

Discussion on the Legal Path of “Railway + Industry” Construction Mode Based on Green and Low Carbon

Xiaoyi Geng^{1, a *}

¹ Xi'an Eurasia University, Xi'an, 710065, China.

^a a2937157481@163.com

Abstract. The transformation of established railways is encountering several practical dilemmas. Given the influence of aging rail infrastructure on urban development and the rule of law within society, it is evident that the low-carbon transformation of old railways represents an inevitable trend in social development. Consequently, this study proposes an integrated development model of ‘railway + industry,’ which emphasizes the green transformation of outdated railways while addressing the requirements of financial balance and reduced emissions. Furthermore, an in-depth examination of the policy and legal challenges associated with the regeneration of railways following the introduction of new industries is conducted. The findings suggest that, in the absence of effective nationwide legal support for carbon emission reduction at this time, establishing a carbon emission reduction fund may be a viable solution. This fund would provide financial assistance for carbon budgeting and establish a corresponding guarantee mechanism, alongside a clearly defined legislative pathway, thereby facilitating the green and low-carbon development of the engineering and construction sectors.

Keywords: old railway; emerging industry; green and low-carbon; carbon reduction; law; policy.

1. Analysis of the Current Situation of Established Railways and Their Transformation Situation

1.1 Mapping of Existing Old Railways Nationwide

Railways, as vital arteries of the national economy, play a significant role in fostering economic and social development [1]. However, the rapid pace of urbanization has led to the abandonment or potential abandonment of some railway lines. Incomplete statistics indicate that the total mileage of existing unused railways in China exceeds 10,000 kilometers, including the Xi'anli special railway line in Changzhi City, Shanxi Province [2]. As a backbone of the green transportation system, the challenge of implementing a green and low-carbon transformation of the railway sector has become an urgent issue for the industry.

1.2 Ecological and Rule of Law issues Caused by Idleness of Existing Old Railways

Old railway lines often experience fragmentation of urban space, along with significant environmental and security issues, as shown in Figure 1. Furthermore, the overall development along these old railway lines is noticeably lagging behind that of other areas, potentially leading to serious ecological and legal challenges.



Fig. 1 The waste railways fragment urban space

2. Analysis of the Transformation Path of Old Railways Based on the Dual-Carbon Goals and the Legal Problems Thereof

The railway sector exhibits significant public welfare characteristics. A persistent issue in rail transit operations is the "externalization of internal benefits and socialization of economic benefits" [3]. This phenomenon exerts considerable pressure on local government finances. Consequently, if the railway continues to pursue quality improvements solely based on its anticipated revenue, it will be unable to satisfy the requirement for financial self-balancing.

2.1 Analysis on Reconstruction Path of Existing Old Railway

In the context of developing a green low-carbon economy, it is essential to enhance the self-sustaining capacity of existing old railways while reducing their dependence on local finances and various forms of policy subsidies. More importantly, a new paradigm for upgrading these outdated railways should be established, grounded in the dual-carbon concept. This is illustrated in Figure 2.

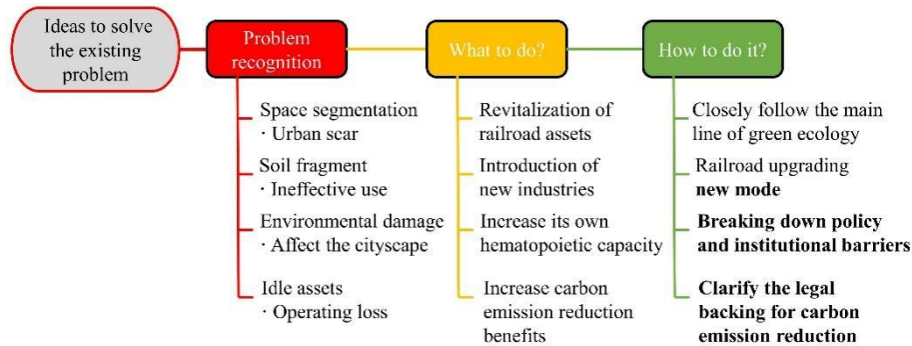


Fig. 2 Old railway problems and ideas for breaking the mold

Both the construction and operation phases of railways are key areas of carbon emission control. Therefore, the new development direction of "Railway + N" should be actively promoted. According to the landing conditions of new industries, green and low-carbon industries with positive returns [4, 5, 6, 7, 8, 9] will be placed along the railway line as far as possible. As shown in figure 3.



Fig. 3 Schematic diagram of emerging industries laid out along a railway's reconstruction phase

Based on the requirements of the two main indicators of positive returns and green and low carbon , photovoltaic power generation and optical storage and charging integrated intelligent parking lot, wind power generation, high-standard farmland and ecological agriculture, eco-parks and watershed management, mine restoration and carbon sinks can be arranged along the existing railways. As shown in figure 4.

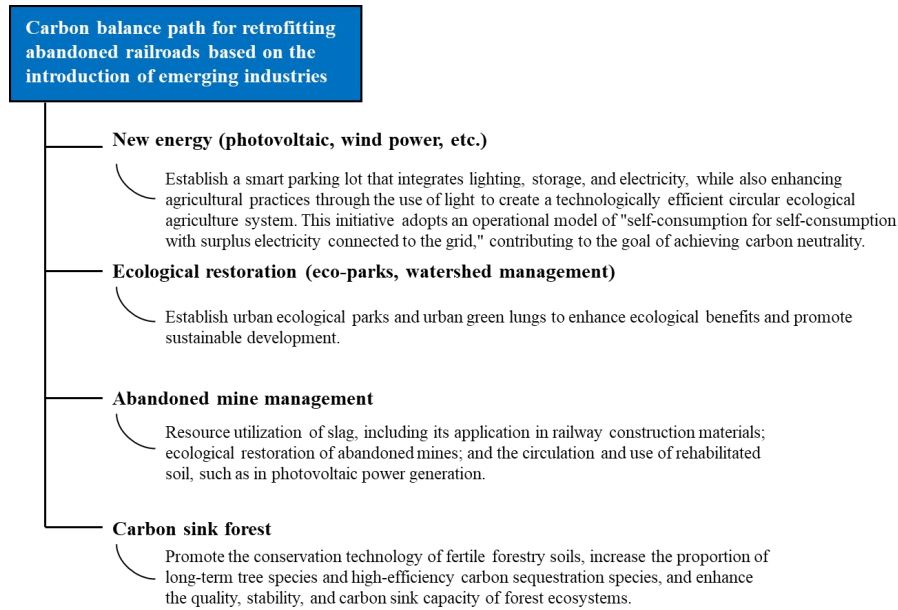


Fig. 4 Analysis of carbon balance paths for retrofitting existing railways

2.2 Policy and Legal Issues Involved in the Reconstruction of Old Railways and Introduction of New Industries

There is a noticeable lag in the institutionalization of the legal framework supporting green and low-carbon development within China's infrastructure construction sector. This issue is particularly apparent in the inadequacies of the existing legal system and the insufficient legal support for effective policy implementation. Consequently, it is imperative to establish a comprehensive legal framework for carbon emission reduction at the earliest opportunity, along with the development of relevant management systems. Such measures will facilitate the timely achievement of carbon neutrality in the engineering and construction domain.

2.2.1 Lack of legal support for carbon emission management after the introduction of new industries into the railway line

Currently, the concepts of green and low-carbon practices have been implemented to varying extents across different industries, including the engineering sector. However, to achieve a truly carbon-neutral or zero-carbon railway, it is essential to establish a clear legal framework and provide robust policy support.

To date, the construction of China's legal system for carbon emission reduction remains incomplete. While there is some policy support for carbon emission reduction, various industries still lack substantial and effective legal backing. This absence of legal support results in a deficiency of enforceable measures for implementing carbon emission reduction strategies, complicating the execution of these initiatives. Consequently, low-carbon investors struggle to secure stable returns on their investments [10]. As a result, there is a diminished incentive for investors to engage in low-carbon projects, leading to the cessation of several carbon-neutral initiatives without tangible outcomes. For instance, projects such as the Chongqing Wulong Xiannu Mountain carbon neutrality initiative and the ecological construction and comprehensive development of the Jinyun Mountain range in Chongqing Beibei District exemplify the challenges faced due to insufficient legal support [11]. Although these projects may initially attract considerable attention, they ultimately fail to achieve their carbon neutrality or low-carbon objectives due to the lack of clear legal protections and policy backing.

2.2.2 Impact of sectoral barriers among emerging industries on carbon emission reduction

As discussed previously, the new industries introduced along the railway encompass a diverse array of sectors. For instance, new energy sources, including photovoltaic and wind power, pertain

to the power sector. Mine restoration engages the Ministry of Land and Resources and the housing sector. Ecological restoration and watershed management are associated with the environmental protection department and the Parks Administration. The development of high-standard farmland and eco-agriculture relates to the agricultural sector. Additionally, carbon sinks are linked to the forestry sector, among others.

Currently, while China has established relevant legislation in areas such as energy and the environment that supports carbon emission reduction in emerging industries, there remains significant fragmentation in the industry management of these sectors. This fragmentation is characterized by a lack of effective coordination mechanisms and the absence of comprehensive national laws. Furthermore, the legal content pertinent to various industries is notably disjointed, which hinders the fundamental removal of industry barriers in the short term. Consequently, this situation fails to effectively encourage the adoption of the latest emission reduction and carbon reduction technologies during the integration of emerging industries into railway systems, thereby limiting the legal effectiveness of carbon reduction initiatives.

3. Suggestions of Carbon Emission Reduction and Analysis of Legal Paths for the Retrofit of Old Railways

To maximize the construction and development of low-carbon railways and to promptly implement national comprehensive carbon emission reduction laws and policies within the engineering and construction sectors, it is essential to achieve breakthroughs in carbon emission reduction mechanisms, legal frameworks, and carbon budget pathways.

3.1 Improve the Carbon Emission Reduction System as Soon as Possible Based on the Opportunity of Dual-Carbon Strategy

The dual-carbon strategy has been elevated to the status of a national strategy. The engineering construction sector should seize this historical opportunity to expedite the establishment of a carbon tax and carbon trading system, focusing on carbon emission reduction. Additionally, it is essential to promote reforms in the infrastructure sector based on the principles of '3L' and '3H'.^[12] The '3L' refers to 'low energy consumption, low pollution, and low emissions,' while '3H' denotes 'high efficiency, high productivity, and high benefits.' Furthermore, it is crucial to clarify the responsibilities of various departments involved in project construction in advance, including the railway department, the Ministry of Land and Resources, the Housing and Construction Bureau, the Energy Bureau, the Ecological Environment Bureau, the Natural Resources Bureau, and the municipal government, particularly concerning the renovation of old railways and the introduction of new industries. This approach will facilitate the formation of a carbon emission reduction mechanism under the unified jurisdiction of the government, ensuring a clear division of labor and orderly collaboration among various local departments.

3.2 Legal Path for Carbon Emission Reduction Fund in the Field of Engineering and Construction

Currently, the existing environmental protection special fund, designed for emergency-style financial support, is insufficient to meet the carbon emission reduction targets necessary for sustainable development. Furthermore, there is a lack of clear policy support for financial initiatives aimed at reducing carbon emissions, compounded by the absence of a superior law to serve as a foundation for implementation. Consequently, the financial budget fails to effectively advance the dual-carbon goal within fundamental social sectors and does not facilitate the flow of funds into carbon emission reduction efforts. Therefore, it is imperative to clarify the purpose of legislation and to develop specialized laws and regulations that outline the objectives, tasks, and measures for carbon emission reduction within the engineering and construction sectors. This will provide a definitive legal framework for the establishment and operation of a carbon emission reduction fund.

In alignment with the characteristics of railway and emerging industry project clusters, the budget necessary for carbon emission reduction will be incorporated into governmental fund control according to specific specialties and phases. Additionally, a dedicated carbon emission reduction fund will be established by sourcing funds through multiple channels, including government financial allocations, social donations, and enterprise investments. These strategies will ensure the sustainability of carbon emission reduction activities associated with the construction and operation of the project.

The primary source of the carbon reduction fund may be the revenue generated from the carbon tax, including mechanisms such as carbon sinks and carbon index trading associated with the new green industry surrounding the railway. Additionally, revenue from certain green industries could be integrated into government financial income, such as a designated percentage from photovoltaic power generation and proceeds from mine management. This approach would establish two distinct lines of revenue and expenditure. Furthermore, it is advisable for national ministries and commissions to develop carbon emission reduction funding sources within the 'Railway + Industry' framework, accompanied by the introduction of corresponding administrative regulations that specify detailed implementation procedures. This strategy would facilitate the creation of a carbon budget characterized by clear logic and hierarchical structure.

3.3 Incorporate Carbon Emission Reduction into Relevant Industry Laws and Regulations

Clarifying the objectives and principles of legislation is essential for formulating industry regulations, as well as defining the goals and tasks of various sectors in relation to carbon emission reduction. Concurrently, it is important to adhere to the principles of integrating socialist core values and prioritizing ecological considerations. This approach will enhance the carbon emission reduction responsibilities of industry stakeholders and facilitate the establishment of a green, low-carbon production and consumption model. Currently, despite the progress made in national green low-carbon initiatives, significant challenges remain in establishing universally applicable carbon emission reduction laws across all industries in the short term. However, each sector can incorporate carbon emission reduction and carbon sink trading into its specific laws and regulations based on its unique circumstances. For instance, the Forest Law could be amended to enhance provisions that leverage the role of forestry in carbon sequestration and absorption. Similarly, the Construction Law could include provisions that promote the longevity of buildings and encourage the development of zero-emission structures.

The regeneration of existing railways involves the reconstruction and expansion of related facilities and equipment, including railway stations, as well as the development of emerging industries along the route, such as smart parking and transit-oriented development (TOD) buildings. All these initiatives should be designed and constructed in accordance with the principles of zero-carbon buildings. Concurrently, it is essential to prioritize the use of recycled building materials and the implementation of low-carbon technologies to minimize carbon emissions and potentially achieve positive outcomes in carbon absorption and sequestration. Utilizing current intelligent technologies, the energy consumption of public buildings along the railway is projected to decrease by 15% to 20% [10]. The <Action Program on Energy Conservation and Carbon Reduction for 2024-2025> clearly outlines the targets and measures for energy conservation and carbon reduction, including indicators such as the proportion of non-fossil energy consumption and the reduction of energy consumption per unit of GDP. This framework provides specific guidance for carbon reduction efforts and serves as a reference for formulating carbon emission reduction regulations within the industry, ensuring both the feasibility and relevance of these regulations.

3.4 Carbon Budget legislation Path Choice Based on the Retrofitting of Existing Railways

In the field of infrastructure construction, particularly in railway construction, it is essential to actively integrate emerging industries to effectively control overall carbon emissions [13]. Additionally, implementing carbon compensation strategies for railway bulk engineering through

carbon sequestration and absorption by these emerging industries is crucial. These measures aim to achieve a carbon emission balance for the entire project [14] and facilitate the introduction of new industries along the railway.

To effectively incorporate the railway construction carbon budget into the legal guarantee system aimed at achieving the "double carbon" goal, it is essential to establish a carbon budget system specifically designed for railway construction, aligned with this goal. This can be accomplished through the creation of specialized institutions, clearly defined responsibilities, and an appropriate allocation of rights [15]. Additionally, a distinct legal framework for carbon emission reduction, centered around the carbon budget, should be developed. This approach will enable the control of total carbon emissions and facilitate refined management through legal mechanisms, thereby establishing a long-term carbon emission reduction strategy in the railway construction and operation sectors. At the legislative level, it is crucial to define the legal status and objectives of the carbon budget, integrating it into the national legal framework. This integration will reinforce its central role in carbon emission reduction efforts and provide a legal foundation for various industries to devise their carbon emission reduction plans. In terms of law enforcement, it is necessary to enhance the legal system that supervises the implementation of carbon budgets, strengthening oversight and inspection of carbon emission reduction initiatives across different industries and regions to ensure effective enforcement of related laws. Concurrently, a monitoring, reporting, and verification system for carbon emission data should be established to guarantee the accuracy and transparency of the information. At the compliance level, a system of incentives and constraints should be introduced. This includes providing financial subsidies and tax incentives to enterprises or regions that exceed their carbon emission reduction targets, while imposing penalties and development restrictions on those that fail to meet their obligations. Such measures will enhance the seriousness and authority of the carbon budget.

4. Conclusions and Recommendations

If you follow the "checklist" your paper will conform to the requirements of the publisher and facilitate a problem-free publication process.

(1) The existence of the old railway not only significantly impacts the city's development but also poses serious challenges to the ecological environment and the rule of law. Therefore, it is imperative to pursue green and low-carbon regeneration.

(2) Although there are obstacles to carbon reduction associated with the old railway and the new industries situated along the route, it is feasible to achieve a carbon balance for the overall "Railway + Industry" project, ultimately leading to the realization of a "Zero Carbon Railway" paradigm.

(3) In response to the demands of green development within the engineering sector, it is crucial to promptly establish a legal framework related to the low-carbon economy, as well as to create a carbon emission reduction fund that provides financial support and a mechanism for carbon budgeting. More importantly, it is essential to implement necessary legal constraints to facilitate green and low-carbon development in engineering and construction, thereby contributing to the successful attainment of the dual carbon targets.

References

- [1] General Office of the State Council of the People's Republic of China. Outline of the Fourteenth Five-Year Plan for National Economic and Social Development of the People's Republic of China and the long-term goal for 2035. People Daily, 2021-03-13(001).
- [2] XIA Haishan. A literature review and commentary on abandoned railways and urban regeneration. World Architecture, 2020, 2020(7): 10-16+125.
- [3] CHEN Xiangsheng. Reflections on the high-quality and sustainable development of urban rail transportation in China. China Metros, 2023, 2023(5): 28-31.

- [4] CHEN Yiqi. Construction of the integrated parking lot for photovoltaic storage and charging. *Lamps & Lighting*, 2022, 2022(12): 91-93.
- [5] HU Zhi. Effective utilization of the value of forestry carbon sinks. *China Finance*, 2023, 2023(14): 101.
- [6] LUO Xiaofeng, XUE Longfei, LI Zhaoliang. Evaluation of economic benefits of forestry carbon sinks and analysis of regional harmonization. *Statistics & Decision*, 2017, 2017(2): 121-125.
- [7] WEI Tengfei. Evaluation of economic benefits of forestry carbon sinks and analysis of regional harmonization. *Journal of Green Science and Technology*, 2019, 2019(10): 286-287.
- [8] GONG Yanling, ZHANG Yingliang. Influence of well-facilitated capital farmland construction policy on grain productivity. *Journal of Huazhong Agricultural University (Social Sciences Edition)*, 2023, 2023(4): 175-190.
- [9] PENG Jing, ZHANG Xiangwei. Evaluation of economic benefits of environmental management of rivers in Japan. *China Water Resources*, 2005, 2005(3): 63-64+66.
- [10] DING Lieyun. Academician Ding Leiyun: Smart technology promotes green city development. *High-Technology & Commercialization*, 2023, 29(2): 12-15.
- [11] Chongqing Beibei District Ecological Environment Bureau. Feasibility Study Report of EOD Project for Ecological Construction and Comprehensive Development and Utilization of the Jinyun Mountain Range in Beibei District. 2021-11-23
- [12] JIA Jia. Study on the legal issues of developing a low-carbon economy in China. Jilin University, 2012.
- [13] PAN Xiaobin. Theoretical isomorphism and legislative path of national carbon budget under carbon neutralization. *Journal of Hunan University (Social Sciences)*, 2024, 38(1): 112-118.
- [14] TAN Xinjian, LV Ying, DAI Zhiren. Value regeneration of abandoned railway and its reconstruction path. *Journal of Railway Engineering Society*, 2024, 41(2): 106-110.
- [15] ZHENG Yiyi. Constructing a legal supervision mechanism for the budget that reflects the requirements of modernization of national governance: The government's public finance budget for environmental protection as a perspective. *Journal of Henan Normal University (Philosophy and Social Sciences Edition)*, 2015, 42(5): 71-75.