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# Carbon Emission Trading System of New Zealand and Its Enlightenment for China

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**Abstract** The design characteristics and operation results of carbon emission trading system of New Zealand was introduced in this paper. The results suggested that taking forest carbon trade as the only one supplying source of greenhouse gas emission improved the foreseeability in forest maintenance, and strengthened the effect of forestation. According to this, the author suggested that carbon emission trading market in which forest carbon trade was the only one supplying source should be cultivated in China. A compensation mechanism that industry compensated forestry should be established. A social participated, highly united, coordinated and mutual intermediated carbon trading market should be built.

**Key words** Carbon emission, Trading market, Forest carbon trade

## 1 Study background

The international community formed a five-year long carbon emission trading system through Kyoto protocol and Marrakech Agreement. This system is applied in 37 countries. In 2004, the general emission in these countries covers 29% of the global emission through Climate Analysis Indicators Tool in 2008. Each country can keep their promise to reduce emission by following the Joint Implementation and Clean Development Mechanisms (following as CDM). The international carbon emission is Assigned Amount Units, (known as AAUs). The first promise period was due in 2012. According to the Intergovernmental Panel on Climate on December 3, 2011<sup>[1]</sup>, from 1990 to 2009, the national carbon emission did not include land, land use change and forest project. The removal of greenhouse through land, land use change and forest rose by 11.5% and 17.6%, and the removal of greenhouse through land, land use and forest project in the country which is going through economic transformation decreases by 41.4% and 54.4%, and that in non-transforming country rose by 2.1% and 0.6%. In 1990, the carbon emission in 1990 was 59.1 million ton, and in 2009 it increased to 71.6 million ton, which rose by 19.4% in recent 20 years. In 2009, the carbon emission in New Zealand rose up to 26.7 million ton through land, land use change and forest program, which increased by 3.2 million ton compared with that in 1990, and the contribution rate of land, land use change and forest program to the removal of greenhouse gas in New Zealand in 2009 increased by 13.6%<sup>[2]</sup>, which suggested that the forest program plays a significant role in the removal of greenhouse gas.

It is stated in the Tokyo Protocol that until 2010, the six

kinds of carbon emission in all developed countries should reduce by 5.2% when compared with that in 1990. Each developed country must finish the concrete reduction goal within the first promise period. Compared with that in 1990, the European Union would reduce by 8%, America by 7%, Japan by 6%, Canada by 6% and each country in East Europe decreases by 5% to 8%. New Zealand, Russia and Ukraine only have to maintain the emission amount at the same level as that in 1990<sup>[1]</sup>. Against the background of global climate changes, study about the global carbon emission trade market attracts wide attention. Zapfel *et al.*<sup>[3]</sup> divide the global carbon emissions trading scheme into two categories, one is established through multilateral negotiation through United Nations Framework Convention on Climate Change, and another is formed through unilateral, bilateral and various cooperation forms. Christian Flachsland *et al.*<sup>[4]</sup> compared the characteristics and differences of global carbon emission trade system in terms of the effectiveness of environment control, cost control and political feasibility. Robbie Andrew *et al.*<sup>[5]</sup> applied input – output method to calculate the liability percentage of each participant under the domestic emission trade system in New Zealand. The conclusion is that 44% of the cost to cut greenhouse emission is shouldered by local producer, 28% by local consumers and 27% by international market. James A. Lennox *et al.*<sup>[6]</sup> studied the influence of free quote based on carbon emission towards macro economy in New Zealand, and they found that as the inner circulation efficiency of income improved, its negative influences on macro economy decreased. Based on the framework of carbon emission trade market in New Zealand, the correlation of various elements was analyzed, so as to provide reference to the carbon emission trade market in China.

## 2 Carbon emissions trading scheme and its operation in New Zealand

Emissions Trading Scheme in New Zealand is a kind of domestic

Received: January 3, 2013 Accepted: June 8, 2013

Supported by Science of Art of Youth Foundation of Central South University of Forestry and Technology (2011ZB002); Key Project of Education Department (10JJD00046); Youth Fund of National Natural Science Fund (71101029).

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political arrangement to abide by the Tokyo Protocol. Its objection is to ensure the implementation of carbon emission in the cheapest way, to promote the changes of consumer behavior to reduce carbon emission, to encourage investment in cleaning technology and reproductive energy, to expand forest area, and to strengthen the national visual construction of green brand<sup>[7]</sup>.

## 2.1 Transformation of carbon emissions trading scheme

(1) Management organization. The ministry of economic development is the management organization of carbon emissions

trading scheme.

(2) Time frame. The government is planning to include all departments into the carbon emission trading scheme from 2008 to 2015, including forest, transportation, fishery, electric power, industrial processing, wastes, agricultural department and other gas emissions besides of Carbon dioxide, (shown in Table 1<sup>[8]</sup>). In January of 2008, forestry was the first one to be included into trading system.

**Table 1 Time frame of each department participating the reduction of carbon emission in New Zealand**

Departments	Voluntary report	Deadline of compulsory report	The day to start the reduction operation	Profits NZUs	Payment NZUs	Whether to distribute NZUs
Forestry			2008 -01 -01	✓	✓	✓
Transportation		2010 -01 -01	2010 -07 -01		✓	
Fishery		2010 -01 -01	2010 -07 -01			✓
Electric power		2010 -01 -01	2010 -07 -01		✓	
Industrial processing		2010 -01 -01	2010 -07 -01		✓	✓
Other gas	2011 -01 -01	2012 -01 -01	2013 -01 -01		✓	
Wastes	2011 -01 -01	2012 -01 -01	2013 -01 -01		✓	
Agriculture	2011 -01 -01	2012 -01 -01	2015 -01 -01		✓	✓

Note: NZUs(New Zealand Units) is the distribution unit in New Zealand. 1 NZUs equals to the 1 Assigned Amount Unit.

(3) Transaction and price. The New Zealand Economy Development Ministry is also responsible for the distribution and re-collection of New Zealand emissions units. All participants have independent accounts and the transaction record is kept under the New Zealand Emission Unit Registry.

(4) Trading mechanism. The participants of the carbon emissions trading scheme must report its carbon emissions and clearance of greenhouse gas. In order to ease the pressure, government distributes NZUs based on the characteristics and influences of company<sup>[9]</sup>.

(5) Temporary arrangement. The period from 2008 to 2012 is transitional period and the legal transaction price per NZUs is at 25 NZ \$ /t. For solid fuels, industrial production and liquid fossil energy, each 2 ton of CO<sub>2</sub> requires 1 unit of NZUs, in other

words, the emission costs 12.5 NZ \$ /t<sup>[10]</sup>. At the end of the transitional period, government would cancel the preference towards all companies and the trade price would be decided by domestic and foreign markets.

**2.2 Operation situation** Until June in 2011, 96 companies were obliged to participate into emission reduction trading scheme and 1 216 companies joined voluntarily (Table 2). In 2010, the transaction of carbon emission trading scheme was up to 8.3 million dollars (Table 3). The actual carbon emissions in New Zealand in 2010 were 16.3 million ton and government would issue 4.7 million ton free quota, which was about 28.8% of the actual emission amount. The free emission quota in high energy consumption industries and manufacturing industry accounted for 41% and 24% respectively (Table 4).

**Table 2 Compulsory and voluntary involvement in the carbon emission trading system in New Zealand**

Compulsory		Voluntary	
Company types	Registered amount	Company types	Registered amount
Participants before 1989	3	Participants after 1989	1 159
Fuel supply	5	Land owner after 1989	36
Carbon import	3	Forest lender after 1989	11
Carbon development	18	Accessory production	1
Import of natural gas	2	Air fuel	4
Development of natural gas	41	Purchase of natural gas	3
Use of land heat	10	Coal purchase	2
Burning of wastes	4	Total 1 216	
Steel	2		
Aluminum industry	1		
Lime production	5		
Glass production	2		
Total	96		

Note: The data comes from reference<sup>[11]</sup>.

**Table 3** The NZUs in each department in 2010

	Transportation	Energy and industry	Forestry	Total
Submitted percentage//%	48	49	3	100
Trading fee/10 <sup>5</sup> dollars	401.9	408.3	19.8	830

Note: The data comes from reference [11].

**Table 4** Distribution of free NZUs in New Zealand in 2010

No.	Industry	Percentage//%	Discharge quota/10 <sup>5</sup> t
1	Steel, Iron, aluminium	41	192.7
2	Cement and lime	15	70.5
3	Paper, industrial package and newspaper	24	112.8
4	Alcohol and peroxide	9	42.3
5	Ammonia, urea, caustic soda, plastics and gelatin	7	32.9
6	Tomato, pepper, cucumber, rose	1	4.7
7	Meeting processing	2	9.4
8	Clay brick	<1	<4.7
9	Reproductive board	1	4.7
Total	100	470.0	

Note: The data comes from reference [11].

**Table 5** The type and percentage of carbon emission trading market in New Zealand in 2010

Trading method	Trading money/Yuan	Percentage//%
Forest NZUs	5 314 161	64.00
Others NZUs	2 556 141	30.73
New Zealand AAUs	262 883	3.17
Certified Emission Reduction CERs	133 150	1.65
Purchased from the government at the price of 25NZ \$	37 325	0.45
Total	8 303 660	100

Note: The Certified Emission Reduction is the carbon emission in developed countries and developing countries under CDM program.

### 3 Characteristics of carbon emission trading scheme in New Zealand

New Zealand is the first one to introduce forest into carbon emission trading scheme, which reflects the high recognition and attention local government gives to the ecological economic effect of forest. In the two decades from 1990 to 2010, the forest area in New Zealand first increased and then decreased. In 1990, the forest area rose to 7.72 million hm<sup>2</sup> and then increased to 8.266 million hm<sup>2</sup> in 200, before continue rising to 8.311 million hm<sup>2</sup> in 2005. The natural forest area reached 2.144 million hm<sup>2</sup>, which accounted

for 26% of forest area, and the artificial forest area was 6.125 million hm<sup>2</sup>, which was 74% of forest area. In face of global climate changes, New Zealand government carried out the construction of carbon emission trading scheme which considered forest carbon as the only supplier.

(1) The simple design of forest carbon reduces the transaction cost. The forest carbon has long been considered as the technical obstruction in the construction of forest carbon market. First, government helps forest owners to finish the digital painting work, so as to improve basic information bank. Later, simple relevant variable data is put into NZEUR. The forest owner can get carbon emission and income data rapidly. Over 100 hm<sup>2</sup> of forest land, the agricultural and forestry department use the artificial sampling method to calculate ETS and provides Field Measurement Approach<sup>[13]</sup>. In order to reduce the transaction cost of forest owners and to simplify transaction procedure, government has started to establish reference coefficient and relevant calculation formula, so as to simplify the forest carbon emission.

(2) Removal of forest carbon credit indicator and improving the predictability. New Zealand government made it a rule to submit the free carbon emission quota to the parliament. Besides of forestry industry, companies have managed to reduce the carbon emission. However, the carbon credit indicator is not subject to the restrain of distribution plan, and as long as the forest program can meet the requirements, it can get corresponding carbon credit, which boosts people's confidence.

(3) The close integration of carbon emission trading scheme in China and abroad has made full use of the carbon emission in the carbon emission trading scheme in New Zealand. In 2010, the trade ratio of NZUs reached 64% (Table 5<sup>[11]</sup>), which was far higher than other kinds of carbon emission trade product<sup>[14]</sup>. Because NZUs is based on national credit, its trading credit is widely accepted in the international society. Although the current New Zealand only allow NZUs participating into the exchange of international market, after the end of transitional period, various kinds of NZUs can take part in international market trade, which suggested NZUs' belief in taking part in international market trade. Owing to the relative rich forest resources in New Zealand, the New Zealand is competitive in carbon emission aspect<sup>[15]</sup>.

(4) The design of transitional period leaves time and space to the domestic industry. New Zealand government gave differential consideration towards the cost increase in carbon emission industry and leading export department. At the end of the transitional period, the emission quota in industrial field decreases by half. Since 2013, the free quota has reduced by 1.3%<sup>[17]</sup> to ensure the complete adjustment and smooth transition.

(5) The agricultural emission would strengthen the outcome of forestation and maintenance. In 2009, the department which emitted the largest amount of greenhouse gas in New Zealand was agricultural department, up to 32.8 thousand ton, which accounted for 46.5% of the general carbon emission. Secondly, the carbon emission in industrial department reached 31.4 thousand ton,

which accounted for 44.4% of the general carbon emission. The emission of greenhouse gas, wastes and used solution was 4.3 million tons, 2 million tons and 30 thousand tons, respectively<sup>[18]</sup>. People have debates on the forestation and expansion of agricultural production. The reduction of carbon emission and expansion of agricultural production are the top two targets of New Zealand's government, to maintain the competitiveness of dairy production in New Zealand and to create favorable ecological environment within the country. While ensuring the certainty, predictability and stability of the owner of forest, the effort to increase forestation and to improve the forest rises significantly<sup>[2]</sup>.

(6) Including each department into the emission trading system contributes to the improvement of evaluation system and the influence of policy to each department. The farming and animal husbandry in New Zealand is the main pillar for economy and its carbon emission largely includes CO<sub>2</sub> and CH<sub>4</sub>. The distribution of free discharge indicator in New Zealand is conducted in terms of annual plan.

(7) It is encouraged to tap the potential of forest resources and to reduce the financial burden of the government. In 2009, the forest system in New Zealand assimilated one fourth of the annual carbon emission. In the first promised period in Tokyo Protocol, the distributed emission indicator in New Zealand is 30.96 million ton and the assimilated amount reached 89.3 million ton after 1989, which suggested that in the first promised period, the assimilated amount after 1989 can make up the carbon emission in New Zealand in 1990<sup>[19]</sup>. In the end of the transitional period, all preferential treatments were called off. If government distributed NZUs at the price of 25 NZ \$ /t, the fiscal expenditure in the first promised period is 1.46 billion NZ \$, which is about 5% of the expenditure in the first promised period,  $(8930 - 3096) \times 10000 \times 25 = 1458500000 \text{ NZ \$}$ .

(8) The carbon sink being listed into the market trading system follows the international rule and realizes the sustainable development of forest. The Tokyo Protocol specified that the carbon emission before 1990 can not be used to pay off the obligation of carbon emission, thus, New Zealand government quantified the carbon emission before and after 1990.

First, the natural forests before 1990 have not been included into the emission system while the cuttings of trees in artificial forests have been restrained. The natural forest before 1990 failed to be a part of the emission system because its carbon sink has been stable and it is administered by many relevant laws about forest protection, such as Resource Management Act, the Forest Accord, and the Forests Act 1949. The government made it a rule that within the first - five - year, artificial forest before 1990s will be put into the carbon emission system. The owner of the forest before 1990 can apply for impunity under following two conditions: removal of trees or the forest land being lower than 50 hm<sup>2</sup> until September 1 in 2007<sup>[20]</sup>.

Second, the natural forest and artificial forest after 1990 can include into the carbon emission system voluntarily. The forest

owner can partially or completely join the carbon emission system and the forest owner can get corresponding NZUs.

#### 4 Revelation

Preliminary study of the influence of including forest into the carbon emission system suggested that according to the Forest Destruction in 2009 by the Ministry of Agriculture and Forestry, if New Zealand had failed to include the forest into the carbon emission system, the destroyed forest in 2009 would have been 700 hm<sup>2</sup>, however, because of the plan, the ruined area reduced to 3500 hm<sup>2</sup>. As time goes by, the effect of emission system is becoming more and more distinct. It is predicted that the ruined forest would be 17 000 hm<sup>2</sup> from 2013 to 2020<sup>[21]</sup>. Although in the global carbon emission system, China didn't shoulder any compulsory obligation, but international society has given a lot of pressure to China to change the economic development mode and to reduce the carbon emission. Therefore, based on the successful experience in other countries, it is extremely important to establish the carbon emission trading system in China and to ensure the development obligation.

First, it is necessary to quicken the construction of carbon emission trading market and to promote the competitiveness of low carbon industry. The Durban meeting in 2011 has a meaningful achievement, that is, to further strengthen the implementation of United Nations Framework Convention on Climate Change. Whether China can seize the opportunity of low carbon revolution is the core of the construction of lower carbon society. Besides, it is advisable to establish a pattern where compulsory and voluntary carbon emission coexists. Right now, Beijing, Guangdong, Shanghai, Tianjin, Chongqing, Hubei and Shenzhen were designated as the first group of carbon emission trading system. In 2013, the general carbon emission trading system was carried out in the above areas. The market will be improved to meet the demand of different participants. The two markets will exhibit different characteristics based on the quality of trading product and trading scale. Considering the plan of industrial development, the industry with high energy consumption and pollution will be included into the system. China now has become a large country which consumes various kinds of resources and the emission of carbon gas will reach the peak value in 2020. The industrial competition pushed forward the industrial progress and the low carbon emission was the key factor in the industrial competition. The construction and improvement of carbon emission trading market will be beneficial to the design of reducing carbon emission. Furthermore, transitional period is set aside to adjust the industry. The industries with high consumption and discharge of energy were monitored to adjust the time arrangement and to improve the competitiveness of Chinese companies.

Second, the ecological compensation mechanism promotes the improvement of comprehensive ecology. The forest has been considered as the only supplier of the carbon emission system. The current government lowers the goal and simplifies the implementation mode to ensure the result. Besides, it is feasible to establish

the forestry mechanism. In the reform of forestry policy, social pension fund is set aside as a part of the social insurance. In the ecological construction, it is necessary to strengthen ecological construction, increase forestry coverage, improve environment quality, and to improve the forestry cultivation in China. Furthermore, it is beneficial to strengthen the construction of public facility, production equipment and investment of community economy.

Third, a social participated, highly united, coordinated and mutual intermediated carbon trading market should be built. Considering the carbon emission in China, the characteristics of reducing carbon emission in other countries and development trend of global carbon emission trade system, it is encouraged to design a system with Chinese characteristics. Besides, it is necessary to restrain the blind expansion of trading organization and to establish coordinated trading system. Right now, there are 12 trading organizations in China. The diverse carbon emission trading market is not conducive to the merge of carbon trading market in future, and can not realize the financial merge. In the end, it is necessary to develop the carbon sink in China and to evaluate the expenditure to create favorable condition for the carbon emission trading market.

The way to solve the baseline of carbon emission is the key. Thus, it is pressing to collect, monitor and renewal the carbon emission trading system.

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(From page 16)