

Analysis of Pathways to Achieve Agricultural Carbon Neutrality and Investment Opportunities

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Abstract

Carbon neutrality is currently a hot topic of concern in the international community, and agriculture, as an important sector, also plays a significant role in the process of achieving carbon neutrality. Against the backdrop of global climate change, agriculture, as a fundamental industry for human survival, plays an important role in carbon neutrality. In particular, should focus on the opportunities for disruptive innovation brought by emerging technologies in the agricultural sector, providing revolutionary solutions for future agricultural production. It is also necessary to improve the investment ecosystem of agriculture, attracting capital and exceptional talents to participate. This article analyzes the pathways to achieve agricultural carbon neutrality and discusses the investment opportunities it brings. This article first introduces the concept of carbon neutrality and its background, and then focuses on analyzing the implementation pathways of agricultural carbon neutrality and discussing the investment opportunities in this field. The aim is to provide reference for the development of relevant industries.

Keywords

Agriculture, carbon neutrality, investment opportunities

Introduction

In September 2020, China made a solemn commitment to the world to strive for carbon peaking by 2030 and carbon neutrality by 2060. Agriculture has long been in a fundamental position in China's economic and social development. The central government has continuously issued the No.1 Document focusing on the development of agriculture, rural areas, and farmers, considering the solution to rural issues as a top priority for the Party's work. On December 28, 2021, the Central Rural Work Conference emphasized that agricultural emission reduction and carbon sequestration are important measures for achieving carbon peaking and carbon neutrality, as well as the potential lies within. In order to implement the dual carbon targets, the Ministry of Agriculture and Rural Affairs and the National Development and Reform Commission issued the "Implementation Plan for Agricultural Emission Reduction and Carbon Sequestration" on June 30, 2022, once again focusing everyone's attention on the green and low-carbon development of agriculture. Agriculture is not only an important source of greenhouse gas emissions but also a huge carbon sink system, containing significant emission reduction potential [1].

The challenge of achieving agricultural carbon neutrality lies in reducing agricultural greenhouse gas emissions while meeting the growing demand for food. Therefore, agricultural carbon neutrality poses new and higher requirements for the development of modern agriculture. At the same time, the systematic transformation and realization of carbon neutrality in the agricultural sector present both challenges and revolutionary opportunities, calling for the emergence of new technologies, new concepts, and new models. This article aims to explore the pathways to achieve agricultural carbon neutrality, analyze related investment opportunities, and provide theoretical and practical guidance for research and practices in the field of agricultural carbon neutrality, as well as references for relevant institutions and government departments.

1. Concept and Background of Carbon Neutrality

Carbon neutrality refers to controlling the emissions of greenhouse gases within a certain range, achieving zero net emissions through technological means, and adopting permanent absorption and storage measures in appropriate locations, thus achieving a technical and management approach to human control of atmospheric greenhouse gas content.

Carbon neutrality is an urgent issue. A report published by the World Bank points out that in less than a century, the world will face the enormous task of reducing 4.5 billion tons of carbon dioxide in carbon neutrality. To address this issue, many countries and regions around the world have formulated carbon neutrality goals. For example, the European Union aims to achieve carbon neutrality by 2050, and China has set a goal of achieving carbon neutrality by 2060. Carbon neutrality poses different requirements for various industries, and agriculture has its unique role and advantages [2].

At the same time, the systematic transformation and realization of carbon neutrality in the agricultural sector present both challenges and revolutionary opportunities, calling for the emergence of new technologies, new concepts, and new models. This article first introduces the concept of carbon neutrality and its background, and then focuses on analyzing the implementation pathways of agricultural carbon neutrality and discussing the investment opportunities in this field. The aim is to provide reference for the development of relevant industries.

2. Pathways to Achieve Agricultural Carbon Neutrality

2.1 Reducing Greenhouse Gas Emissions

(1) Paddy field management: Organic matter in the soil forms an anaerobic environment under long-term flooding conditions, leading to the production of methane in rice fields. Therefore, methane emissions from paddy fields can be controlled through water-saving irrigation.

(2) Reduction and efficiency improvement of nitrogen fertilizer: By reducing the amount of chemical fertilizers and optimizing fertilizer structure, the utilization efficiency of nitrogen fertilizers can be improved, leading to a reduction in methane and nitrous oxide emissions.

(3) Improvement of livestock feed: Methane produced in the intestines of livestock is formed through enzyme actions and microbial transformations of feed in the ruminant digestive system. Therefore, reducing methane emissions from animal intestinal fermentation can be achieved through improved livestock feed management and the use of appropriate feed additives, thus reducing nitrous oxide emissions in the process of manure storage and treatment [3].

(4) Utilization of livestock manure: Treating livestock manure through fermentation and anaerobic digestion methods can convert organic matter in manure into anaerobic digestion biogas and organic fertilizers, which can be used as clean energy to replace fossil fuels, further reducing greenhouse gas emissions.

2.2 Enhancing Carbon Sequestration in Agricultural and Grassland Ecosystems

(1) Conservation tillage: Modern tillage techniques, mainly based on reduced or no-tillage and crop residue coverage, can reduce the emission of greenhouse gases from soil and increase soil carbon storage [4].

(2) Straw incorporation: Returning crop residues to the soil can increase soil organic matter content, promote microbial reproduction and activity, and simultaneously absorb an equivalent amount of CO₂ while emitting CH₄.

(3) Application of organic fertilizers: Applying animal manure and human urine to the soil after fermentation and maturation can improve soil structure and enhance soil's nutrient retention and buffering capacity.

(4) Grassland conservation, rotational grazing, and grass-animal balance: Promoting plant growth, increasing organic matter in grasslands, and enhancing carbon sequestration capacity.

2.3 Promoting Renewable Energy Substitution

(1) Saving fossil energy: Using straw bundles as fuel instead of traditional fuels, providing centralized heating for communities, governments, schools, etc., through professional stoves [5].

(2) Solar energy utilization: Promoting the development of photovoltaic power generation, as well as the application of solar water heaters, solar street lights, and solar-powered buildings.

(3) Upgrading rural biogas projects: Promoting the transformation and upgrading of rural biogas projects towards large-scale development, comprehensive utilization, scientific management, and driving economic benefits [6].

(4) Research and promotion of advanced low-carbon and energy-saving agricultural machinery and equipment: Vigorously phasing out old agricultural machinery with high energy consumption, heavy pollution, and low safety, and improving the promotion and utilization efficiency of advanced low-carbon agricultural machinery.

(5) Promoting clean heating with biomass energy: In suitable rural areas, accelerate the construction of a rural modern energy green system with biomass energy as the main source and other energy sources as supplements. Tailor the layout to include solar, wind, tidal, and other energy facilities [7].

3. Investment Opportunities in Agricultural Carbon Neutrality

Agricultural carbon neutrality presents higher requirements for modern agriculture and, at the same time, creates new opportunities. Firstly, in the process of investing in agricultural carbon neutrality projects, carbon credits can be obtained [8], which can be converted into monetary benefits through carbon trading markets. Secondly, the realization of agricultural carbon neutrality requires a lot of technical support, which can bring business opportunities for investors through technological research and development and services. Finally, the promotion of agricultural carbon neutrality requires a significant amount of publicity and dissemination, which can bring market opportunities for investors through media and training [9]. Countries or enterprises that can seize the opportunity and embrace transformation rapidly will take the lead and thrive in the future technology-driven era of agriculture [10].

Investors, in particular, should focus on the opportunities for disruptive innovation brought by emerging technologies in the agricultural sector, providing revolutionary solutions for future agricultural production. It is also necessary to improve the investment ecosystem of agriculture, attracting capital and exceptional talents to participate.

(1) Technological innovation: Achieving agricultural carbon neutrality relies on advanced technological means and innovative agricultural production methods. Therefore, agricultural carbon neutrality provides opportunities for technological innovation for investors. Examples include investing in the research and improvement of agricultural production tools, the development and utilization of bioenergy, carbon capture and storage technologies, etc., which can bring considerable economic returns [11].

(2) Ecological agriculture and organic agriculture: Ecological agriculture and organic agriculture are important ways to reduce agricultural greenhouse gas emissions and achieve agricultural carbon neutrality, with enormous development potential. For example, through the cultivation and sales of organic agricultural products and the promotion of ecological agricultural technologies, a win-win situation can be achieved in terms of economic and environmental benefits.

(3) Gene editing breeding: In the past 30 years, seed innovation has made positive contributions to improving crop yields. The progress of gene editing technology is expected to have a strong impact on future food supply. It has the potential to improve nitrogen fertilizer utilization efficiency, effectively reduce crop losses, and has significant potential in saving land and water resources [12].

(4) Climate finance: With the intensification of global climate change, climate finance has gradually become an important investment field. Investments in climate finance can include carbon trading markets, carbon asset management, climate risk management, etc. By participating in climate finance investments, investors can achieve stable investment returns while promoting the realization of agricultural carbon neutrality.

(5) Improvement of livestock feed: Methane produced in the intestines of livestock is formed through enzyme actions and microbial transformations of feed in the ruminant digestive system. Therefore, reducing methane emissions from animal intestinal fermentation can be achieved through improved livestock feed management and the use of appropriate feed additives, thus reducing nitrous oxide emissions in the process of manure storage and treatment [13].

4. Conclusion

Against the backdrop of global climate change, agriculture, as a fundamental industry for human survival, plays an important role in carbon neutrality. This article analyzes the pathways to achieve agricultural carbon neutrality and discusses the investment opportunities it brings. With the increasing global environmental awareness, opportunities arising from agricultural carbon neutrality will continue to grow. It requires support and promotion in terms of funding, policies, and technologies to ensure the sustainability and long-term benefits of agricultural carbon neutrality.

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