

# The Significance of Achieving Carbon Peak and Carbon Neutrality Goals in the Gansu Section of the Yellow River Basin from the Perspective of High-quality Development

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## Abstract

The high-quality development of the Yellow River Basin and the strategies of peaking carbon dioxide emissions and achieving carbon neutrality are of great significance to the great rejuvenation of the Chinese nation and the sustainable development, and are major strategic decisions made by the Central Committee of the Communist Party of China after careful consideration. Gansu Province deeply implements Xi Jinping's ecological civilization ideology, adheres to the organic integration of the goals of peaking carbon dioxide emissions and achieving carbon neutrality with the strategy of high-quality development of the Yellow River Basin, in order to ensure that the Gansu section of the Yellow River Basin achieves the "dual carbon" goals as scheduled. Based on data from the "Statistical Yearbook of Gansu Province", this article analyzes the economic development, carbon emissions, and high-quality development of the Yellow River Basin in Gansu Province. It is concluded that from 2009 to 2021, the gross domestic product, total carbon emissions, and per capita carbon emissions in Gansu Province showed an overall fluctuating upward trend, while the carbon emission intensity showed a downward trend year by year. In combination with the actual situation in Gansu Province, achieving the "dual carbon" goals in the Gansu section of the Yellow River Basin will help promote the process of ecological civilization construction, build a clean, low-carbon, safe, and efficient energy system, promote energy consumption revolution, facilitate the upgrading and transformation of traditional industries, drive the construction of beautiful rural areas, and achieve the six aspects of significance for the people to live a better life.

## Keywords

Yellow River Basin; High-quality Development; "Dual Carbon" Goal; Gansu.

## 1. Introduction

In recent years, the global economy has been developing rapidly, with production and daily activities becoming increasingly active. The increase in carbon dioxide emissions has intensified the global greenhouse effect, resulting in phenomena such as climate warming, rising sea levels, glacier melting, land desertification, increased pests, and endangered species on the brink of extinction. These phenomena constantly threaten global ecological security. It is urgent to pay attention to the climate change brought about by global warming and actively respond to the threats of abnormal weather. To address climate change, the international community jointly signed the Paris Agreement in 2015, aiming to urge all contracting parties to keep the global average temperature within 2°C above pre-industrial levels (1850-1900), strive to limit it to 1.5°C, and implement carbon emission reduction measures tailored to each country to peak carbon emissions[1]. On the occasion of the fifth anniversary of the signing of the Paris Agreement, on September 22, 2020, General Secretary Xi Jinping delivered an

important speech at the 75th session of the United Nations General Assembly, solemnly declaring to the world that "China will peak CO<sub>2</sub> emissions before 2030 and strive to achieve carbon neutrality by 2060[2]." The government work report of 2021 has also prioritized achieving peak carbon emissions and carbon neutrality, incorporating it into China's "14th Five-Year Plan," emphasizing the acceleration of low-carbon and green development[3]. General Secretary Xi Jinping has also repeatedly emphasized in important speeches the need to incorporate peak carbon emissions and carbon neutrality into China's overall ecological civilization construction plan. By demonstrating determination and striving to achieve the "30/60 dual carbon" goals on schedule, China has fully demonstrated its great power responsibility and contribution, providing new development opportunities and challenges for economic development in various provinces and industries[4].

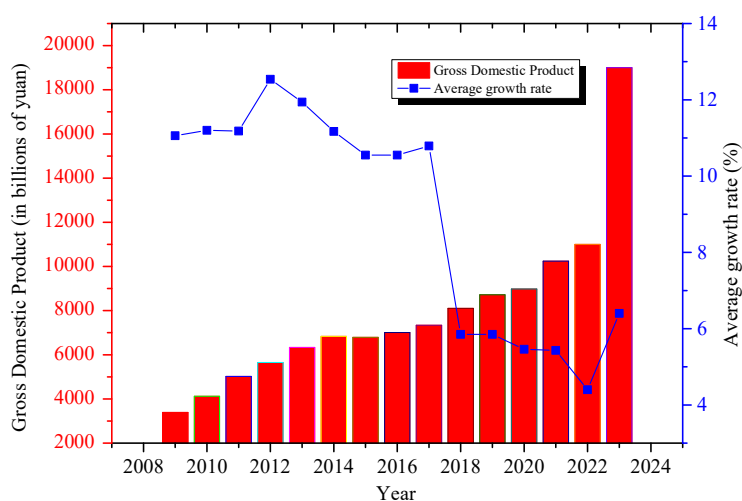
In recent years, many domestic scholars have conducted extensive research on carbon reduction and the realization of dual-carbon goals. Coal combustion is recognized as one of the main sources of carbon emissions, however, China's abundant coal resources are considered as a bottom-line energy source and cannot be blindly abandoned due to the proposal of dual-carbon goals. It is suggested that a coordinated CH<sub>4</sub>-CO<sub>2</sub> emission reduction strategy should be implemented[5]. Thermal power generation is considered the main culprit of CO<sub>2</sub> emissions, accounting for 40% of the total carbon emissions. Zhang Anan analyzed the CO<sub>2</sub> metering methods for thermal power plants mainly based on carbon accounting, supplemented by carbon monitoring, which helps to visually assess the CO<sub>2</sub> emissions from thermal power generation and promotes the development of the carbon trading market[6]. The chemical industry, as one of the six major high-energy-consuming industries, also has a significant amount of CO<sub>2</sub> emissions, causing severe environmental pollution. Chen Tingqiang analyzed the characteristics of green chemical technology and the mechanisms for carbon reduction from three dimensions: zero emission of pollution, dual-dimensional carbon reduction, and low-carbon technology[7]. At the same time, the realization of "dual-carbon" goals is closely related to economic and social development, not only the reduction of carbon emissions, but also the low-carbon green development under the context of healthy economic development, which poses both opportunities and challenges for regional development. On the one hand, the development of a region generally goes through five stages: starting, growing, maturing, transitioning, and declining, with different standards and requirements for high-quality development at each stage. The focus during the starting and growing stages is on the construction and improvement of the industrial system, while during the mature stage, the emphasis shifts towards industrial structure adjustment and transformation. On the other hand, in recent years, with the rapid economic development and optimization of industrial structure in China, the country's economic development model has gradually moved away from extensive and low-carbon green development has become the path to achieve high-quality development. General Secretary Xi Jinping has emphasized many times, "High-quality development is a requirement that all regions must implement, not only targeting economically developed regions." However, with varying territorial spans and imbalances in regional economic development and carbon emissions across China, the progress of achieving regional "dual-carbon" goals under the perspective of high-quality development is not consistent.

Gansu is located in the northwest of China, and it is also the upper and middle reaches of the Yellow River. The main stream passes through 4 prefectures and cities including Lanzhou, Baiyin, Linxia, and Gannan, while the tributaries flow through 5 cities including Tianshui, Dingxi, Pingliang, Wuwei, and Qingyang. It is an important water source conservation and supply area in the Yellow River basin. The high-quality development of Gansu province is very important for the northwest region and even the entire Yellow River basin. Exploring the significance of Gansu province in achieving the "dual carbon" target strategy in the perspective of high-quality development will help promote the realization process of the regional "dual carbon" target.

## 2. Current Situation of Economic Development and Carbon Emissions in the Gansu Section of the Yellow River Basin

### 2.1. Current Situation of Economic Development in Gansu Province

Gansu Province is located in the northwest inland of China, with a relatively remote location. Although its economy has maintained rapid growth, due to its relatively small economic scale, it ranks lower among all provinces and cities in the country. Despite the effects of the Western Development Policy and investments becoming apparent, the reality of a relatively small gross national economy will continue for a long time in the future. According to the statistical analysis of economic and social development parameters in Gansu Province from 2009 to 2022 in the "Gansu Statistical Yearbook," the Gross Domestic Product (GDP) and economic growth rate of Gansu Province in recent years are shown in Figure 1.



**Figure 1.** Gansu Province's Gross Domestic Product (GDP) and economic growth rate

According to Figure 1, the GDP of Gansu Province shows a fluctuating upward trend, while the average economic growth rate shows a fluctuating downward trend. In 2009, the GDP of Gansu Province was 3387.56 billion yuan, which increased to 4120.75 billion yuan in 2010, with an average annual growth rate of 11.2%. By 2014, the GDP had increased to 6836.82 billion yuan, and then remained relatively stable until 2017. Subsequently, there was a rising trend in growth, and by 2021, the GDP of Gansu Province reached 1.02433 trillion yuan, more than three times that of 2009. Over the past decade, the annual average economic growth rate has shown an overall downward trend, although there was a small peak in 2021 at 12.54%, after which it continued to decline to 10.55% in 2015, and then remained basically stable by 2018. Since 2019, due to the global impact of the COVID-19 pandemic, the overall economy has been on a downward trend, and Gansu Province is no exception, with economic growth rates continuing to decline.

### 2.2. Overview of High-quality Development in Gansu Segment of the Yellow River Basin

The Gansu section of the Yellow River Basin is an important water source conservation area, a key ecological security barrier in western China, and a major economic development belt in Gansu Province. The region is rich in mineral resources, with concentrated industrial layout and dense population[8]. However, the natural ecological foundation is fragile, the carbon sequestration capacity of vegetation is weak, and economic development and ecological protection are in sharp contrast due to frequent production and living activities in the region.

The carrying capacity of the ecosystem and the water conservation function have declined[9]. The comprehensive index of high-quality development has increased from 0.0725 in 2010 to 0.1025 in 2018, although it is still at a relatively low level compared to other provinces, it shows an overall positive development trend[10]. The imbalance in development between cities is evident, showing a pattern of "four highs and one low," with the focus gradually moving towards the Weihe River, a tributary of the Yellow River, shifting from Lanzhou towards Tianshui.

In recent years, the water conservation function of the Yellow River Basin in Gansu Province has been declining, with inadequate river replenishment. In 2022, the surface water resources in Gansu Province were 238.3 billion cubic meters, and the per capita water resources have decreased to about half of the national average level. The basin shows a trend of increasing sand content from the upper reaches to the lower reaches, leading to issues such as desertification, grassland degradation, soil erosion, and water pollution. In 2021, the gross domestic product (GDP) of Gansu Province was 1.024 trillion yuan, accounting for 0.9% of the national total. The per capita regional gross domestic product was 41,046 yuan, with an average economic growth rate of 5.43%. The GDP of the primary industry was 136.472 billion yuan, accounting for 1.64% of the national total; the GDP of the secondary industry was 346.656 billion yuan, accounting for 0.77% of the national total; the GDP of the tertiary industry was 541.202 billion yuan, accounting for 0.89% of the national total. It can be seen that the GDP of the primary industry in Gansu Province is relatively higher compared to the secondary and tertiary industries at the national level. The GDP of the provincial capital city, Lanzhou, was 323.129 billion yuan. Compared to other provincial capital cities, its overall economic strength, radiation, and driving capacity are still insufficient. Furthermore, only Lanzhou in the entire province has a GDP exceeding one trillion yuan, while cities like Jiayuguan, Jinchang, Linxia Prefecture, and Gannan District have GDPs below 50 billion yuan.

### 2.3. Current Status of Carbon Emissions in Gansu Province of the Yellow River Basin.

According to the "Gansu Statistical Yearbook", statistics on the total energy consumption, gross domestic product, population, etc. from 2009 to 2021 were conducted and carbon emissions, carbon emission intensity, and per capita carbon emissions were calculated using formulas. The changes in carbon emissions statistics are shown in Figure 2, while the per capita carbon emissions situation is shown in Figure 3.

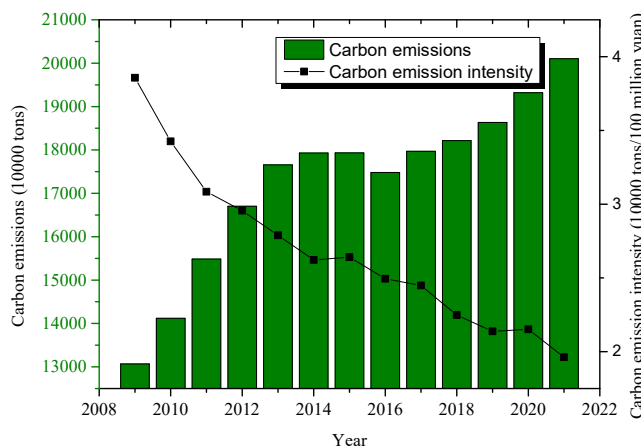
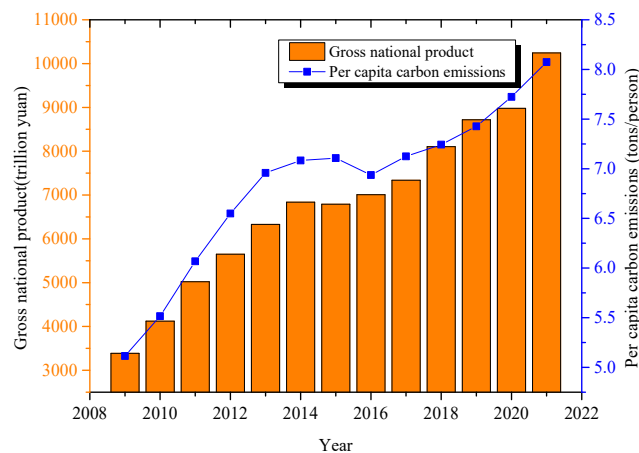


Figure 2. Carbon Emission Situation in Gansu Province



**Figure 3.** Per Capita Carbon Emission in Gansu Province

From Figure 2, it can be seen that during the period from 2009 to 2021, the carbon emissions in Gansu Province showed a trend of fluctuating increase in carbon emissions while the carbon intensity decreased year by year. The carbon emissions increased from 13,065.94 million tons of standard coal in 2009 to 17,928.13 million tons, reaching a small peak, then fell back to 17,480.42 million tons in 2016, rose again in 2017, and continued to rise until 20,103.83 million tons in 2021; the carbon intensity decreased from 3.86 million tons of carbon per million RMB in 2009 to 1.96 million tons of carbon per million RMB in 2021. From Figure 3, it can be seen that from 2009 to 2021, the Gross Domestic Product (GDP) of Gansu Province showed a trend of fluctuating increase, and the per capita carbon emissions showed a synchronous increase. The GDP increased from 338.756 billion RMB in 2009 to 6,836.82 billion RMB in 2014, then stabilized around 700 billion RMB until an upward trend appeared again in 2018, reaching 10,243.31 billion RMB in 2021, achieving a new high GDP. The per capita carbon emissions changed synchronously with GDP, reflecting the relationship between GDP and per capita carbon emissions contribution. In conclusion, from the statistics of carbon emissions and intensity in Figures 2 and 3, it can be seen that the carbon emission control effects in Gansu Province in the past decade have been quite significant. Next, in the critical phase of achieving the "dual-carbon" goals, more efforts should be made in the "dual-control" of carbon emissions and intensity to achieve low-carbon and green development.

### 3. The Significance of Achieving the "Dual Carbon" Goal Strategy in the Gansu Section of the Yellow River Basin

#### 3.1. Contribute to Promoting the Construction of Ecological Civilization in Gansu

The "3060 dual-carbon" target proposed by our country and the ecological protection and high-quality development of the Yellow River basin are major strategic decisions made by the central government after careful consideration, which are related to the high-quality development of our country's economy and society and ecological security. Gansu Province is located in the upstream area of the Yellow River basin. As an ecological security barrier in western China, it is ecologically fragile, with serious soil erosion and desertification. Moreover, it belongs to underdeveloped provinces in the west, and is in a development stage of multiple periods such as the accelerated industrialization process, the growth stage of economic development, and the promotion stage of urbanization, etc. The carbon emissions and intensity will increase accordingly, which may cause further deterioration of the ecological environment. At this critical moment, the Chinese government has made a solemn commitment to the world with

the "3060 dual-carbon" target, which has created both pressure and new opportunities and challenges for Gansu Province along the Yellow River basin. Facing the new situation and tasks, Gansu Province must, under the guidance of the "dual-carbon" target, use carbon governance as a powerful tool, increase the intensity of basin regulation with determination, adjust the relationship between people, land, ecology, and society in the region, enhance the resilience of the ecological environment, and take the path of resource conservation and low-carbon green high-quality development in order to continuously promote the process of ecological civilization construction in Gansu Province.

### **3.2. Contribute to Building a Clean, Low-carbon, Safe, and Efficient Energy System**

The dual-carbon goals have put forward new requirements for the alternative or transformational upgrade of traditional fossil energy consumption. Coal, as the ballast stone and bottom energy of China, will continue to play a role. It is indisputable that its share in primary energy consumption will decrease. Gansu, as well, will take the "dual-carbon" goal as an opportunity to further optimize the coal industry layout, eliminate backward production capacity, and promote the green development of the coal industry. Strictly implement industry energy consumption standards for high-energy-consuming and high-polluting industries such as steel, non-ferrous metallurgy, chemical industry, and building materials, control coal consumption, vigorously promote the clean and efficient utilization of coal, and strictly prohibit the use of high-polluting and low-quality coal. Increase the development of green oil and gas and promote their clean and efficient utilization, playing the role of clean oil and gas in complementing various energy sources. Actively promote the multi-energy complementary development model, accelerate the construction of large-scale wind and solar photovoltaic bases, vigorously develop new energy sources, and scientifically guide the use of biomass energy and biogas for power generation. Encourage the development and utilization of geothermal energy in areas with deep geothermal energy reserves in Lanzhou, Qingyang, Dingxi, Tianshui, and other regions. Give full play to the regulating capacity of the Yellow River cascade reservoirs in Gansu Province, actively promote hydropower development, leverage new materials and new energy, build a new type of power system, and optimize the allocation of clean electricity resources. Under the "dual-carbon" goal, through comprehensive planning and overall consideration, actively promote the transformation and upgrading of traditional fossil energy and the construction of a diversified and complementary energy system with new energy sources.

### **3.3. Contribute to Promoting the Energy Consumption Revolution**

By establishing target responsibility systems in various cities and industries across the province, the carbon emission reduction goals are being scientifically and systematically promoted. Running ahead activities to improve energy efficiency and reduce carbon emissions are being carried out in various regions and units through a reward-based evaluation system. A comprehensive three-tier energy conservation and emission reduction monitoring system covering provinces, cities, and counties is being established to enhance supervision and law enforcement capabilities. Advanced technologies are being applied to upgrade and transform basic designs in construction, heating, transportation, and other sectors to enhance urban overall efficiency. Special remediation activities with full coverage and zero blind spots are being conducted in high-energy consumption and high-polluting industries such as non-ferrous metallurgy, petrochemicals, and manufacturing, strictly following industry standards and requirements for technical transformation and upgrades. Demonstrative projects for energy conservation and carbon reduction are being established, with a focus on technical innovation and upgrading of key energy-consuming equipment, benchmarking against national and industry standards, accelerating the elimination of outdated and inefficient equipment, and

encouraging the use of first-rate energy-efficient equipment. In the context of the "dual carbon" goals, through policy guidance, incentives, technology upgrades, and other strategies, energy-saving, consumption reduction, low-carbon, and pollution reduction green actions are being vigorously promoted in production and daily life, effectively driving the energy consumption revolution in Gansu.

### **3.4. Contribute to the Upgrade and Transformation of Traditional Industries**

Under the vision of the "dual carbon" goals, Gansu Province will continue to promote low-carbon industrial development, actively eliminate outdated capacity, optimize industrial structure, cultivate and expand emerging industries such as fine chemicals, electronic information, and high-end equipment manufacturing, and vigorously promote the clean and efficient use of fossil energy in the industrial sector. It will optimize the layout of steel production, strictly implement capacity replacement, eliminate outdated capacity, and help the steel industry achieve carbon peaking. Accelerate the promotion of new technologies for the utilization of waste heat resources in non-ferrous metal production processes, reduce carbon emission intensity, and increase the efficiency of non-ferrous metal smelting. Cultivate and expand the green building materials and new building materials industry, replace inefficient capacity, fully implement green manufacturing, promote the use of new equipment and technologies, and achieve quality and efficiency improvements in the building materials industry. The petrochemical industry is one of the main contributing industries to the economic development of Gansu Province. The provincial government's administrative department should vigorously optimize the industrial layout and scale planning, strictly control project access thresholds, orderly eliminate outdated capacity, quickly implement the transfer and concentration of the petrochemical industry, build industrial bases, and achieve quality and efficiency improvements in the petrochemical industry. Accelerate the transformation of traditional coal chemical industry into fine chemicals, extend the upstream and downstream industrial chains, increase added value, and build a cluster of clean and efficient use of coal industry. Firmly curb the blind implementation of high-energy-consuming and high-emission projects, strictly implement carbon emission standards and ecological environmental protection access thresholds, and promote the upgrading and transformation of traditional industries.

### **3.5. Contribute to the Construction of Beautiful Rural Areas**

The dual carbon goals have put forward new requirements for rural construction, requiring scientific planning in infrastructure, construction land, water supply and drainage, etc. The use of low-carbon building materials, circular economy building materials, steel structure residences, etc. should be vigorously promoted. It is also actively promoting the application of waste resource, promoting the use of geothermal energy, biomass energy, solar energy, and other clean heating methods according to local conditions. Accelerating the intelligentization of agricultural production, developing energy-efficient agricultural greenhouses, promoting low-carbon and environmentally friendly stoves, electric agricultural vehicles, energy-saving and environmentally friendly agricultural machinery. Actively carry out integrated construction of photovoltaic buildings, fully utilize rural housing, rural public building roofs, and other resources to implement distributed photovoltaic power generation projects.

### **3.6. Contribute to the People's Realization of a Better Life**

The longing for a beautiful life by the people is our goal for struggle." This is the main part of the speech by General Secretary Xi Jinping at the meeting with Chinese and foreign journalists of the members of the Political Bureau of the 18th Central Committee of the Communist Party of China. It emphasizes people's desire and pursuit for a more beautiful environment, green mountains, and clear waters. The "dual-carbon" goal is an important strategic decision relating

to the sustainable development of the Chinese nation, concerning people's livelihood, ecological protection, long-term development, and the pursuit of a better life. The industrial revolution has brought material wealth to humanity but also caused environmental pollution, ecological destruction, food safety issues, posing a serious threat to the environment and safety we rely on for survival. In reality, while the economy has improved in some areas, PM2.5 levels have exceeded standards, there are more hazy days, clean water sources are scarce, and the clear blue skies and white clouds are no longer visible. The proposal of the "dual-carbon" goal has pointed out the direction for our economic and social development, requiring us to focus more on the quality of development while promoting economic growth under the premise of low-carbon environmental protection. The advancement of the "dual-carbon" goal will surely allow us to breathe fresh air, consume safe food, drink clean water in an environment of green mountains, chirping birds, and fragrant flowers, building a beautiful home.

#### 4. Conclusion

The clarion call for China's "dual carbon" goal has been sounded. As a part of the upstream region of the Yellow River basin, Gansu Province has thoroughly implemented the important speech and instructions of General Secretary Xi Jinping during his inspection of Gansu. The province has incorporated peak carbon emissions and carbon neutrality into the overall layout of economic and social development and ecological civilization construction. It closely combines the implementation of the ecological protection and high-quality development strategy in the Yellow River basin. Gansu Province adheres to the overall requirements of "taking proactive actions, overall coordination, prioritizing conservation, dual-wheel drive, and risk prevention". It is carrying out the peak carbon emissions work in an orderly manner, promoting efficient resource utilization, green transformation of production and living methods, and accelerating the realization of green, low-carbon, and high-quality economic and social development.

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