

On Low-Carbon Technology

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Abstract

Low-carbon technology generalizes all the means and methods for low-carbon or carbon-free. It suits the need of adapting to a low-carbon economy, reducing greenhouse gas emissions and preventing global warming. Low-carbon technology mainly includes carbon reduction technology, carbon-free technology, carbon removal technology, carbon management technology, resource saving and recycling technology. Low-carbon technology aims at carbon reduction. It's harmonious, sustainable, efficient and international. On one hand, low-carbon technology is the key of developing low-carbon economy. On the other hand, it's a significant means of relieving climate warming, energy crisis and sustainable development. A series of policies, laws, systems are the necessary safeguards for low-carbon technology development.

Keywords

Low-Carbon Technology, Low-Carbon Economy, Climate, Resource

1. Introduction

In the context of global climate changing, “low-carbon economy” and “low-carbon technology” are increasingly concerned by the world. Human industrialization brought great amount of carbon dioxide which resulted in global warming. With the developing of global economy, energy demand and carbon dioxide emission will rise up quickly over time. “Low-carbon technology, reducing the use of fossil fuels, energy conservation, developing new energy, alternative energy and improving the current situations of global warming are fundamental ways to solve above problems” [1]. Low-carbon technology is concerned because of its key role in the economic transformation of each country. At the same time, it becomes more important as a result of people's profound understanding.

2. Connotation and Classification of Low-Carbon Technology

2.1. Connotation of Low-Carbon Technology

As a new-born conception, low-carbon technology is not a clear definition. In spite of different ideas exist, scholars have a basic consensus: low-carbon technology is the key of low-carbon economic development, and it can reduce carbon dioxide level in the atmosphere.

Low carbon (carbon reduction or carbon-free), means emission of a little (zero possibly) greenhouse gas (mainly carbon dioxide). Simply speaking, low-carbon technology is a kind of technologies adapting to low-carbon economy. Generally considered, technology is the sum of all the effective means and methods in the process of human reforming the nature, society and itself. The definition of low-carbon technology from the author should be:

Low-carbon technology means the sum of equipments, methods, knowledge and other modalities for low-carbon or carbon-free. It suits the need of adapting to a low carbon economy, reducing greenhouse gas emissions and preventing global warming.

2.2. Classification of Low-Carbon Technology

Five classes make low-carbon technology up: carbon reduction technology (energy-saving technology in the area of high energy consumption and high emission), carbon-free technology (nuclear energy, solar energy, wind energy, biomass and so on), carbon removal technology (colleting, burying, using of carbon dioxide), carbon management technology, resource conservation and recycling technology.

The carbon emission reduction technology, no carbon technology and carbon removal technology have been detailed description of the demonstration by scholars, understood better by people from all walks of life, and applied extensively. However, low carbon management technology, resource conservation and recycling technology are still new for people, which have important value to promote the development of low carbon technology. So, it is necessary to explain the last two classes especially. As a kind of low-carbon technologies and low-carbon management technology don't means specific equipments reducing the level of carbon dioxide in the atmosphere only, it also means the sum of equipments, methods, knowledge and other modalities. Government and companies shall management scientifically, and then promote the development of low-carbon economy from the management innovation of low-carbon technology. For instance, formulating assessment criteria, energy efficiency standards, audit system of carbon emission, formulating evaluation system of low-carbon economy for provincial governments and companies, making standards of carbon trading, carbon budget, carbon allocation etc. [2].

Why does resource conservation and recycling technology belong to low-carbon technologies? Low-carbon technology supports the development of low-carbon economy, and low-carbon economy is an economic development model for low consumption, slight pollution and low emissions. As resource conservation and recycling tech-

nology is a technology for low consumption, slight pollution and low emissions, so it belongs to low-carbon technologies. All the related technologies (recycling technology etc.) belong to low-carbon technologies, such as garbage power generation technology, recycling waste cement road construction technology, old building materials recycling technology and so on [3].

The author thinks that low-carbon technology can be divided into three categories from the perspective of production process:

1) Low-carbon technology of the initial production

It's the technology which can reduce carbon dioxide emission by using low-carbon energy, efficient use of existing resources and developing new energy during the initial production.

2) Low-carbon technology of the production process

It's the technology which can reduce carbon dioxide emission by strengthening low-carbon management, transforming traditional equipments, and changing energy use patterns during the production process.

3) Low-carbon technology of the end of production process

It's the technology which can collect and use carbon dioxide generated in the production process.

3. Features and Functions of Low-Carbon Technology

3.1. Features of Low-Carbon Technology

Low-carbon technology is a new word in technology system. It's proposed for the purpose of overmuch carbon dioxide in the atmosphere. Low-carbon technology reduces carbon emissions and promotes economic growth, increases energy consumption at the same time. Features of low-carbon technology:

First, low-carbon technology reduces the carbon.

Low-carbon technology is the technology for the purpose of carbon reduction. The key of low-carbon technology development is carbon reduction and unit energy consumption reduction. This is a marked feature of low-carbon technology. Low-carbon technology is in concordance with environment. Low-carbon technology reduces the concentration of greenhouse gases to the relatively stable level by controlling carbon emissions. It's beneficial to the balance of the ecosystem, the palliation or cancellation of the effects of global climate change, coordinated development with the environment and harmonious development of man and nature with economic growth.

Second, low-carbon technology is of sustainability. Traditional technology emphasized to maximize the economic benefits and disregarded the laws of nature, then the energy crisis and the greenhouse effect. Low-carbon technology is of sustainability, and this technology won't cause any damage to the environment and the interests of future generations. It complies with the laws of nature, and guide people to develop and utilize new energy sources actively. In the future, greenhouse gas emissions will be reduced, the greenhouse effect will be slowed down, and energy crisis will be eased with the less use of fossil energy like coal, oil and so on. Sustainable development of economy and

society becomes possible.

Third, low-carbon technology is efficient. Efficiency of low-carbon technology means not only high efficiency, but also great benefit. High efficiency is the quantity requirement of low-carbon technology. It means the improvement of energy efficiency, that is the improvement of carbon productive forces (more GDP is produced when the unit carbon dioxide emissions) [4]. Great benefit is the quality provision of low-carbon technology. It means the economic benefit and environment benefit of social development. Efficiency of low-carbon technology means not only the unity of high efficiency and great benefit, but also the unity of quality and quantity.

Fourth, low-carbon technology is international. Energy shortage and global warming are global problems. Developing low-carbon economy is an important way to solve these problems. The development of low-carbon economy becomes the main trend of global economic development. Low-carbon technology is international because of the internationality of low-carbon economy. Each country in the world attaches importance to low-carbon technology development and solving energy shortage and global warming problems. Energy shortage and global warming are the common tasks of the world, and it's not tasks for some country only. Low-carbon technology development needs to be advanced with the strengthen cooperation of all the country and the exchange of scientific experience, so as to promote the development of low-carbon economy and alleviate global ecological problems.

3.2. Functions of Low-Carbon Technology

Low-carbon technology is human's strategic choice for tackling climate change and solving the energy crisis. Specifically, low-carbon technology mainly has the following functions:

First, low-carbon technology is the key to support low-carbon economy development. Low-carbon economy is the economic development model based on "low energy consumption, low emission and low pollution". At the same time, "low energy consumption, low emission and low pollution" rely on the development and use of low-carbon technology. Saving energy, reducing consumption and emissions, developing and utilizing renewable energy, and optimizing the energy structure are based on the development, application and popularization of low-carbon technology [5]. Therefore, low-carbon technology is the key to support low-carbon economy. Only by vigorous promoting low-carbon technology innovation, low-carbon technology development, and core technical resources grasp can we improve efficiency, reduce energy consumption, reduce carbon emissions, win low carbon economy initiative, transform economic development mode into "low-carbon" and achieve development goals of low-carbon economy.

Second, low-carbon technology is the main way to slow down global warming. A large amount of carbon dioxide discharges, and it combines with other trace gases, then earth's greenhouse effects. Global warming causes a series of problems: such as polar ice melting, sea-level rising and so on. Human high-carbon economy development

causes current climate, and the origin is backward technologies and improper application of technology. The use of low-carbon technologies and low-carbon economy development are ways to solve climate problems. Low-carbon technology runs after economic efficiency and market demand, and it can effectively reduce the carbon content in the atmosphere and achieve the efficient recycling of ecosystem [6]. Therefore, low-carbon technology development is able to maintain the balance of carbon in the atmosphere, control greenhouse gas emissions, help relieve climate warming etc.

Third, low-carbon technology is the effective measure to ease the energy crisis and achieve sustainable development.

The traditional growth pattern of economy is based on the fossil energy, such as coal, petroleum, natural gas with high consumption, low output and high pollution, which caused a series of the ecological crisis of human survival and development, energy depletion, environmental pollution, climate warming, and so on. Only by developing low-carbon technologies, new energy and renewable energy can we ease the energy crisis. Sustainable development is proposed in the context of increasingly serious global environmental issues. Humans must transform the economic development mode and develop low-carbon economy. In other words, the use of low-carbon technologies will change the traditional development pattern of economy, and bring about a new revolution in energy use patterns to control the excessive carbon emissions produced by fossil fuels, and open a new era that renewable energy is gradually applied and replaced by fossil energy, so the country will realize the sustainable development with low input, high output and low pollution. To develop low-carbon economy and achieve sustainable development, it is necessary to control the carbon emission of excessive fossil energy by low carbon technology. Development and utilization of low-carbon technologies have to find and develop new energy sources continuously, and improve the utilization of existing resources and energy constantly. These features meet the needs of sustainable economic society development and the coordinated development between man and nature, and they are significant to achieve sustainable economic and social development.

4. Development Strategy of Low-Carbon Technology

In recent years, with the development of low-carbon technologies, low-carbon technology is more concerned as important support of low-carbon economy, and countries in the world are keen to develop low-carbon economy. EU low-carbon technology roadmap is focused on clean energy technology development priorities, when US low carbon technology development is focused on comprehensiveness and Japan attaches great importance to the development and application of carbon capture and storage technology for domestic energy shortages [7]. Development of low-carbon technologies is a complicated system engineering, and it develops with the comprehensive coordination of business, government, and social etc. Development of low-carbon technologies is depended on businesses' efforts and a series of government policies, laws and regulations, institutions as support and protection.

Currently, the development situation of China's low-carbon technology is not optimistic: First of all, the public awareness of low-carbon technology is not sufficient. The importance and necessity of low-carbon technology are lack of understanding. Second, the innovation and application ability of China's low-carbon technology is insufficient. Backward technology in China's key areas and industries, backward key equipment, the lack of independent research and development ability, and the severe loss of green, environmental and high technology lead to the situation of China's high investment, low output and high emissions still existing, and the development of China's low-carbon economy is far behind the developed countries. Again, the related policies and legal system of China's low-carbon technology are not perfect.

Less preferential policies and imperfect incentive mechanism affect the enthusiasm of the enterprise to the development and application of low carbon technology, and provide little comprehensive, effective guarantee of policy and law.

Development of low-carbon technology is a complex system engineering; it needs the common development of enterprises, government and society, and strong support for policies and laws.

Therefore, the government should do something from the following aspects.

4.1. Government Should Vigorously Popularize Low-Carbon Education and Encourage Enterprises to Actively Carry Out Low-Carbon Technology Innovation

Government should vigorously promote the concept of green low-carbon development and improve public awareness of low-carbon and literacy, which play an important role in the research and application of low-carbon technology. If business leaders have higher environmental awareness, they will be able to consciously implement cleaner production in the whole production process, lead employees to eliminate high-carbon technology and carry out low-carbon technology innovation. At the same time, if business leaders regard coordinated development of ecology and economy as their own task and consciously regulate their behaviors concerning the environment laws and regulations, low carbon technology innovation will be vigorously developed. Consequently, the government should strengthen the publicity and education of low-carbon economy development in the whole society, create a good social environment for development of low-carbon technologies and promote low-carbon economy. The government should rely on public media such as TV, newspapers, internet, magazines, broadcast and so on, and educate and guide the general public to learn about energy efficiency and low consumption. The general public will raise their low-carbon awareness and understand long-term benefits of low-carbon economy by these practices. The government should urge business leaders to carry out staff education and training of low-carbon economy, and all employees can establish the concept of low-carbon economy and recognize the importance of a low-carbon economy for enterprise development. Only if employees master the low-carbon technologies and work in accordance with low-carbon standard can enterprises' low-carbon technology innovation be promoted effectively.

4.2. Government Should Provide Strong Scientific Research and Personnel Support for the Low-Carbon Technology Innovation

As technological innovation is important to improve energy efficiency, reduce energy consumption and promote the development of new energy industry, the government should vigorously strengthen low carbon technology innovation, promote carbon-free and low-carbon energy technologies, and develop CO₂ capture and storage technology by increasing the support for technological innovation in the field of energy conservation and new energy technologies. States should encourage and support low-carbon energy research, low-carbon energy demonstration projects and the promotion of low-carbon energy projects. At the same time, mature low-carbon technologies should be widely used in practice by organization, guidance and support. As low-carbon technology innovation talents in government are inadequate, the government shall lead capital and talent to flow to new low-carbon technologies and energy field. A high level low-carbon technology research team can be formed by recommending and training of low-carbon economy and technology senior management talented persons, and it will provides strong scientific research and personnel support for the development of low-carbon technologies. The government should encourage the research, development, transfer, introduction and use of low-carbon technology and improve the development level of low carbon technologies.

4.3. Government Should Establish and Improve the Policy Support System of Low-Carbon Technological Development

Government should formulate a well-developed policy support system for low-carbon technology development and create a favorable policy environment and institutional guarantee for low-carbon technology.

First, establishing and improving economic policies ensure and support the development of low-carbon technologies. Low-carbon technology development requires a lot of capital and production equipment improvement for businesses. As processing of carbon dioxide would virtually increase the company's production costs, the government need to provide financial support for the development and production of low-carbon technology products, and formulate preferential policies for enterprises to develop the low-carbon technology innovation activities like government funding, government subsidies etc. The initial investment cost of low-carbon technologies is huge, and the government should formulate appropriate economic policies to support low-carbon technologies and flexibly use the regulation of fiscal and financial leverage.

Second, establishing and improving the tax policy can promote the enterprise to develop low-carbon technologies. Tax incentives and restrictive tax policy constitute a complete tax policy on saving energy. On one hand, the government implements enterprises which efforts to low-carbon technology innovation and high-yield, low-power development tax incentives. The government gives preferential for companies which actively use low-carbon technology on the fields of corporate income tax, VAT, fixed

assets investment orientation regulation tax and land use tax. Low-carbon incentives encourage enterprises to develop low-carbon technologies, such as tax relief, concessional loans, accelerated depreciation, low-carbon bond issue and so on. On the other hand, the government needs to form the external power to promote enterprise to develop low carbon technologies by collecting resources tax and carbon tax and encouraging enterprises to develop new energy technologies.

4.4. Government Should Establish and Improve the Legal System to Promote and Develop Low-Carbon Technologies

In order to develop and promote the use of low-carbon technologies, and promote the development of low-carbon economy, we need a perfect policy system as well as a set of comprehensive coordinated and effective legal system to guarantee. However, there is a development lagging in the innovation and promotion of low carbon technology in the present China. And there are faults that restrict the development of low-carbon technologies such as scatter of the related laws and regulations, no system, lack of operability. Therefore, the government needs to establish a perfect legal system to promote the development of low-carbon technologies immediately, strengthen legal supervision, rise the innovation transformation and application of low-carbon technologies to the legal level and then into the method of governance orbit, provide legal guarantee for the development of low-carbon technologies. We should mainly do the following several aspects:

1) Establish the basic law of single on low-carbon technologies. According to our country's legal status of low-carbon technologies, the government should promote, standardize, guidance and encouragement the basic law of innovation and application on low carbon technology. The basic law includes "actions addressing climate change", "low carbon technology promotion law", etc. will improve the legal effectiveness of low-carbon technology and will safeguard the innovation low-carbon on technology and use it.

2) Improving legislation in the specific areas of low-carbon technology.

At present, the legislation of low-carbon technology in our country is lack, and the legal protection for low-carbon technology is obviously insufficient.

In developed countries, the special legislation about research, development and utilization of low-carbon technology has been more perfect, Chinese government should learn from their advanced experience and establish a perfect and special legislation of low-carbon technologies in special domain, such as the development of solar and wind energy legislation, bio fuel quality special regulations and so on, so as to improve the effectiveness and pertinence of legislation on low-carbon technology.

In addition, government should effectively constrain the enterprises with high energy consumption, high pollution and high carbon emissions, make carbon emissions standards in different industry and department, clearly define environment legal responsibility, and give a necessary enforcement power to enforce the right to environmental protection departments, in order to promote the development and application of low-

carbon technology.

4.5. Government Should Establish and Improve the Market Service System Promoted and Developed Low Carbon Technologies

The government should establish a market service system which promotes the development of low-carbon technologies. Using the advanced experiences of developed countries for reference and taking the actual, relatively late, lower level situation of the development of low carbon economy into account, our country should as soon as possible establish a market service system of low-carbon technologies, to build a service platform of low-carbon technology, to set up a low carbon industry research and development center, to form a low carbon technology industry alliance. So, we can achieve the goal includes socialization, marketization, standardization, informatization and specialization of low-carbon technology service. Specific measures are as follows:

- 1) To establish low-carbon technology information service system;
- 2) To establish an information network and information transmission mechanism of low-carbon technologies. The main content of information network are fund, technology, consulting, personnel, market development, etc.;
- 3) To release information of low carbon technology timely to help the public and enterprises grasp the development trend;
- 4) To foster low-carbon technology capital markets, broaden the financing channels, encourage social capital to the key project investment of low carbon technology, financing for development of low-carbon technologies.

In short, the government should make full use of market driving force to stimulate research and development and application of low-carbon technology to provide active market environment for low carbon technologies. As a result, the government will promote commercialization, industrialization, internationalization of low-carbon technology and promote the development of low-carbon economy healthy and rapidly.

References

- [1] Lin, Z.H. (2011) Low Carbon Technology and Its Application. *Nature Magazine*, No. 2, 74.
- [2] Niu, G.M. (2011) The Core of Developing Low Carbon Economy. *Tianjin Daily*, 2011-07-11 (09).
- [3] Lin, Z.H. (2011) Low Carbon Technology and Its Application. *Nature Magazine*, No. 2, 75.
- [4] He, J.K. (2009) Low Carbon Technology Innovation Is the Key to Develop Low Carbon Economy. *Greenery*, No. 1, 46.
- [5] Wang, B. (2011) Low Carbon Technology: The Key to Develop Low Carbon Economy. *The Government Economy and Guide*, No. 3, 56.
- [6] Cui, C. (2010) Low Carbon Technology: Inevitable Choice of Development of Industry in 12th Five-Year. *Unity*, No. 1, 23.
- [7] Zhuang, G.Y. and Chu, C.S. (2009) Choice of Low Carbon Economy and Practice of Scientific Development. *Chinese and Foreign Energy*, No. 1, 20.



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