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A Review of Carbon Asset Management in Oil and Gas Enterprises

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Abstract: In the context of carbon peak and carbon neutrality, people are increasingly paying attention to energy conservation and emission reduction. As a major carbon emitter in China, oil and gas enterprises have an unshirkable responsibility to manage carbon assets and promote green and low-carbon development. This article reviews the latest research achievements in carbon asset management at home and abroad, analyzes the existing problems in carbon asset management of oil and gas enterprises, and puts forward development suggestions, aiming to provide reference for the future development of oil and gas enterprises.

Keywords: Oil and Gas Enterprises; Carbon Assets; Carbon Asset Management.

1. Introduction

In 1992, the United Nations Framework Convention on Climate Change was adopted, establishing the concept of "carbon assets". Marland (2001) first proposed that carbon assets are a type of carbon emission rights that can be traded and have practical value, and encouraged extensive academic discussion on the connotation of carbon assets. Han Liyan and Huang Gubo (2015) first proposed technological carbon assets and analyzed the main reasons that affect the value changes of carbon assets from the perspective of technological carbon assets. It is also believed that in addition to defining carbon assets based on the value of carbon emission rights, carbon assets can also be understood from multiple perspectives such as energy, ecology, and accounting. Wang Weiwen (2019) believes that carbon assets are the resources for enterprises to achieve economic benefits through implementing emission reduction measures, thereby reducing emissions below the baseline. Wan Quanmin (2019) believes that carbon assets have scarcity due to emission limits generated by reasonable environmental capacity, and such assets can be called carbon assets. It is believed that the main body responsible for managing carbon assets includes not only emission control enterprises but also non emission control enterprises and intermediary institutions that profit from managing corporate carbon assets. Justin D (2020) believes that carbon assets refer to assets that contribute to carbon reduction practices and are suitable for storage, circulation, and value adjustment, including tangible and intangible assets. Carbon assets are assets generated by enterprises due to emission reduction. Liu Tianshu (2020) believes that resources that can contribute to low-carbon are considered carbon assets.

With the continuous improvement of the concept of carbon assets, people's accounting measurement methods for carbon assets are also constantly improving. Davis et al. (2010) believe that carbon assets, as an asset, require accounting standards and can be measured as inventory or fixed assets. Zhang Peng (2011) analyzed the characteristics of carbon assets, including the initial measurement, subsequent measurement, and disposal methods, and provided specific cases as references. Yao Wenyun and Lu Yao (2020) focused on the identification and treatment of carbon emissions and believed that a general ledger account for "carbon emission rights" should be added, and fair value measurement should be adopted. Zhao Changli (2022) summarized the current discussion and research on which type of asset carbon assets belong to, and the measurement methods of carbon asset holding stages.

Research on the connotation of carbon asset management, Zhang Yalian and Zhang Su (2013) believe that strengthening carbon asset management is necessary and cannot be limited to only studying carbon emission rights. Tang&Luo (2014) summarized 10 essential elements in carbon asset management systems and believed that effective carbon asset management systems can effectively enhance the value creation ability of carbon assets. Liao Gao, Zhang Su et al. (2014) believe that carbon asset management is an important part of the construction of a "green China", which can be carried out from aspects such as carbon inventory, carbon budgeting, carbon accounting treatment, carbon disclosure, and carbon funds. Tao Chunhua (2016) analyzed the factors driving carbon asset management, and the theoretical research on carbon asset management plays a significant role in environmental resource protection and promoting ecological civilization construction. Herold et al. (2017) summarized through 15 years of practical experience in carbon asset management in the logistics and transportation sectors, effective carbon asset management includes five core parts: carbon strategy formulation, carbon risk assessment, carbon target setting, implementation of emission reduction measures, and carbon performance and carbon information disclosure. Duan Yachao (2017) believes that carbon asset management includes comprehensive carbon asset management business and carbon asset preservation and appreciation business, and there are risks in carbon asset management business. Fang Qun, Yin Jingyu et al. (2019) conducted a study on the carbon emission management system of the cement industry. Carbon asset management work is carried out based on quotas and performance, performance evaluation, and carbon trading to reduce enterprise costs. Ding Chang (2020) believes that carbon asset management of geothermal clean energy has good economic and social benefits, and more development of geothermal utilization projects is conducive to reducing carbon emissions. Zhao Yucheng, Li Xinchuang, et al. (2022) selected the steel

industry as the research object based on the current needs of low-carbon development and constructed a six dimensional carbon asset management system, providing reference for future carbon asset management of enterprises. Ma Yanan and Gao Xueming (2022) have constructed a "five in one" carbon resource management system, providing reference for the sustainable development of enterprises.

Some scholars have conducted research on strategies for carbon asset management. Calel et al. (2016) found in their study on the European Emissions Trading System (EUETS) that EUETS has a significant driving effect on low-carbon technological innovation. A mature carbon emissions trading market has a positive impact on enterprises conducting low-carbon technology research and development. Zeng Yin and Fan Lili (2017) established the ABMS (Agent Based Modeling&Simulation) model to simulate and analyze carbon assets, and found that low-carbon technology is the key factor leading to the development, evolution, and adjustment strategies of other carbon assets.

Zhang Caiping and Zhang Ying (2017) established a carbon asset performance evaluation system, which mainly includes carbon capital turnover rate, carbon emission rate, carbon quota surplus rate, carbon fixed asset return rate, and low-carbon technology conversion rate. These indicators are used to measure the efficiency of carbon asset management. Huang Jinpeng, Qi Shaozhou et al. (2019) believe that carbon asset management models include three types: large group companies can establish their own carbon asset management departments, establish independent carbon asset management companies, and a combination of the first two models. Han Jieping and Niu Yiheng (2023) constructed a carbon budget system covering six parts: target determination, process design, form preparation, responsibility decomposition, adjustment item handling, and deviation assessment under the "dual carbon" goal.

This article reviews the relevant theories and practices of carbon assets and carbon asset management, analyzes the current challenges and problems faced by carbon asset management in oil and gas enterprises, and proposes corresponding solutions and suggestions. Through in-depth research and practical experience summary, we hope to provide useful reference and inspiration for oil and gas enterprises to better implement carbon asset management, and jointly promote the process of global low-carbon transformation and sustainable development.

2. Development Status of Carbon Asset Management in Oil and Gas Enterprises

Firstly, at the strategic level, many oil and gas companies have begun to incorporate carbon reduction targets into their comprehensive decision-making and investment costs of development strategies, and attach great importance to carbon asset management from a strategic perspective. Secondly, at the level of management standards, oil and gas enterprises are gradually adopting and implementing the relevant greenhouse gas emission accounting methods and reporting guidelines formulated by the National Development and Reform Commission. This will help enterprises establish efficient carbon inventory capabilities and introduce carbon asset management methods that are suitable for their own situation. In addition, at the level of management mode, oil and gas enterprises are establishing a guarantee and support system for implementing carbon asset management. These measures aim to enhance the capacity building of emission control enterprises to address the challenges of carbon asset management. Finally, at the level of technological application, some oil and gas companies have begun to use digital technology to promote carbon asset management. Overall, the development status of carbon asset management in oil and gas enterprises shows a trend of strategic emphasis, unified management standards, innovative management models, and improved technological applications. However, with global climate change and the promotion of national carbon peak and carbon neutrality strategies, oil and gas enterprises still need to further strengthen their capacity building in carbon asset management to achieve low-carbon transformation and sustainable development.

3. The Development Dilemma of Carbon Assets in Oil and Gas Enterprises

3.1. Lack of a Comprehensive Carbon Asset Management System

In the context of constantly changing carbon markets and increasingly complex policy environments, enterprises need to make decisions quickly and accurately. However, currently oil and gas companies only have some simple strategies for managing carbon assets, lacking a comprehensive management system. Due to the lack of unified standards and processes, enterprises may find it difficult to accurately calculate and monitor carbon emissions, thereby affecting the achievement of carbon reduction targets. A sound carbon asset management system should also include risk assessment, monitoring, and response mechanisms. Secondly, without these mechanisms, enterprises may not be able to detect and manage risks and issues in the carbon asset management process in a timely manner, thereby increasing the risks and uncertainties faced by enterprises.

3.2. Low Transparency and Strong Subjectivity in Carbon Footprint Accounting

Carbon footprint accounting directly affects the accuracy and reliability of carbon asset management. Carbon footprint accounting is the process of quantifying and tracking greenhouse gas emissions generated by products or services throughout their lifecycle. However, due to incomplete data collection and reporting, as well as the diversity of accounting methods and standards, many companies face issues of insufficient transparency and subjectivity in carbon footprint accounting.

3.3. Insufficient Professional Carbon Asset Management Personnel

Firstly, professional carbon asset managers possess rich knowledge and skills in carbon asset management, and can accurately understand and grasp the dynamic changes in the carbon market. They are familiar with the regulations, policies, and standards related to carbon asset management, and can provide strong support for enterprises to develop carbon asset management strategies that are in line with their actual situation. However, currently there are relatively few talents in the market with these professional skills and experience, which makes it difficult for enterprises to find

suitable carbon asset management personnel.

Secondly, professional carbon asset managers need to possess interdisciplinary comprehensive qualities. Carbon asset management involves knowledge in multiple fields such as environmental science, economics, and finance, requiring managers to possess interdisciplinary comprehensive literacy. This requires companies to pay more attention to the comprehensive quality and potential of talents when recruiting and cultivating carbon asset management personnel, rather than just focusing on their professional skills and experience.

4. Suggestions for Optimizing Carbon Asset Management

4.1. Develop a Comprehensive Framework for Carbon Asset Management System

In order to optimize carbon asset management, enterprises urgently need to establish a sound carbon asset management system. This system should cover all aspects of carbon asset management, including goal setting, strategy formulation, method selection, process design, tool application, and risk assessment and response equivalence. By establishing a comprehensive carbon asset management system, enterprises can manage carbon assets more systematically and comprehensively, improve management efficiency and effectiveness, and provide strong support for their low-carbon transformation and sustainable development.

4.2. Improve the Transparency and Accuracy of Carbon Footprint Accounting

Firstly, enterprises should establish a sound data collection and reporting mechanism to ensure the integrity and accuracy of data. Secondly, enterprises should actively adopt internationally recognized carbon footprint accounting methods and standards to reduce the subjectivity of accounting results. In addition, enterprises should strengthen communication and cooperation with external stakeholders to improve the transparency and credibility of carbon footprint accounting. Through the implementation of these measures, enterprises can more accurately and reliably manage their carbon assets, making positive contributions to low-carbon transformation and sustainable development.

4.3. Strengthen Team Training and Talent Development

In order to cultivate more carbon asset management talents, enterprises can start from the following aspects.

Firstly, strengthen internal training: Enterprises can improve their existing employees' knowledge and skills in carbon asset management by organizing internal training, seminars, and other activities. This can not only improve the comprehensive quality of employees, but also cultivate more carbon asset management personnel reserves for the enterprise.

The second expansion of recruitment channels: Enterprises can expand their recruitment scope through various channels, such as establishing cooperative relationships with universities, research institutions, etc., to attract more outstanding talents with relevant professional backgrounds and skills to join.

The third is to establish incentive mechanisms: Enterprises can establish comprehensive incentive mechanisms, such as providing competitive salary benefits, promotion opportunities, etc., to attract and retain excellent carbon asset management personnel.

5. Conclusion

Oil and gas enterprises face enormous challenges and opportunities in carbon asset management. As a member of the high carbon emission industry, oil and gas companies need to actively respond to the trend of global climate change and low-carbon transformation, strengthen carbon asset management, reduce carbon emission intensity, and increase the value of carbon assets. By improving the carbon asset management system framework of oil and gas enterprises, improving the transparency and accuracy of carbon footprint accounting, strengthening team training and talent building, and other measures, it is beneficial for the carbon asset management of oil and gas enterprises. In short, carbon asset management in oil and gas enterprises is a long-term and arduous task. Only through continuous efforts and innovation can we achieve the goals of carbon reduction and carbon asset appreciation, laying a solid foundation for the future development and social responsibility of enterprises.

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