Environment, Resource and Ecology Journal (2024)
Clausius Scientific Press, Canada

DOI: 10.23977/erej.2024.080207
ISSN 2616-3756 Vol. 8 Num. 2

Pathways and Plans for Achieving Peak Urban Carbon Emissions

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Keywords: Peak urban carbon emissions; Pathways; Plans

Abstract: As global climate change intensifies, reducing carbon emissions and achieving carbon neutrality have become common global goals. As the world's largest developing country, China has significant responsibilities in addressing climate change. The Chinese government has proposed targets for peak carbon emissions and carbon neutrality, aiming to achieve these through measures such as optimizing the energy structure, improving energy efficiency, developing a circular economy, and increasing carbon sinks. By improving energy efficiency, enhancing traffic management, and strengthening waste management, a series of policy measures can help achieve peak urban carbon emissions. This paper will explore the pathways and plans for achieving peak urban carbon emissions, providing valuable references for cities aiming to meet peak carbon targets.

1. Introduction

With the rapid development of the global economy, human demand for energy continues to increase, leading to a sustained rise in carbon emissions and triggering global climate change issues. Various countries have proposed goals to reduce carbon emissions, with cities, as the primary sources of emissions, being key to achieving peak carbon emissions. Achieving peak urban carbon emissions is a crucial measure in responding to global climate change, benefiting environmental protection and promoting sustainable development. It is a long-term and challenging task that requires the collective and continuous effort of governments, enterprises, and all sectors of society. Only through joint efforts and continuous innovation across society can the goal of peak urban carbon emissions be realized, contributing positively to the creation of a beautiful China and a beautiful Earth. This paper will discuss the pathways and plans for achieving peak urban carbon emissions, analyzing the methods and measures to achieve this goal and providing references for urban sustainable development.

2. The Significance of Achieving Peak Urban Carbon Emissions

Globally, cities are the engines of economic development and the main areas of energy consumption and carbon emissions. Statistics show that urban carbon emissions account for over 70% of the global total[1]. As urbanization progresses, urban carbon emissions will continue to grow.

Therefore, controlling urban carbon emissions and achieving peak emissions has become a crucial task in global climate governance. Achieving peak urban carbon emissions is beneficial for mitigating global climate change, protecting the ecological environment, and promoting sustainable development. Specifically, it has the following benefits: (1) Reducing greenhouse gas emissions and mitigating global climate change. (2) Improving urban environmental quality and ensuring residents' physical and mental health. (3) Promoting green and low-carbon development and facilitating economic transformation and upgrading. (4) Enhancing urban competitiveness and establishing an international image. Achieving peak urban carbon emissions is of great significance in mitigating global climate change, improving urban environmental quality, promoting green and low-carbon development, enhancing urban competitiveness, and promoting social equity and justice.

3. Pathways to Achieving Peak Urban Carbon Emissions

Achieving peak urban carbon emissions requires a multifaceted approach, including optimizing the energy structure, improving energy efficiency, developing a circular economy, and increasing carbon sinks. These measures need the joint efforts and cooperation of the government, enterprises, and society at large to reach the goal of peak urban carbon emissions. Continuous exploration and innovation are also necessary to find more effective pathways and solutions. Achieving peak urban carbon emissions is a long-term and arduous task that demands persistent efforts and investment from all sectors of society. By clarifying principles, streamlining strategies, and highlighting priorities, the goal of peak urban carbon emissions can be effectively promoted.

3.1 Optimizing the Energy Structure

Optimizing the energy structure is the primary task for achieving peak urban carbon emissions. This involves reducing reliance on fossil fuels and vigorously promoting the development of renewable energy[2]. (1) Developing renewable energy vigorously. Renewable energy such as wind energy, solar energy and hydropower has the characteristics of clean and pollution-free, and should become an important part of the urban energy structure. The government should introduce relevant policies and measures to encourage and support the development and utilization of renewable energy and increase its proportion in energy consumption. (2) Promoting clean and efficient use of coal. Although coal still occupies a certain proportion in the current energy structure, it can be promoted through technological transformation and industrial upgrading. For example, advanced coal washing, combustion, desulfurization and denitration technologies have been adopted to reduce pollutant emissions during coal combustion. (3) Strengthening the development and utilization of clean energy such as natural gas. Natural gas as a relatively clean energy, should be more attention and application. The government can invest more in gas extraction and transmission infrastructure and encourage companies to use natural gas instead of high-carbon energy sources such as coal.

3.2 Improving Energy Efficiency

Improving energy efficiency is a key link in reducing carbon emissions. Measures such as energy saving and carbon reduction and waste resource utilization can reduce energy consumption and carbon intensity[2]. (1) Promoting energy saving and carbon reduction in industries, buildings, and transportation. Industries, buildings, and transportation are the main areas of urban energy consumption and carbon emissions. The government should introduce relevant policies to encourage enterprises to adopt advanced energy-saving technologies and equipment, implement energy-saving transformations, and optimize energy management. Additionally, the formulation and enforcement of building energy-saving standards should be strengthened, promoting green buildings and energy-

saving buildings. In the transportation sector, public transportation and non-motorized travel should be vigorously promoted to reduce the use of private cars. (2) Strengthening waste resource utilization. Waste resource utilization can reduce energy consumption and carbon emissions and achieve resource recycling. The government should introduce relevant policies to encourage enterprises to carry out waste resource utilization work, promoting the development of a circular economy.

3.3 Developing a Circular Economy

Developing a circular economy is an important pathway to achieving peak urban carbon emissions. By promoting the concept and technology of a circular economy, resource reduction, reuse, and recycling can be achieved, reducing carbon intensity[3]. ① Promoting the concept and technology of a circular economy. The government should strengthen the promotion of a circular economy, enhancing public awareness and participation. At the same time, enterprises should be encouraged to adopt circular economy technologies and models, driving the optimization and upgrading of industrial structures. ② Strengthening industrial collaboration and regional cooperation. A circular economy requires industrial collaboration and regional cooperation. The government should establish platforms for industrial collaboration and regional cooperation, promoting resource sharing and complementary advantages, and building circular economy industrial chains and ecosystems. The joint efforts of the government, enterprises, and the public are necessary to promote the spread and development of a circular economy, contributing to achieving peak urban carbon emissions. Figure 1 illustrates the workflow for achieving peak carbon emissions.

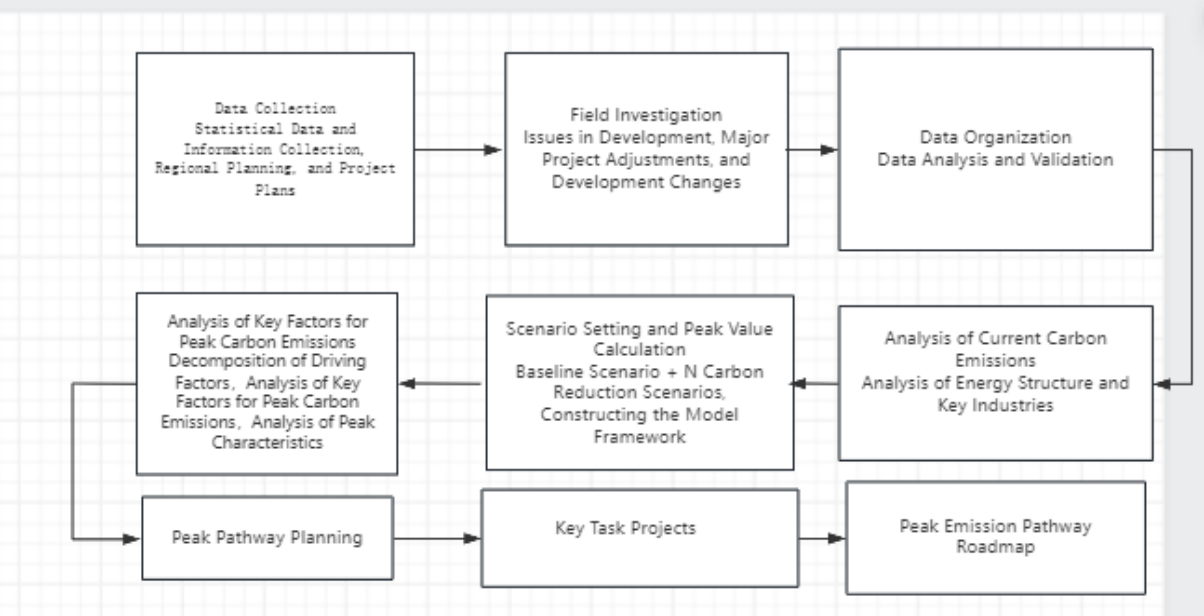

Figure 1: Carbon Peak Work Flow Diagram

3.4 Increasing Carbon Sinks

Increasing carbon sinks is an important method for offsetting carbon emissions. By undertaking measures such as afforestation, restoring degraded land, and protecting wetlands, we can enhance the carbon sink capacity of ecosystems, thereby offsetting some carbon emissions[4]. (1) Afforestation: Afforestation is an effective way to increase carbon sinks. The government should organize large-scale afforestation activities, encourage active participation from all sectors of society, and increase forest coverage. (2) Restoring Degraded Land: Restoring degraded land not only improves the ecological environment but also increases carbon sinks. The government should invest more in land

restoration projects, develop relevant policies and measures, and promote the management and rehabilitation of degraded land. (3) Protecting Wetland Ecosystems: Wetlands are one of the most important carbon sinks on Earth. The government should enhance the protection and restoration of wetland ecosystems, prevent wetland destruction and degradation, and maintain the stability and sustainability of their carbon sink functions.

4. Urban Carbon Emission Peak Plans

4.1 Establishing Carbon Emission Control and Intensity Reduction Targets

To achieve the goal of peak carbon emissions in cities, it is essential first to set clear and scientific targets for total carbon emission control and intensity reduction. These targets should be based on the city's actual development level, energy structure, industrial structure, and future trends in economic and population growth[5]. The target-setting process should involve extensive consultation to ensure the targets are reasonable and feasible. Setting scientific and reasonable targets for carbon emission control and intensity reduction is a critical step in reaching the urban carbon emission peak. This work must be undertaken with a strong sense of responsibility and mission, contributing to the city's sustainable development and global climate change response.

4.2 Implementing Key Industry Carbon Emission Peak Actions

First, in the industrial field, it is necessary to promote green industrial transformation, encourage enterprises to adopt advanced energy-saving technologies and equipment, implement energy-saving transformation and optimize energy management [6]. For high-emission industries, stricter emission standards should be formulated and supervision should be strengthened. At the same time, it is necessary to promote the concept of circular economy and improve the level of resource utilization of industrial waste. Second, in the field of construction, green buildings and energy-efficient buildings should be promoted to improve building energy efficiency. For existing buildings, energy-saving transformation should be implemented to improve the thermal insulation performance of buildings. In addition, we should strengthen the treatment and utilization of construction waste and promote the resource utilization of construction waste. Third, in the field of transportation, it is necessary to optimize the transportation structure and vigorously develop public transportation and non-motor vehicle travel modes. We should promote new energy vehicles and increase the proportion of new energy vehicles in public transportation and taxis. It is also necessary to strengthen the construction of transportation infrastructure, improve the efficiency of traffic operation, and reduce traffic congestion and emissions.

4.3 Enhancing Policy Support and Market Mechanism Construction

The first is policy support. Policies and measures to support carbon peaks, such as financial subsidies and tax incentives, should be formulated to stimulate the enthusiasm of enterprises and individuals to reduce emissions. For enterprises that actively take emission reduction measures, certain incentives and support should be given. The second is the market mechanism. Market mechanisms such as carbon emission trading should be established to guide enterprises to reduce carbon emissions. Through carbon emission trading, enterprises can buy and sell carbon emission rights according to their own emission reduction costs and market prices, so as to optimize emission reduction costs. The third is green finance. Green financial products and services should be developed to provide financial support for peak urban carbon emissions. Through financial instruments such as green bonds and green funds, attract social capital to invest in low-carbon fields and promote the

development of low-carbon industries. Figure 2 is an example of SWOT analysis of carbon emission peak in Changsha.

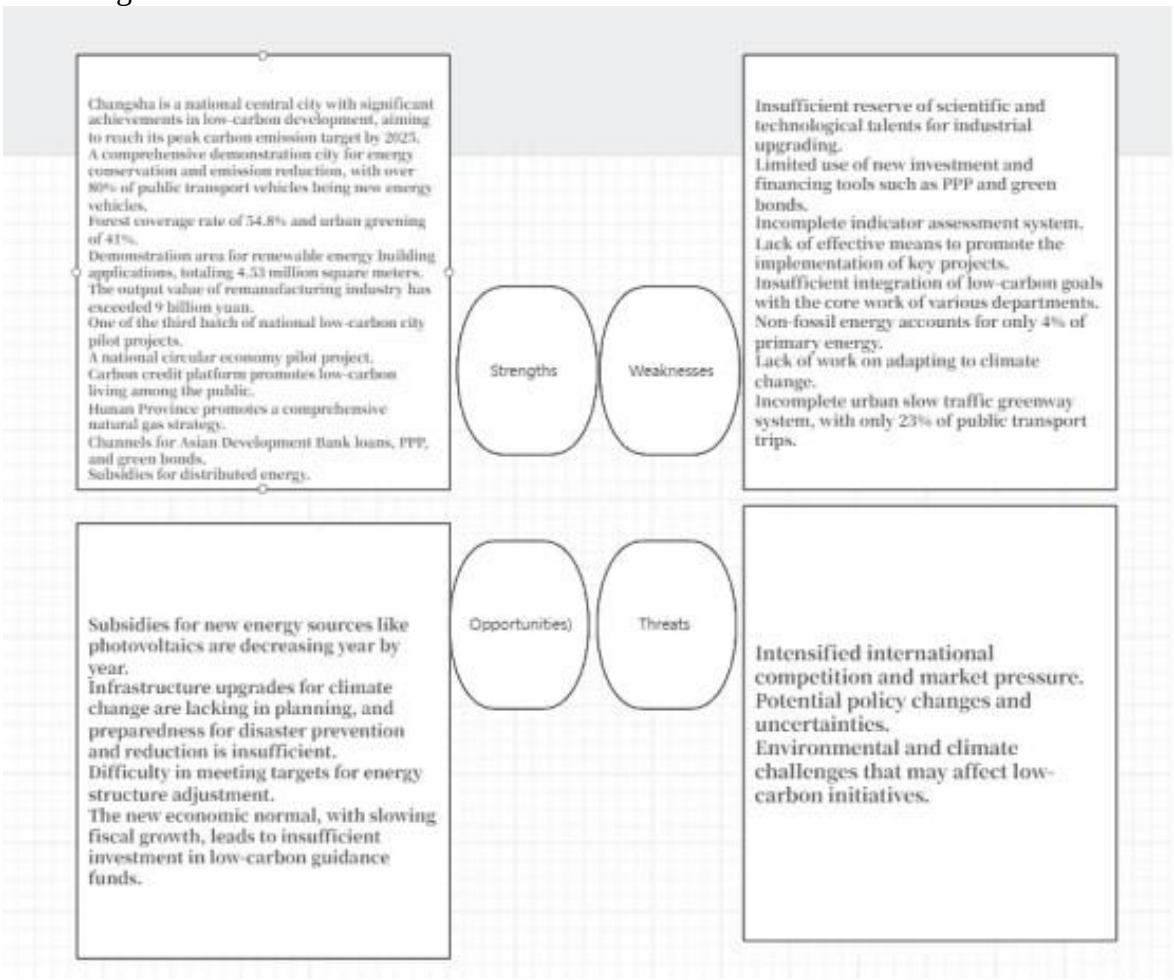

Figure 2: SWOT Analysis Example of Changsha's Carbon Emission Peak

4.4 Strengthening Technological Innovation and Talent Development

Strengthening technological innovation and talent development is crucial for achieving urban carbon emission peak targets. Governments, businesses, and academia should work together to advance technological innovation and talent development efforts, contributing to the achievement of urban carbon peak goals. It is necessary to strengthen the R & D and application of carbon capture, utilization and storage technology (CCUS) and other low-carbon technologies. We should also improve energy efficiency and carbon emission control through scientific and technological innovation. At the same time, international cooperation should be strengthened to introduce and digest international advanced low-carbon technologies. It is necessary to strengthen the training and introduction of talents in fields related to peak carbon emissions. Through universities, scientific research institutions and other channels, a group of talents with low-carbon technology R & D and application capabilities can be trained. At the same time, exchanges and cooperation with international counterparts should be strengthened to improve the internationalization level of talents.

5. Conclusion

Achieving urban carbon emission peaks is a key element in reaching global carbon neutrality goals.

By optimizing energy structure, improving energy efficiency, developing a circular economy, and increasing carbon sinks, setting scientific and reasonable carbon emission control and intensity reduction targets, implementing key industry carbon peak actions, enhancing policy support and market mechanisms, and fostering technological innovation and talent development, cities can effectively reach their carbon emission peak targets. Additionally, strengthening organizational leadership, coordination, monitoring, evaluation, reward and punishment systems, as well as public education and social participation are essential safeguards. Only through collective efforts from all sectors of society can urban carbon emission peak targets be achieved, making a positive contribution to addressing global climate change. In practice, cities should tailor their carbon emission peak routes and plans to their specific conditions and development stages.

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