial innovation, successfully secured a 25 million RMB special loan for low-carbon transformation, saving approximately 1.2 million RMB in annual financial expenses.

3.6. Improve the Policy System and Optimize the Institutional Environment

Formulate an industry-specific carbon peak implementation plan, clarifying the strategic target to achieve the peak before 2030 [1]. Enhance fiscal and tax incentive policies; it is recommended to establish a 300 million RMB special green development fund, providing subsidies of up to 25% for retrofits to enterprises with advanced carbon efficiency. Accelerate the development of a carbon emission accounting and product carbon footprint standard system, striving to complete the formulation of relevant standards within two years. Build public service platforms to provide comprehensive technical services to enterprises, expected to reduce carbon management costs for SMEs by over 30%.

4. Specific Implementation Suggestions for Enhancing Carbon Asset Management in Yibin Baijiu Enterprises

4.1. Enterprise-Level Suggestions:

Immediately initiate a systematic carbon emission

inventory and establish a carbon asset ledger [2]. Complete the initial inventory within 6 months and establish a dynamic update mechanism within 1 year. Referencing advanced enterprises' experiences, systematic inventories can uncover over 20 emission reduction opportunities, with an annual reduction potential of 15,000 tons.

Formulate enterprise-specific carbon peak implementation strategies, defining phased goals [7]. Set annual emission reduction targets, ensuring a 25% reduction in carbon intensity by 2030 compared to 2020. Practices of industry benchmarks show that target management can reduce carbon emissions per unit product by over 25% within five years.

Establish a carbon budget management system, incorporating carbon emission costs into the performance assessment system [8]. Include carbon efficiency indicators in departmental performance evaluations with a weight of no less than 8%. One enterprise's implementation led various departments to proactively propose 25 emission reduction solutions, saving nearly 10 million RMB annually. Strengthen cooperation with scientific research institutions for joint emission reduction technology R&D [10]. Allocate annual R&D investment of no less than 1.2% of operating revenue, focusing on breakthroughs in key technologies like low-carbon brewing.

4.2. Government and Industry-Level Suggestions:

Establish an industry carbon efficiency evaluation system and implement benchmark management [4]. Regularly publish carbon efficiency rankings and provide policy support to top-performing enterprises. Implementation is estimated to improve average industry carbon efficiency by over 4% annually. Set up an industrial green development fund to support enterprise technological transformation [1]. Suggest an initial scale of 500 million RMB, focusing on supporting SMEs, with maximum support of 8 million RMB per project. Explore the establishment of a regional carbon inclusion mechanism to incentivize emission reduction behaviors [3]. Design a carbon points system covering the entire industrial chain to facilitate the market-based trading of emission reductions. Build industry exchange platforms to promote technology and experience sharing [4]. Hold at least two low-carbon technology promotion events and organize no less than three study tours to benchmark enterprises annually.

5. Conclusion and Outlook

Guided by the carbon peak and carbon neutrality goals, strengthening carbon asset management has become an imperative for Yibin Baijiu enterprises to achieve sustainable development [1]. This requires a fundamental shift in development philosophy, transforming environmental constraints into drivers of innovation through the construction of a systematic carbon management system. Empirical analysis indicates that through the coordinated advancement of management innovation, technological innovation, and institutional innovation, Yibin Baijiu enterprises can not only achieve the carbon peak target before 2030 but also realize a reduction of over 35% in carbon emission intensity per unit product by 2035 [7]. This transformation will not only help Yibin Baijiu enterprises gain a competitive advantage in the new development stage but also provide replicable practical experience for the green and low-carbon transformation of traditional industries.

It must be emphasized that this transformation requires the collaborative participation and sustained efforts of multiple stakeholders, including enterprises, government departments, and industry organizations [1]. Establishing a tripartite coordination mechanism involving "government, industry associations, and enterprises" is recommended, with regular coordination meetings to promptly address implementation challenges. Simultaneously, attention should be paid to building a professional talent training system, planning to cultivate over 150 carbon management professionals within three years to support the industry's green transformation. Through systematic and sustained efforts, Yibin Baijiu enterprises are poised to pioneer a green upgrade path for traditional industries with Chinese characteristics, making positive contributions to achieving the national carbon peak and carbon neutrality goals.

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