

Carbon emission right as a new property right: rescue CDM developers in China from 2012

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Abstract Clean development mechanism (CDM) is encountering many uncertainties due to the coming end of the commitment period and critically suggested reformation. As the largest participant in the CDM market, China shoulders the biggest proportion of market risk. Among the studies on CDM in China, few have focused upon the legal aspect of CDM, which is crucial in defending developers' interests. To fill this research gap in making the transition from policy to law, this paper claims that carbon emission right, which is the basis of trade, should be attributed as a property right in Property Law of People's Republic of China. The present study will discuss the characteristics of carbon emission, definition, and legal attribution of carbon emission right. The valid object of carbon emission right in the CDM market under Property Law should be certified emissions reductions (CERs). The usufructuary right could be specifically applied in practice to the owners' property right on CERs in China. Although experience from the CDM is not fully applicable to the development of cap and trading, the success of CDM market provides a reasonable platform to study emission right in the view of legal science. Furthermore, the proposed research acts as the pioneer study that lay the theoretical foundations in legal science on emission right trading for other potential schemes, which in turn addresses international environmental issues.

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Abbreviations

CDM	Clean development mechanism
CERs	Certified emissions reductions
GHG	Greenhouse gas
KP	Kyoto Protocol
IPCC	Intergovernmental Panel on Climate Change
EUETS	European Union Emissions Trading Scheme
PRC	People's Republic of China
DNA	Designated National Authorities
CAAA	Clean Air Act and Amendments
EB	Executive Board
DOE	Designated Operational Entities
PDD	Project design document

1 Introduction

Clean development mechanism (CDM) is a market-based solution under the Kyoto Protocol (KP) that allows developed countries to buy emission reduction credits (certified emissions reductions, CERs) from the greenhouse gas (GHG) emission reduction projects of developing countries. The trading item of CDM market has been viewed as emission right that can be deferred for future use (Mannea and Richels 2004) or excessive to be sold (Klepper and Peterson 2005). Although legalization of climate change issues is strongly advised by the Intergovernmental Panel on Climate Change (IPCC 2007), interpreting this emission right from a legal perspective by using CDM experiences within China has rarely been explored.

Currently, CDM market faces many uncertainties due to two principle reasons. Firstly, the quantified emission limitation and reduction commitment period under KP are coming to an end in 2012. From 2013, the European Union Emissions Trading Scheme (EU ETS) will only accept CERs from “Least Developed Countries” decreasing the demand for international credits. Secondly, CDM has been criticized for acting as a barrier to building the global carbon market since current beneficiaries might be reluctant to take further actions to promote global carbon market (Neuhoff and Vasa 2010). Many new plans to reform CDM have been suggested in diverse implications consequently (Chung 2007; Stripple and Falaleeva 2008; Schneider 2009).

As the largest participant in the CDM market, China¹ (People's Republic of China (PRC)) inherently bears the biggest proportion of market risk. As of May 29, 2012, the number of Chinese registered projects in CDM is 2027, which accounts for 48.53% of the total.² The number of issued CERs is 565 million tons, accounting for 59.77% until June 4, 2012.³ Furthermore, as of May 11, 2012, the number of approved CDM projects by

¹ In the analysis, China always refers to People's Republic of China.

² See <http://cdm.unfccc.int/Statistics/Registration/NumOfRegisteredProjByHostPartiesPieChart.html>.

³ See <http://cdm.unfccc.int/Statistics/Issuance/CERsIssuedByHostPartyPieChart.html>.

Chinese designated national authorities (DNA) is 4208.⁴ If the CDM market changes, China will suffer from the greatest impact. The stake holders in CDM who bears the greatest risk include: project owners, consultants, and buyers (i.e., developed countries) (Pei et al. 2009a). Therefore, methods and strategies employed to protect CDM developers in China occupy central stage as the large economic flow generated by international developers.

Thus far, many studies in the fields of economics, technology, and politics provide recommendations for protecting the benefit of CDM developers in China (Boyd et al. 2009; Gaast et al. 2009; Yang et al. 2010). However, protecting the CERs and other emission right under the legal framework is difficult as there is a paucity of legal research in this field. Therefore, the current article concentrates on the interpretation and legal attribution of carbon emission right arising in the CDM market, which is the basis of trading. Considering the specialty of individual countries, the domestic local legalization of climate change issues is also suggested by IPCC (2007). The paper focuses mainly on carbon emission right based on the legal system in China with a view of theories and practices from other countries.

This study is the first attempt to investigate the protection of CDM developers from a legal perspective, following Dales' pioneer study on realizing marketable emission right in accordance with the economics of property rights and the environment (Dales 1968). The study concludes with several key recommendations for legal protection in China under the latest Property Law of China promulgated in 2007 and international practice, which improved previous legal study on CDM (Pei et al. 2009b). The usufructuary right is clearly suggested in the article to protect CDM developers' profits in real practice. Furthermore, CDM market has proven successful in past years, which could be applied to address other environmental issues. Although experience from the CDM is not fully applicable to the development of cap and trading, CDM market provides a reasonable platform to study emission right in the view of legal science. Therefore, the research on the carbon emission right in CDM market holds theoretical implication of clarifying emission right with empirical analysis, as well as practical significance of implementing legal protection of CDM developers in China.

2 Definition of carbon emission right

Carbon emission right was initiated from environmental capacity on CO₂ absorption in the atmosphere, which was adopted by the KP. Environmental capacity is an environmental buffering mechanism that serves "to maintain stability (or resistance) against external physical and chemical stresses that would otherwise cause damage or malfunction" (Munn 2002). The use of environmental capacity has given birth to a new right to use environmental capacity, commonly known as pollution right or emission right, such as the SO₂ emission right market in USA (Joskow et al. 1998) and EU ETS (Ellerman and Buchner 2007).

Currently, the carbon emission right under political and technological focus is the energy usage regulated by the market (Golden 1999), which is also regarded as the most important type of carbon emission right from Chinese view (Gao 2007). Therefore, in the current article, only carbon emission right under the market approach is studied. Economic and social development takes energy as a necessary impetus. Inexorably, energy use produces and

⁴ See <http://cdm.ccchina.gov.cn/web/index.asp>.

expels GHG into atmosphere. By 2008, energy-related GHG emission had been 29.3 billion tons (IEA 2010). Therefore, limiting the emission of GHG is equal to hindering one country's economic and social development. From the perspective of economic and social development, carbon emission right is synonymous to a country's development (Grubb et al. 2011), hence receiving worldwide political attention (Golden 1999).

The new commodity established by the CDM market requires a legal definition for market participants to make it tradable (MacKenzie 2009). At present, there is insufficient research to define what carbon emission right is in the academia world, let alone in China. Not only in theory but also in practice, tradable emission right is a relatively new instrument to address environmental issues. Often the case, marketable permits on emission attract more attention than tradable emission right. The individuals or firms have to obtain the requisite permits or license to emit (Cohen 2001). The transferable permit model is discussed by policy makers to address wastewater or air emission (Rodgers 1994). The occurrence of tradable permits holds great importance as being a potential policy option, though controversies remain on its idea in behind (Findley and Farber 1999). The permits remain effective at the level relevant to the policies and regulated by government sector (Burnett-Hall and Jones 2009). Interpreting tradable emission as a right under the view of legal research is hardly the case by focusing on tradable permits.

Tradable emission right was first implemented as law in 1990 in USA on SO₂ emission trading by *Clean Air Act and Amendments* (CAAA) (Woerdman 2005). According to the KP, emission right finally gained principle prominence as the pattern of carbon emission right (Crals and Vereeck 2005). Due to the success of CDM market, many countries aim to boost the transactions under the incentive of economic benefit. There has been little discussion on the legal nature of carbon emission right. Since SO₂ emission right trading is the oldest practice, the definition on carbon emission right can be inferred according to *Clean Air Act and Amendments* for reference, which should be a most reasonable way. In the meantime, the proposed study on the legal nature of carbon emission right contributes to theory and practice with the focus on China.

In the *Clean Air Act and Amendments*, marketable SO₂ emission right is designed to “protect and enhance the nation's air resources so as to promote the public health and welfare and the productive capacity of the population.” Similarly, carbon emission right could be interpreted as, “under the premise that human needs of survival and development can be met and environment can be protected, the right of human to utilize maximum amount of GHG based on the absorbing and enduring capacity in atmosphere.” This definition is not perfect; however, it could encompass a relatively substantial understanding on carbon emission right.

3 Characteristics of carbon emission

Carbon emission right is based upon carbon emission. To illustrate the definition of carbon emission right (cf. Sect. 2), the characteristics of carbon emission are discussed below.

3.1 Non-polluting

CO₂ as the most important GHG is an essential element of both inorganic earth processes and of the organic cycles of the biosphere. CO₂ can be considered neither an “irritant” nor a “contaminant” (Donald and Davis 2009). CO₂ is a harmless gas that cannot cause air pollution, which is defined as “the presence of harmful substances in the atmosphere...

detrimental effects are at the heart of the definition” (Alexander and Fairbridge 1999). The physical and chemical features of CO₂ are completely different from common pollutants. Therefore, it is not regulated as a toxic or harmful gas (Hepple 2005), for example in China, USA, EU, and Japan.

3.2 Economic value

According to classic economic theory, environmental capacity is a scarce resource. As of June 5, 2012, 4191 projects have been registered in CDM Executive Board (EB) and the amount of CERs issued has reached 597 million tons per year.⁵ If the market price would become 10 USD per ton CO₂, the market would enlarge and become quite influential. Therefore, carbon emission right continues to garner mainstream attention. However, little research is available on the kind of legal right to which carbon emission right should be attributed (Pei et al. 2009b).

3.3 Highly related to country development

Traditionally, environmental problems have been considered as the externalities of social or economic activities (Tietenberg 2003). Individuals are the concern of solutions to environmental issues (Fahlquist 2009). The discussions on environmental issues are more related with the well-being of individual citizens. However, under climate change, carbon emission right is much more closely related to national development (Hardee and Mutunga 2010) (cf. Sect. 2).

As explained in the former section (cf. Sect. 2), the restriction of carbon emission right is synonymous to hindering national social and economic development. Therefore, carbon emission right is closely related to national wealth (Du and Luo 2007; Roberts and Grimes 1997). Any policies tackling climate change must include as many countries as possible to achieve ideal effect (Buchner and Carraro 2005). And since carbon emission right is highly related with country development, political conflicts will emerge with regard to its allocation and implementation (DeCanio 2009).

4 Legal attribution of carbon emission right

4.1 Beyond environmental rights

Current research on environmental right has been divided into three schools (Fitzmaurice 1999). The first school of thought strongly supports that there can be no human rights without an environmental right (Trindade 1991). The second believes that a “generic international environmental entitlement, both as an already existing and emerging human rights concept, is a highly questionable proposition” (Handl 1995). The last takes on an intermediate position and admits that the existence of some environmental right is derived its existence from other forms of human rights (Weber 1991). Environmental rights on basic environmental health are necessary for human rights (Giorgetta 2002). However, environmental rights are also regarded as a combination rights separate from human rights (Miller 1998).

⁵ See <http://cdm.unfccc.int/Statistics/index.html>.

In China, environmental right is defined as the right of citizens to access a comfortable environment and at the same time, the responsibilities of citizens to protect environment (Cai 2002), the right to enjoy a healthy environment and their right to utilize environmental resources (Chen 1997), and the right to be protected from pollution which also allows citizens to claim compensation if negatively affected (Lv 2000). Finally, environmental right is the right to participate in environmental decision-making processes and to obtain legal assistance in the case of lawsuit (Gao 2000), and so on.

The above discussion shows how environmental right contains rather board dimensions. This scope is too wide for regulating specific environmental problems. In addition, environmental rights protect citizens from pollution and environmental accidents from the above understandings. However, the damaging effects of global warming may include climate extremes, which require national response, rather than individual reaction. Furthermore, CO₂ is not considered as pollution by most country's environmental law system. If carbon emission right is taken as environmental right, there would be a legal vacuum.

4.2 Right to development

Economic development is often used as a defense for carbon emission, especially in some developing countries. In China, climate change is fundamentally a development issue besides an environmental issue based on political view.⁶ However, the right to development does not share a common legal protection system with carbon emission right. Pursuant to the *United Nations Declaration on the Right to Development* on December 4, 1986, the right to development is defined as “an inalienable human right by virtue of which every human person and all peoples are entitled to participate in, contribute to, and enjoy economic, social, cultural and political development, in which all human rights and fundamental freedoms can be fully realized” (Article 1 of the Declaration on the Right to Development). Human beings are the beneficiaries of the right to development, as well as of all human rights.

The implementation of the right to development is the performance of States to improve human development by making appropriate policies and enacting effective legislations. To promote a favorable condition for a sustainable development, China has updated the notion of right to development from simple economic development to “scientific outlook on development,” in the Report on the Work of the Government 2008, placing “people first and (that) seeks to ensure comprehensive, coordinated and sustainable development,” including taking environmental protection as a “fundamental State policy.” However, the protection on right to development from the level of policies is insufficient.

4.3 Property right

At present, the international community generally agrees that carbon emission is a property (Bennett 2010; Palmer 2011; Quinn 2009). Many economists also see the tradable emission right as property right due to its exclusive use, economic value, and incentive effects (Woerdman 2005). The establishment of carbon markets ultimately aims at environmental protection, which requires that the environmental resources assign a clear definition of right on environmental goods (Coase 1960). According to economic theory, property right is used to solve the externality problems that cause the environmental issues (Tietenberg 2003). However, effective protection of property right on environmental goods is far

⁶ See China's National Climate Change Program.

beyond the domain of economic control. It needs a suitable legal system to help to protect ownership.

In the trading scheme for SO₂ emissions in USA, a legal provision was adopted that an emission right, alias “allowance,” does not constitute a property right (in Section 403(f) of the CAAA). Although some conclude that emission rights are, and should be, temporary “rights of use” (Convery et al. 2003), law and economics studies prefer to characterize allowances as mixed, hybrid, or regulatory property rights (Rose 1999; Yandle 1999). Moreover, although allowances in the American SO₂ emissions trading scheme are not named as property rights, allowances are in fact recognized as property right by emitters, buyers, and governments (Cole 1999).

Therefore, in comparisons with SO₂ emission right, carbon emission right is generally characterized as property right (Woerdman 2005). The “market-based” status of CDM is essentially established and acknowledged by setting the lawful right of the private actor to trade emission rights (Boyle 2008). CDM could be improved if the property right on trade item could be well assigned, monitored, and enforced (Victor 2007). Vague and indefinite statutory rights can generate uncertainties, not only for the holder of the carbon right, but also for third parties (Friedman 1971). The property right approach maintains that many cases involving environmental and public goods based on Coase Theorem (Ibarraran and Boyd 2006) that allows individuals to maximize their utilities, thus resulting in a Pareto optimal status (Coase 1960).

To sum up, only law of property right could protect the interest of developers in CDM market. In a legal sense, property right is defined as the relationship that an individual or a corporation has with the object and with the rest of the world in relation to that object (Hepburn 2001). In this article, property right is conceived as being able to better identify and protect carbon emission right, which is also an approach for sustainability in economy

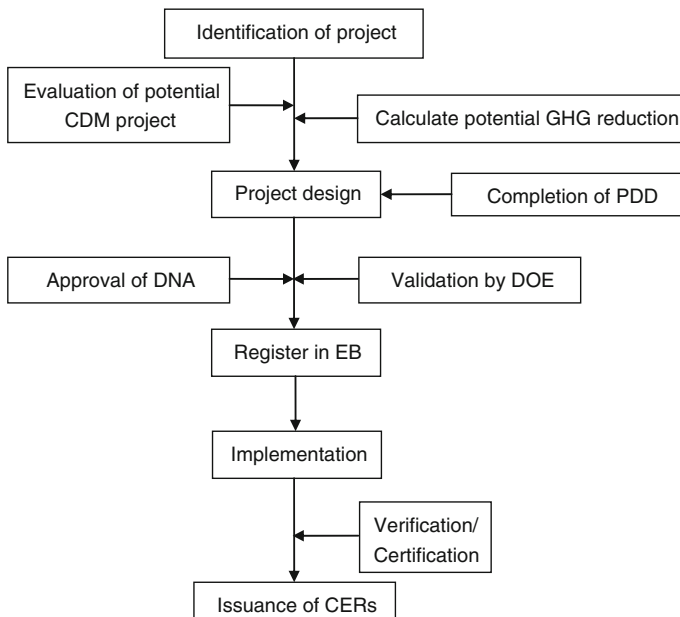


Fig. 1 The whole process of project development in CDM (Pei and Wang 2008)

(Cerin and Karlson 2002). The property right is based on the object. In the case of China, property and property right are different. Property is the object of property right. Property right is the right on the property. Therefore, the valid object of carbon emission right deserves more discussion in Sect. 5.

5 Valid object of carbon emission right in Property Law

In China, CDM requires several approvals from different agencies (i.e., DNA, Designated Operational Entities (DOE), and EB) on the project design document (PDD), as shown in Fig. 1. Therefore, carbon emission could be viewed as a kind of property under the legal protection. This discussion is highly significant for the identification of property under legal protection in Chinese CDM market (Hepburn 2009).

Property Law has long divided the legal protections accorded to tangible property and intangible property (Merges et al. 2000). This division has traditionally rested on the fact that tangible property derives its value from being inherently exclusive and physically useful; however, intangible property is only worth the value of the information it represents (Worthington 2007). Due to the development in technology and finance, the property in law is involving into diverse types. With the review of cases (*Mundy v. Decker*⁷ and *Intel v. Hamidi*⁸), the meaning of property (intangible property) should be re-examined and reinterpreted as the nature of an object's utility and its association with the individual, that is, individual dominion to effectuate its socially beneficial purpose or intended function of the property (Schottenstein 2009).

In this sense, the item trading in the carbon market should be categorized as intangible property. On the one hand, the item of carbon emission right does not exist in a physical form in the world. On the other hand, it is developed, possessed, and traded in the purpose of interest in the carbon market. In the view of law, property should be defined clearly (Zhao 2005). Intangible property should include two equally important aspects: creative activities and authorizations (not only from local authorities) (Wu and Hu 2005). Authorizations are used to accept the creation in law because for intangible property, creation is the necessary source of right and granted by law, which is the next step to become a right (Patterson and Lindberg 1991). Therefore, in the current practice, the license arrangement is a common way to develop and manage intangible property (Brauman 1997; Dau and Donnelly 2003; Ramu 1997). As claimed by Article 6 in Property Law of PRC in 2007, "The creation or transfer of the real right of a movable property shall be delivered according to law." The intangible property or intangible moveable property shares the same legal principles.

To briefly summarize the above discussion, intangible property not only has the value for trading, but also should be entitled by current law. Therefore, under this background, only CERs could be the valid property in law. More specifically, some scholars view CERs as intangible moveable property in China (Tung 2009). In the area of CDM, EB is the final and supreme authority in regulating the CDM market. Approval from DNA and a validation report from DOE are both necessary to become registered in EB. By registering in

⁷ No. A-97-882, 1999 WL 14479 (App. Jan. 5, 1999): Conversion by the plaintiff's former secretary who had permanently "deleted the entire contents of the WordPerfect directory" from the company computer.

⁸ Super. Ct. No. 98AS05067 (App. Jun. 30, 2003): a former Intel Corporation employee's e-mails to current Intel employees, despite requests by Intel to stop sending messages, did not constitute trespass of Intel's e-mail system.

EB, the proposed project could be a real CDM project. After the registration, if the CDM project is implemented according to its monitoring plan, CERs can be issued and available to trade in CDM market. In sum, only CERs qualify to be an object of property right in law.

6 Legal protection of CERs in China

The article fundamentally aims at identifying the legal protection on carbon emission right to realize the benefits of CDM developers. The best property regime depends on the relative costs and benefits of property protection in the specific local context (Carlson and Pollak 2001), of which attention to local variation has largely been absent from the debate on property rights (Serkin 2007). The differences between countries or even between regions within a nation come from variable factors, such as cultural differences (Ehrmann 1976), legal traditions (Krygiel 1986), considerations of governments (McConnell 1988), and so on. Furthermore, the world at present has two major legal systems: common law and civil law. The pure legal rights are grounded on laws that directly or indirectly confer rights on these subjects to any given legal system (Wellman 1995). Therefore, in this section, the legal protection of CERs is discussed only in the context of China, which is also suggested by IPCC to consider the local conditions (IPCC 2007).

The Mainland China adopts a civil law system. The present Property Law entered into force on October 1, 2007. Property right and real right are the same despite the different names of translation.⁹ The protection from the Property Law in China has two steps. First, it should be an item that belongs to “property” in the Property Law of China. Second, if it belongs to “property” in the Property Law of China, what kind of property right it falls under.¹⁰ Following this logic, legal protection in China is discussed in this section.

In the previous section, the valid object is CERs in the carbon trading as property. At present, the international community generally agrees with CERs as a property. In the common law system, property is the right to possess, use, and enjoy a determinate thing, that is, the right of ownership (Garner 2004). However, in civil law system, property is not a legal right. Property is only viewed as the object of property right (real right) in China.¹¹

CERs reflect that human beings utilize maximum amount of GHG based on the absorption and endurance capacity in the atmosphere, under the premise that human needs of survival and development can be met and environment can be protected. With the utilization and trade of CERs, CDM can be compared to classic pollutant emission right trade. The precondition of emission right trade is the identification and right definition of

⁹ The translation in the article is from <http://www.chinalawinfo.com/index.aspx> established by the prestigious Peking University on the basis of its Legal Information Center. In the Website, there are two versions of translations: the Property Law of the People’s Republic of China and Real Right Law of the People’s Republic of China. In this article, we refer to the Property Law of the People’s Republic of China as the English version. See <http://www.lawinfochina.com/Display.aspx?lib=law&ID=6642>.

¹⁰ The Property Law of the People’s Republic of China, Article 1: “For the purpose of safeguarding the basic economic system of the state, maintaining the socialist market economic order, clearly defining the attribution of the res, giving play to the utilities of the res and protecting the real right of the right holders, this Law has been formulated in accordance with the Constitution Law.”

¹¹ The Property Law of the People’s Republic of China, Article 2: “This Law shall apply to the civil relationships generated from the attribution and utilization of the res. The term ‘res’ as mentioned in these measures includes realities and chattels. In case there is any provision that certain right shall be taken as an object of real right, this provision shall apply. The term ‘real right’ as mentioned in this Law refers to the exclusive right of direct control enjoyed by the holder according to law over a specific res, including ownership, usufructuary right and real rights for security.”

environmental capacity, based on law, in order to realize the optimization of environmental goods and protect environment. Moreover, legal judgment to the right on CERs is highly related with trade security in CDM market.

In China, property right is the dominance of a specific property (including real property and personal property, tangible and intangible property collectively) (Xu 2003). It includes many aspects referring to the real right, to all controlling rights to property, and to the nonprofit rights, and so on (Sun 2006). According to civil law, the combination of property and ownership (including natural and legal persons) is a property right in China (Wang 2000). Therefore, CERs could be viewed as the “res” subject of property right (see footnote 11), which is consistent with previous discussion (cf. Sect. 5). Furthermore, the attribution of ownership on CERs as property right has several unique advantages.

1. Owners pay more attention to their use, which is a good incentive, consistent with the carbon emission trading market ultimate goal.
2. Within the process of the transaction, owners have integrity rights of possession, use, gaining income, and disposal because real right covers both absolute right and controlling right.
3. Carbon emission right is endowed with properties of possession and exclusive power. This clear definition is in line with Coase’s theory on the basis of property economics.

With the clear understanding on the CERs as “res” in the Property Law of China, what kind of property right can be set is the second task. In terms of property right as including environmental resources, there has also been a great deal of discussion. Property right is considered as a form of power on a sanction and authority for decision making over resources (Denman 1978). Property right also includes environmental goods (also known as natural resources) (Dasgupta 1982). Therefore, scholars have long recognized that natural resources can be viewed and defined as a kind of property right.

Property right in the civil law system has the real right of oneself and real right of others (Hudson 2004). According to property right in China, the natural resources are owned by the nation. Therefore, individuals and companies have no right to own it. The usufructuary right could be adopted in this case under the Property Law of China. The usufructuary right is a right of enjoyment enabling a holder to derive profit or benefit from property that either is titled to another person or which is held in common ownership, as long as the property is not damaged or destroyed. But the usufructuary does not have possession of this property.

In the Property Law of China, the law has set the rules on the usufructuary right: “Article 117, as regards the realty or chattel owned by someone else, a usufructuary right holder is entitled to possess, use and seek proceeds from it in accordance with law.” “Article 118, as regards the natural resources that are owned by the state or that are owned by the state but used by the collective as well as those that are owned by the collective as prescribed by law, an entity or individual may possess, use and seek proceeds from them.” Therefore, similar to mineral prospecting right, mining right, water intake right, and the right to use water areas or tidal flats for breeding or fishery, property right on CERs could also be attributed as the usufructuary right. Furthermore, the emission right is claimed and should be regarded as “rights of use” (Convery et al. 2003). A recent study claimed to set carbon emission right as property right (Pei et al. 2009b), while it neither identified the valid object nor granted the usufructuary right to carbon emission right. Another study suggests that the right granted to CDM project owners is analogous to the usufructuary right (Streck and Zhang 2005). However, this study failed to clarify the valid object of the usufructuary right, which lacks of feasibility in practice. In academia, these rights, as part of the usufructuary right on natural resources, are also regarded as quasi-property rights

(Deng 2005); regardless of what these rights are named, they deserve serious attention in academia to implement the environmental protection in China (Wang 2008; 2007).

7 Conclusions

Currently, carbon emission right is generated under international negotiations that aim to relieve the environmental problem of climate change. CDM is facing many uncertainties, especially within China—the largest participant in the worldwide CDM market. Therefore, the legal protection of CDM in China must be implemented in a timely fashion. The protection from law could provide a firmer and more stable basis rather than from policies. The legislation in China could provide higher trust and further responsibilities in tackling global warming issue.

The following conclusions may be extracted from the above article discussion:

1. Carbon emission right should be viewed as a property right.
2. The valid object of carbon emission right of CDM market in the Property Law of China should be certified emissions reductions (CERs).
3. The usufructuary right in the Property Law of China could be applied in practice to protect owners' property right on CERs.

The future of CDM market is precarious; and neglecting the benefits of CDM developers, especially in China, will cause more confusion. Nonetheless, CDM market has proven successful in the past years by promoting GHG emission reduction and local sustainable development in developing countries. Therefore, the present research not only suggests a feasible tool to protect the benefits of CDM developers in China and other countries, but could also acts as the pioneer study that lay the theoretical foundations in legal science on emission right trading for other potential schemes, which in turn addresses international environmental issues.

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References

- Alexander, D. E., & Fairbridge, R. W. (Eds.). (1999). *Encyclopedia of environmental science (encyclopedia of earth science series)*. AA Dordrecht. The Netherlands: Kluwer Academic Publishers.
- Bennett, L. (2010). Are tradable carbon emissions credits investments? Characterization and ramifications under international investment law. *New York University Law Review*, 85, 1581–1617.
- Boyd, E., Hultman, N., Roberts, J. T., Corbera, E., Cole, J., Bozmoski, A., et al. (2009). Reforming the CDM next term for sustainable development: Lessons learned and policy futures. *Environmental Science & Policy*, 12(7), 820–831.
- Boyle, G. (2008). A review of emerging GHG emissions trading in North America: Fragmentation or progress. *Alberta Law Review*, 46, 173–202.

- Brauman, M. V. (1997). Tax planning for foreign expansion by U.S. petroleum companies. *Journal of Natural Resources and Environmental Law*, 13, 1–46.
- Buchner, B., & Carraro, C. (2005). Economic and environmental effectiveness of a technology-based climate protocol. *Climate Policy*, 4(3), 229–248.
- Burnett-Hall, R., & Jones, B. (Eds.). (2009). *Burnett-hall on environmental law* (2nd ed.). London: Sweet & Maxwell.
- Cai, S. (2002). On right to environment. *Jin Ling Law Review*, 1, 83–119.
- Carlson, A. E., & Pollak, D. (2001). Takings on the ground: How the supreme court's takings jurisprudence affects local land use decisions. *Davis Law Review*, 35(103), 105–106.
- Cerin, P., & Karlson, L. (2002). Business incentives for sustainability: A property rights approach. *Ecological Economics*, 40(1), 13–22.
- Chen, Q. (1997). Analysis on the right to environment. *Chinese Legal Science*, 2, 61–69.
- Chung, R. K. (2007). A CER discounting scheme could save climate change regime after 2012. *Climate Policy*, 7, 171–176.
- Coase, R. H. (1960). The problem of social cost. *Journal of Law and Economics*, 3(1), 1–44.
- Cohen, M. A. (2001). Criminal law as an instrument of environmental policy: Theory and empirics. In A. Heyes (Ed.), *The law and economics of the environment*. Cheltenham [England]. E. Elgar Pub: Northampton, Mass.
- Cole, D. H. (1999). Clearing the air: Four propositions about property rights and environmental protection. *Duke Environmental Law and Policy Forum*, 10(103), 103–130.
- Convery, F. J., Redmond, L., Dunne, L., & Ryan, L. B. (2003). *Assessing the European Union Emissions Trading Directive*. Paper presented at the 12th Annual Conference of the European Association of Environmental and Resource Economists (EAERE), Bilbao, Spain, pp 28–30.
- Crals, E., & Vereeck, L. (2005). Taxes, tradable rights and transaction costs. *European Journal of Law and Economics*, 20, 199–223.
- Dales, J. H. (1968). *Pollution, property and prices*. Toronto: University of Toronto Press.
- Dasgupta, P. (1982). *Control of resources*. Cambridge, MA: Harvard University Press.
- Dau, P., & Donnelly, R. (2003). Globalization of intangibles-based businesses: Tax aspects. *Stanford Journal of Law, Business and Finance*, 9(1), 1–36.
- DeCanio, S. J. (2009). The political economy of global carbon emissions reductions. *Ecological Economics*, 68(3), 915–924.
- Deng, H. (2005). On the quasi—property nature of environmental capacity law and the composition of right thereof. *Chinese Legal Science*, 4, 61–68.
- Denman, D. R. (1978). *The place of property: A new recognition of the function and form of property rights in land*. Herts: Geographical Pubns. Ltd.
- Donald, J. W., & Davis, C. W. (2009). Carbon dioxide: Harmless, ubiquitous and certainly not a pollutant under a liability policy's absolute pollution exclusion. *Seton Hall Law Review*, 39, 107–128.
- Du, F. M., & Luo, R. (2007). Study on China's economic growth and CO2 emissions. *China Population Resources and Environment*, 17(2), 94–99.
- Ehrmann, H. W. (1976). *Comparative legal cultures*. Englewood Cliffs, NJ: Prentice-Hall.
- Ellerman, A. D., & Buchner, B. K. (2007). The European union emissions trading scheme: Origins, allocation, and early results. *Review Environmental Economics and Policy*, 1(1), 66–87.
- Fahlquist, J. N. (2009). Moral responsibility for environmental problems—individual or institutional? *Journal of Agricultural and Environmental Ethics*, 22(2), 109–124.
- Findley, R. W., & Farber, D. A. (1999). *Cases and materials on environmental law* (5th ed.). St. Paul: West Group.
- Fitzmaurice, M. (1999). The right of the child to a clean environment. *Southern Illinois University Law Journal*, 23, 1–56.
- Friedman, A. (1971). The economics of the common pool: Property rights in exhaustible resources. *University of California Los Angeles Law Review*, 18, 855–877.
- Gaast, Wvd., Begg, K., & Flamos, A. (2009). Promoting sustainable energy technology transfers to developing countries through the CDM. *Applied Energy*, 86(2), 230–236.
- Gao, J. (2000). *European environment law*. Beijing: Gong Shang Publisher.
- Gao, G. (2007). Carbon emission right allocation under climate change. *Advances in Climate Change Research*, 3, 87–91.
- Garner, B. A. (2004). Black's law dictionary. In B. A. Garner (Ed.), *Black's law dictionary*. St Paul: Thomson business.
- Giorgetta, S. (2002). The right to a healthy environment, human rights and sustainable development. *International Environmental Agreements: Politics, Law and Economics*, 2(2), 173–194.

- Golden, D. (1999). The politics of carbon dioxide emissions reduction: The role of pluralism in shaping the climate change technology initiative. *UCLA Journal of Environmental Law and Policy*, 17, 171–206.
- Grubb, M., Laing, T., Counsell, T., & Willan, C. (2011). Global carbon mechanisms: Lessons and implications. *Climatic Change*, 104, 539–573.
- Handl, G. (1995). Human rights and protection of the environment: A mildly revisionist view. In IIDH-BID (Ed.), *Human rights, sustainable development and environment* (2nd ed., pp. 117–142).
- Hardee, K., & Mutunga, C. (2010). Strengthening the link between climate change adaptation and national development plans: Lessons from the case of population in national adaptation programmes of action (NAPAs). *Mitigation and Adaptation Strategies for Global Change*, 15(2), 113–126.
- Hepburn, S. J. (2001). *Principles of property law* (2nd ed.). Sydney, NSW: Cavendish.
- Hepburn, S. (2009). Carbon rights as new property: The benefits of statutory verification. *Sydney Law Review*, 31, 239–272.
- Hepple, R. P. (2005). Human health and ecological effects of carbon dioxide exposure. In D. C. Thomas (Ed.), *Carbon dioxide capture for storage in deep geologic formations* (Vol. 2, pp. 1143–1172). Amsterdam: Elsevier.
- Hudson, A. (2004). The unbearable lightness of property. In A. Hudson (Ed.), *New perspectives on Property Law, obligations and restitution* (p. 118). London: Cavendish.
- Ibarraran, M. E., & Boyd, R. (2006). *Energy, economics, and the environment in 21st century Mexico*. Dordrecht: Springer.
- IEA. (2010). *World energy outlook 2010*. Paris: International Energy Agency.
- IPCC. (2007). Climate change 2007: Mitigation. Contribution of working group III to the fourth assessment report of the intergovernmental panel on climate change. In B. Metz, O. R. Davidson, P. R. Bosch, R. Dave, & L. A. Meyer (Eds.), Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Joskow, P. L., Schmalensee, R., & Bailey, E. M. (1998). The market for sulfur dioxide emissions. *The American Economic Review*, 88(4), 669–685.
- Klepper, G., & Peterson, S. M. (2005). Emissions trading, CDM, JI, and more—the climate strategy of the EU. *Kiel Working Paper 1238*.
- Krygier, M. (1986). Law as tradition. *Law and Philosophy*, 5(2), 237–262.
- Lv, Z. (2000). Rethinking citizens' right to environment. *Chinese Journal of Law*, 6, 129–139.
- MacKenzie, D. (2009). Making things the same: Gases, emission rights and the politics of carbon markets. *Accounting, Organizations and Society*, 34, 440–455.
- Mannea, A., & Richels, R. (2004). US rejection of the kyoto protocol: The impact on compliance costs and CO2 emissions. *Energy Policy*, 32, 447–454.
- McConnell, M. W. (1988). Contract rights and property rights: A case study in the relationship between individual liberties and constitutional structure. *California Law Review*, 76(2), 267–295.
- Merges, R. P., Menell, P. S., & Lemley, M. A. (2000). *Intellectual property in the new technological age* (2nd ed.). Gaithersburg: Aspen Law & Business.
- Miller, C. (1998). *Environmental rights: Critical perspectives*. London, UK: Routledge.
- Munn, T. (Ed.). (2002). *Encyclopedia of global environmental change (the earth system: Biological and ecological dimensions of global environmental change)*. West Sussex, UK: Wiley.
- Neuhoff, K., & Vasa, A. (2010). The role of CDM post-2012. Paper presented at the DIW Berlin Carbon Pricing and Investment Response Roundtable, February 5, Berlin.
- Palmer, C. (2011). Property rights and liability for deforestation under REDD+: Implications for 'permanence' in policy design. *Ecological Economics*, 70(4), 571–576.
- Patterson, L. R., & Lindberg, S. W. (1991). *The nature of copyright: A law of users' rights*. Athens: University of Georgia Press.
- Pei, Q., Jiang, D., & Zhang, M. (2009a). A study of contract legal issues in Chinese carbon market. *Ecological Economy*, 5, 314–322.
- Pei, Q., Jiang, D., & Zhang, M. (2009b). A study of legal attributes of carbon emission rights in carbon trading. *Ecological Economy*, 5(1), 11–19.
- Pei, Q., & Wang, C. (2008). Introduction and analyst is on programmatic CDM. *Environmental Science and Management*, 33(12), 65–74.
- Quinn, E. L. (2009). Comment, the solitary attempt: International trade law and the insulation of domestic greenhouse gas trading schemes from foreign emissions credit markets. *University of Colorado Law Review*, 80(1), 201–254.
- Ramu, S. S. (1997). *International licensing: Managing intangible resources*. New Delhi: Sage Publications.
- Roberts, J. T., & Grimes, P. E. (1997). Carbon intensity and economic development 1962–1991: A brief exploration of the environmental Kuznets curve. *World Development*, 25(2), 191–198.
- Rodgers, W. H. (1994). *Environmental law* (2nd ed.). St. Paul: West Pub. Co.

- Rose, C. M. (1999). Expanding the choices for the global commons: Comparing newfangled tradable allowance schemes to old-fashioned common property regimes. *Duke Environmental Law and Policy Forum*, 10(45), 45–72.
- Schneider, L. (2009). A clean development mechanism with global atmospheric benefits for a post-2012 climate regime. *International Environmental Agreements: Politics, Law and Economics*, 9(2), 95–111.
- Schottenstein, N. M. (2009). Process and product: Kremen V. Cohen and the consequences of recognizing property rights in domain names. *Virginia Journal of Law and Technology*, 14(1), 1–25.
- Serkin, C. (2007). Local Property Law: Adjusting the scale of property protection. *Columbia Law Review*, 107(4), 883–948.
- Streck, C., & Zhang, X. (2005). Implementation of the clean development mechanism in china: Sustainable development, benefit sharing, and ownership of certified emission reduction. *Yearbook of International Environmental Law*, 16, 259–284.
- Stripple, J., & Falaleeva, M. (2008). *CDM post-2012: Practices, possibilities, politics*. Palaestra: Lund University.
- Sun, X. (2006). *Arguments and analysis: The notes of legislating Property Law*. Beijing: Renmin University Press.
- Tietenberg, T. H. (2003). *Environmental and natural resource economics* (6th ed.). Boston: Addison Wesley.
- Trindade, A. A. C. (1991). The parallel evolutions of international human rights protection and environmental protection and the absence of restrictions upon the exercise of recognized human rights. *The Inter-American Institute of Human Rights Magazine*, 13, 35–76.
- Tung, C. (2009). Carbon law and practice in China. In D. Freestone & C. Streck (Eds.), *Legal aspects of carbon trading: Kyoto, Copenhagen, and beyond*. Oxford, NY: Oxford University Press.
- Victor, D. G. (2007). Fragmented carbon markets and reluctant nations: Implications for the design of effective architectures. In J. E. Aldy & R. N. Stavins (Eds.), *Architectures for agreement: Addressing global climate change in the post-kyoto world* (pp. 133–144). Cambridge, UK: Cambridge University Press.
- Wang, L. (2000). *Civil law*. Beijing: Renming University Press.
- Wang, L. (2007). *Study on real rights law* (2nd ed.). Beijing: Renming University Press.
- Wang, L. (2008). *Study on the system of civil code*. Beijing: Renming University Press.
- Weber, S. (1991). Environmental information and the European convention on human rights. *Human Rights Law Journal*, 12(5), 177–185.
- Wellman, C. (1995). *Real right*. New York, USA: Oxford University Press.
- Woerdman, E. (2005). Tradable emission rights. In J. G. Backhaus (Ed.), *Elgar companion to law and economics* (pp. 364–380). Cheltenham: Edward Elgar.
- Worthington, S. (2007). The disappearing divide between property and obligation: The impact of aligning legal analysis and commercial expectation. *Texas International Law Journal*, 42(3), 917–939.
- Wu, H., & Hu, K. (2005). *Study on the system of intangible property rights*. Beijing: China Law Publisher House.
- Xu, B. (2003). *English-Chinese dictionary of anglo-American law*. Beijing: Chinese Law Publishing House.
- Yandle, B. (1999). Grasping for the heavens: 3-D property rights and the global commons. *Duke Environmental Law and Policy Forum*, 10(13), 13–44.
- Yang, M., Nguyen, F., Serclaes, P. D. T., & Buchner, B. (2010). Wind farm investment risks under uncertain CDM benefit in China. *Energy Policy*, 38(3), 1436–1447.
- Zhao, L. (2005). *The concept of property right: From the contract perspective*. Beijing: Intellectual Property Publishing House.