



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Review of Study on Development Low Carbon Industry

Han LIU*, Zuwen CAO

College of Economics and Management, Southwest University, Chongqing 400715, China

Abstract Through collecting and arranging research findings in recent years, connotation, necessity, power mechanism, support system and foreign experience and implications of low carbon industry are reviewed and discussed. It is believed that future study should continue to follow up foreign latest research findings. In addition, it should attach importance and strengthen study on economic performance, system and technical management of low carbon industry.

Key words Low carbon industry, Development, Documentary review

1 Introduction

In 1972, the Club of Rome think tank published its book *The Limits to Growth*, marking that western countries started reviewing harm brought by industrial civilization at the cost of high energy consumption and pollution. In 2003, British government issued *Energy White Paper: Our Energy Future – Creating a Low Carbon Economy*, initially describing concept of low carbon economy. Low carbon economy is an economic development model expected to generate maximal economic output at the minimal cost of natural resource consumption and environmental pollution. It is characterized by advantages of improving people's living conditions and quality, providing development space for creation and application of advanced technology, creating new business opportunities, and increasing jobs^[1]. In line with foreign concepts and domestic conditions, many Chinese scholars also proposed explanation of low carbon economy. Zhuang Guiyang^[2] contended that the low carbon economy is ecological economy based on low energy consumption, low pollution, and low emission, with improvement of energy efficiency and adjustment of clean energy structure as essence, and alleviation of harm of climate change and promotion of sustainable development as objectives. Feng Zhijun *et al.*^[3] believed that low carbon economy, as a general name of low carbon development, low carbon industry, low carbon technology, and low carbon living, is mainly to tackle harm of carbon-based energy to climate, and to guarantee sustainable development of social economy. From the above introduction, it can be known that low carbon economy is an economic development model that is to prevent harm of climate change and satisfy sustainable development of human society at the cost of minimal energy consumption. Since an industry is a group of economic activities of companies having the same type attribute, it becomes particularly important to promote development of low carbon industry in the low carbon economy oriented economic development model. In this situation, review of researches on low carbon industry will be greatly significant in both theory and practice.

2 Connotation and development necessity of the low carbon industry

In a narrow sense, the low carbon industry refers to production or service industry that discharges little CO₂ in the production process; in a broad sense, the low carbon industry also includes service industry providing energy-saving and emission reduction technologies and relevant industries purifying CO₂ pollution. Wang Haixia *et al.*^[4] summarized characteristics of new industries in low carbon economy development model, including having low carbon feature and potential of energy conservation and emission reduction, staying strategic position in national economy, manifesting leading and innovation of technology, and having environment-friendly and green driving functions. Liu Wenling *et al.*^[5] defined the low carbon industry by the density of industry, and thought that low carbon industry is the industry that can realize higher economic output at less emission of greenhouse gases, and mainly includes technology-intensive and knowledge-intensive industries. Cui Yi *et al.*^[6] stated that the low carbon industry is a group of industries engaged in research, production and development of energy conservation and emission reduction products, with reduction of carbon emission or emission right of carbon as resource, with technology of energy conservation and emission reduction as basis, having diversified characteristics of industrial fields. Li Jinhui *et al.*^[7] proposed that the low carbon industry should include new industry transformed from high carbon industry through low carbon processing, production industry with low content of carbon, industry producing low carbon technology, as well as industry engaged in trade of carbon emission right, and each component has respective low carbon standard and consists of several enterprises capable of reaching low carbon standard. With reference to these opinions, the low carbon industry is mainly characterized by its reduction of carbon emission with application of state-of-the-art technologies and management methods, and large-scale and intensive use of resources. In this sense, low carbon industry not only includes new manufacturing industries which take renewable energy and new energy as major means of production, but also incorporates modern agriculture and modern service industries transformed for realizing conservation of energy and reduction of greenhouse gas emission,

as well as new trade industries based on carbon emission trading. After clearly defining concept of the low carbon industry, it is required to clarify differences between traditional type and low carbon type of the specific industry. Take low carbon agriculture as an example, it refers to agriculture that takes full advantage of carbon sink function to minimize carbon emission and to realize low carbon emission in the whole process of food production. This definition gives prominence to the essence of agriculture, which is the transformation process of primary energy and resources into foods, and featuring carbon sink and carbon source. Thus, it not only expounds the difference in concept between low carbon agriculture and traditional agriculture, but also shows clear operation basis for practice of low carbon agriculture^[8].

With global integration and deepening of understanding of environmental problem, utilization, development and acquisition of energy have become primary factors restricting economic development of every country. For China, fostering low carbon industry is of great significance to promote sustainable development of national economy and enhancing international competitive power. However, it shall be noted that low carbon economy is not to limit development, but rather stress low carbon development. At present, China has certain economic strength and most enterprises have higher capacity of transformation. Thus, it is feasible to take full advantage of funds, technologies and management mechanism brought by international cooperation in emission reduction mechanism, to realize low carbon agriculture, low carbon industry, as well as low carbon living. Chen Wenjie *et al.*^[9] stated that the key is to push forward development of low carbon industry in the process of transformation into low carbon economy, because economic competition between countries is mainly manifested as fighting of products at international market, while only those products adopting new carbon innovation technology have competitive power. Under this situation, advancing development of low carbon industry is beneficial to transformation and upgrade of traditional energy-intensive industries and high pollution industries. Besides, it can expedite the emergence of new technology service industries engaged in energy conservation and emission reduction and deal with CO₂ pollution. Also, it can bring new growth point for economy, and gradually move towards low carbon economy.

3 Power mechanism for development of low carbon industry

Power mechanism refers to relationship of different levels, motive force and the process, mechanism and method of their generation, transmission and interaction, on which a society, region, and industry relies for movement, development and change, and its essence is to describe intrinsic connection between motive force and movement and development of things^[10]. Philosophically speaking, development and change of anything is an interaction of external and internal factors, so the development of low carbon industry also possesses unique power mechanism. Fu Yun *et al.*^[11] summarized power mechanism of low carbon industry as energy demand

and environmental restriction (internal factor) resulted from rapid economic development, and emission reduction promise made by international society (external factor). Bao Jianqiang *et al.*^[12] explained necessity for developing low carbon industry from the perspective of future national competitive power, and brought about that carbon emission policies of developed countries will influence economic decisions of developing countries. Liang Zhong^[13] contended that external power for innovation of low carbon industry mainly includes responding to demands for climate changes, global industrial structural adjustment, and transformation of China's industrial development model, while internal power is primarily strategic demands for self development and making breakthrough in technological innovation. Wu Xiaobo *et al.*^[14] introduced internal and external power for cluster development of low carbon industry: internal power includes policy and system innovation in low carbon management, low carbon technological innovation, and public participation mechanism; external power includes carbon tariff and barrier in international trade, incentive of low carbon economic policies and effect of market performance. Wang Huanfang *et al.*^[15], judging from *American Clean Energy and Security Act* issued by US House of Representatives in 2009 and trade policies in recent years, concluded that green and technical trade barrier will force Chinese enterprises to take more powerful measures to reduce emission; in the meanwhile external stimulation of government policies and improvement of public awareness on low carbon consumption will promote development of low carbon industry, which is being an essential internal power for driving cluster low carbon development.

Summing up the above ideas, it can be inferred that development power of low carbon industry comes from internal and external factors. The external power mainly comes from pressure of international society on developing countries in emission reduction. Developed countries force developing countries to undertake the responsibility for reduction of greenhouse gas emission. They set a series of trade barriers to limit transformation of developing countries to low carbon industry. This is manifested in adjustment of industrial structure to promote low carbon transformation of high carbon industry and improve environmental conditions. The internal power primarily comes from improvement of environmental protection awareness of the public and the growth of low carbon consumption. In addition, the economic system, with fiscal and taxation system as the major means to control carbon emission and using market mechanism to promote carbon trade, is also internal power for development of low carbon industry.

4 Supporting system for development of low carbon industry

4.1 System support System support is an indispensable element for new industry in starting stage. Wang Wenjun *et al.*^[16] believed that it is firstly required to formulate the state low carbon economic development strategy, evaluate carbon emission intensity, and on the basis of this it may be feasible to support low car-

bon industry. Wu Wensheng *et al.*^[17] had similar opinions, and advocated that government should make plan for future low carbon industry structure, support low carbon industry through taxation reduction or exemption, and financial support, and foster proper market mechanism suitable for low carbon development of high carbon industry. Gao Yu *et al.*^[18] stated that proper industrial policies will be favorable for pushing forward low carbon economy, and proposed a few shift of industrial policies from structural policies to organizational ones, from market displacement policies to market cultivation policies, and from traditional industrial policies to new industrial policies. The above opinions show that formulation of relevant policies at macroscopic level and cultivation of enterprises at microscopic level reflect support of formal system for low carbon industry. Moreover, function of informal system should not be neglected. Chen Xiaochun^[19], and Pang Jing *et al.*^[19], from the perspective of consumption guidance and public welfare propaganda, claimed that cultivating low carbon awareness of the public is an incentive under the informal system, under which increase in demands for low carbon products will indirectly guide enterprises to transform to low carbon type.

4.2 Industrial cluster Industrial cluster, as Alfred Marshall defined, is geographical concentration of industries that enterprises within can cooperate with high efficiency and have complementary advantages. Based on this theory, some researchers think that it is possible for low carbon industry to bring about cluster effect. Jin Yueqin *et al.*^[21], present a concept of building pilot zone of low carbon economy; Bian Jihong^[22] further segmented models of low carbon industrial clusters and believed that it is feasible to establish industrial system cycle through simulating the food chain of "producer – consumer – decomposer" in natural system, and set up ecological industrial practice park by technical means of closed cycle of matters and multi-level utilization of energy. Thus, it shows that the original thought of low carbon industrial spatial distribution is low carbon development of agriculture. Under the guidance of this thought, Poyang Lake ecological economic zone becomes a model example of low carbon industrial cluster for effectively controlling and reducing emission of pollutants and increasing resource utilization efficiency^[23].

4.3 Technological innovation Austrian economist Joseph Alois Schumpeter firstly introduced the concept of technological innovation. He argued that both the innovation of production technology and change of production method promote economic development. With acceleration of innovation of new technologies in new energy fields, low carbon economy will gradually take the place of traditional high emission development model, while the new technologies appear just because the market provides profit mechanism for such technological innovation^[24]. Wang Xiwei *et al.*^[25] analyzed knowledge innovation path for evolution of industrial technological chain in low carbon economy, and pointed out that both organization individual and organization itself will conduct research on low carbon, and spontaneously carry out invention of low carbon technology and knowledge creation, to realize large scale application of low carbon technology in the process of

experience accumulation. This statement indicates that innovation of low carbon technology advances in spiral form, technological innovation organized by enterprises is the everlasting motive force for development of low carbon industry. However, the power mechanism has manifested importance of both internal and external forces for promoting development of low carbon industry. If combined with technological innovation, technological innovation of low carbon industry will inevitably have market demand and supply that agree well with each other. Based on these, Sheng Jichuan *et al.*^[26] declared that low carbon technological research and development are mutually connected with low carbon business opportunity. Specifically speaking, it is required to give prominence to cultivating market mechanism for low carbon technology, and supporting development of enterprises engaged in research and development of energy conservation, emission reduction and pollution mitigation. Enterprises should constantly upgrade their technology, enhance international cooperation, and introduce advanced low carbon technology. Only through these can it better provide technological support for development of low carbon industry.

4 Foreign experience and implications

Developed countries have accumulated valuable practice experience in low carbon economy and low carbon industry. Chinese researchers have made a few summarization. Fu Xueliang *et al.*^[27] found that developed countries promote optimal allocation of market resources mainly via controlling type and market type policies.

The United Kingdom is the representative of countries adopting market type policies. It mainly takes three kinds of incentive measures. (1) Imposing the climate change levy, primarily for maximizing energy utilization efficiency and minimizing negative impact; (2) Setting up independent Carbon Trust funded by government and operating in corporate model, aiming to reduce CO₂ emission and capture business opportunities of low carbon technologies; (3) Launching the greenhouse gas trade plan, intended to provide motive force for enterprises to conserve energy and reduce emission^[28].

By contrast, Japan and the United States are representatives of countries adopting controlling type policies. As the sponsor and advocator of Kyoto Protocol, Japan attaches great importance to development of low carbon economy, and promulgated *Basic Law for Promoting the Creation of a Recycling – Oriented Society* and *Law for the Promotion of Effective Utilization of Resources* to provide legal basis and guarantee for effective promotion of low carbon economy^[29]. The United States passed *Energy Policy Act* in 2005, stipulating the implementation of tax reduction for photovoltaic investment; in 2007, it passed *Energy Independence and Security Act*, setting investment amount of clean energy technology and energy efficiency technology; in 2009, it issued *American Recovery and Reinvestment Act and American Clean Energy and Security Act* to promote development of renewable energy industries. Apart from legislative policies, American government also takes inclined policies for low carbon industries in budgetary funds to energetically support development of new low carbon industries^[30]. Foreign successful experience proves that the development of low carbon

industry requires great support of government in legislation, policy making, administrative and financial and many other aspects.

5 Conclusions

Since the concept of low carbon economy was put forward in 2003, both foreign and domestic low carbon industries are staying at early stage, relevant researches do not have a complete framework, and there are no established research methods and paths, therefore most researches are discussed from macro-economy, industrial structure and policy planning, and it is basically manifested as qualitative research and lack of quantitative research. In view of these, we recommend taking following measures: (1) Keeping track of latest findings of low carbon research and drawing up experience from them to analyze problems in the development of low carbon industry in China, and guide development of low carbon industry; (2) Stressing researches on economic performance of low carbon industry, and taking specific industry as starting point to study economic performance of industry in the process of low carbon development, so as to clearly understand power source for development of low carbon industry; (3) Strengthening researches on system field, especially industrial policies. Currently, developing low carbon industry needs policy support. Thus, research on formulation and implementation effect of systems is helpful for grasping gain and losses in the development process of low carbon industry; (4) Enhancing researches on technological management. Technology is important support for low carbon industry, so technological innovation and scientific management can provide powerful motive force for development of low carbon industry.

References

- [1] UK Government, Energy White Paper, Our Energy Future: Creating a Low Carbon Economy [R/OL]. http://www.decc.gov.uk/en/content/cms/legislation/white_papers/white_paper_03/white_paper_03.aspx, 2003.
- [2] ZHUANG GY. An analysis of "low carbon path" potentials in China's economic growth [J]. Pacific Journal, 2005(11): 79–87. (in Chinese).
- [3] FENG ZJ, NIU WY. Low-carbon economy with science & technology development [J]. China Soft Science, 2009(8): 13–19. (in Chinese).
- [4] WANG HX. On development of new – rising industries in low-carbon economy [J]. Productivity Research, 2010(3): 14–16. (in Chinese).
- [5] LIU WL, WANG C. Practice and patterns of low carbon city development [J]. Chinese Journal of Population Resources and Environment, 2010(4): 17–22. (in Chinese).
- [6] CUI Y, HAO TY, CHEN Y. Forecast the development of low-carbon industry in the background of low-carbon economy [J]. Ecological Economy, 2010(6): 91–99. (in Chinese).
- [7] LI JH, LIU J. Research on low carbon industry and the development path of low carbon economy [J]. On Economic Problems, 2011(3): 37–40, 56. (in Chinese).
- [8] WANG SL, C. D. Caldwell, ZHU WF. Low carbon agriculture: origins, principles and strategies [J]. Research of Agricultural Modernization, 2010, 31(5): 604–607. (in Chinese).
- [9] CHEN WJ, YAN KG. The development strategy of emerging low-carbon industry [J]. Economic Geography, 2010(2): 200–203. (in Chinese).
- [10] WANG XK. The theoretical and empirical research on the driving mechanism of urban tourism development [D]. Tianjin: Tianjin University, 2008. (in Chinese).
- [11] FU Y, MA YH, LIU YJ, *et al.* The development model of low-carbon economy [J]. Chinese Journal of Population Resources and Environment, 2008(3): 22–27. (in Chinese).
- [12] BAO JQ, MIAO Y, CHEN F. Low carbon economy: Revolution in the way of human economic development [J]. China Industrial Economics, 2008(4): 153–160. (in Chinese).
- [13] LIANG Z. Analysis of construction and operation mechanism of low carbon industry innovation system [J]. Inquiry into Economic Issues, 2010(7): 141–145. (in Chinese).
- [14] WU XB, ZHAO GH. On the dynamic mechanism of low carbon industry cluster [J]. Economic Theory and Business Management, 2010(8): 15–19. (in Chinese).
- [15] WANG HF, HU ZH. Analysis on dynamic mechanism and implementation path of low carbon industry cluster [J]. Reform of the Economic System, 2011(5): 107–111. (in Chinese).
- [16] WANG WJ. Technical economy model and path of low-carbon economy development [J]. Social Sciences in Yunnan, 2009(4): 114–117. (in Chinese).
- [17] WU WS, CHEN J, CHEN J, *et al.* Study on realization mechanism of low-carbon industry structure [J]. China Urban Economy, 2011(1): 22–23. (in Chinese).
- [18] GAO Y, CAO DY. The low-carbon – oriented transformation of industrial policy in China [J]. Ecological Economy, 2011(4): 95–101. (in Chinese).
- [19] CHEN XC, ZHANG XH. A brief discussion on consumption guide in the low carbon economy [J]. Consumer Economics, 2009(4): 71–74. (in Chinese).
- [20] PANG J, LI WL. On low-carbon preference and consumption function [J]. Chinese Journal of Population Resources and Environment, 2011(9): 76–80. (in Chinese).
- [21] JIN LQ, LIU R. Low-carbon economy and the transition of Chinese economic development patterns [J]. Inquiry into Economic Issues, 2009(1): 84–87. (in Chinese).
- [22] BIAN JH. Low carbon economic mode of industrial cluster development in China [J]. Ecological Economy, 2011(1): 58–60, 66. (in Chinese).
- [23] CHEN WH, GUAN XY, LIU SQ. The realistic path of industrial low-carbon and ecological civilization—— Taking the case of Poyang Lake Eco-economic Zone [J]. Management World, 2011(1): 170–171. (in Chinese).
- [24] The State Council Development Research Center. Greenhouse gas emissions reduction: A theoretical framework and global solution [J]. Economic Research Journal, 2009(3): 4–13. (in Chinese).
- [25] WANG XW, LIN MX, LIU L. Research on the pathways and platform of knowledge creativity in industrial-tech chain in the low-carbon economy [J]. Information Science, 2010(7): 1010–1015. (in Chinese).
- [26] SHENG QC, CAO J. Study on analysis approaches for technology roadmapping of low-carbon industry [J]. Science of Science and Management of S. & T., 2011(11): 85–92. (in Chinese).
- [27] FU XL, LIU SH, WANG XT. The policy instrument selection of low-carbon economy development abroad and the enlightenment [J]. Science & Technology Review, 2010(19): 120–121. (in Chinese).
- [28] PAN JH, CHEN Y, ZHUANG GY, *et al.* Incentive measures for UK low carbon development and the references [J]. China Economic & Trade Herald, 2006(18): 51. (in Chinese).
- [29] WANG WJ. Experience & enlightenment of foreign countries and China's development of low-carbon economy [J]. Journal of Northwest Sci-Tech University of Agriculture and Forestry (Social Science), 2009(11): 73–77. (in Chinese).
- [30] CHEN LY. Development trend of new energy industry abroad [J]. Development Research, 2011(8): 84–89. (in Chinese).