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Towards Improving Clean Development Mechanism (CDM) Wind Power Projects in China

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Author's declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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ABSTRACT OF THESIS submitted by:

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As one type of renewable energy resources, wind power would be an optimal alternative energy as for mitigating climate change and solving energy security. Currently, wind power should be deemed as a mature technology that would be viable and competitive with conventional energy technologies, especially at windy sites. Considering the large landmass and long coastline, China is a big country with abundant exploitable wind resources.

The Clean Development Mechanism (CDM) plays an important role in promoting wind power in China in the context of financial and technology transfer via carbon-offset projects. Following hydro power projects, CDM wind power projects take up the second largest market in China. However, in 2009 a controversy of wind power projects happened between the Chinese government and United Nations Framework Convention on Climate Change (UNFCCC). The controversy was ascribed to a wind power benchmark feed-in-tariff issued by the Chinese government in July 2009. As a result, UNFCCC suspended the registration of several Chinese CDM wind power projects based on suspicion that wind power subsidies in China were deliberately cut to make them eligible for the CDM's additionality requirement.

This thesis focuses on identifying detailed institutional and structural barriers of CDM additionality assessment that resulted in the wind power controversy in 2009, as well as analyzing interactions between the global carbon-offset policy and feed-in-tariff for wind sector.

Afterwards, this thesis will address institutional strengths and reform opportunities for improving CDM wind power projects in China. For instance, increasing work efficiency of Executive Board (EB), establishing appeal procedures for CDM project activities and sectoral crediting etc. Besides, long-term structural amendments of additionality assessment and feed-in-tariff policy guidance recommendations will be included as well.

Keywords: <additionality, clean development mechanism, feed-in-tariff, renewable energy, wind power>

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

ABBREVIATION LIST

BAU	Business As Usual
CDM	Clean Development Mechanism
CER(s)	Certified Emission Reduction(s)
COP	Conference of the Parties (to UNFCCC)
COP15	COP at its 15th Meeting
DNA(s)	Designated National Authority(-ies)
DOE(s)	Designated Operational Entity(-ies)
EB	Executive Board
EB28	Executive Board of the CDM 28th Meeting
GHG(s)	Green House Gas(es)
IRR(s)	Internal Return Rate(s)
IPP	Independent Power Producer
KP	Kyoto Protocol
MOP	Meeting of the Parties (to KP)
NDRC	National Development and Reform Commission of China
PDD(s)	Project Design Document(s)
POA	Programme of Activities
PP(s)	Project Participant(s)
SCDM	Sectoral crediting CDM
SOE(s)	State Owned Enterprise(s)
SPC	State Power Company
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

CHAPTER 1 – INTRODUCTION

The global climate change has been becoming increasingly evident nowadays(Jane and Sami 2007). Serious consequences have been observed around the world, such as more frequent occurrences of flooding, heat wave, hurricanes, forests fired and drought, as well as sea level rising, wide spread famines(Schroeder 2009). Global warming is ascribed to an excess of green houses gases (GHGs) around the earth(Heltberg *et al.* 2009). The foremost GHG is carbon dioxide due to anthropogenic burning of fossil fuel. The United Nations Framework Convention on Climate Change (UNFCCC) was constituted as a major global response to the climate change in 1992, which was hoped to stabilise green house gas concentrations in the atmosphere. Afterwards, in 1997 Kyoto Protocol (KP) was complemented for UNFCCC, comprising 184 parties that have committed to reducing GHG emissions by about five percent by 2010 against 1990 levels during the first commission period (2008-2012)(Tompkins and Amundsen 2008).

The Kyoto Protocol actually came into force on 16th February 2005 and now is on full operation. The industrialized countries (defined as 37 Annex I countries in KP) have the foremost responsibilities of mitigating climate change. There are six main GHGs defined in KP: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluoracarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6)(Anger 2008). The KP also allows Annex I countries to meet their emission reduction commitments through three flexible mechanisms: 1) Joint implementation (JI) among Annex I countries; 2) the Clean Development

Mechanism for Annex I countries to earn emission credits via investing carbon offset projects in non-Annex I countries; 3) carbon trading among Annex I countries(Jane and Sami 2007).

As a mitigation to climate change, the Clean Development Mechanism (CDM) was stipulated by Article12 of KP (1992) aiming at: 1) helping industrialized countries (Annex I countries) meet their GHGs reduction targets; 2) assisting developing countries in promoting environmentally friendly investment from industrialized countries (Jane and Sami 2007). The detailed modalities and procedures for the implementation of the KP were established at Conference of the Parties (COP) 7 in Marrakesh in 2001, which is called "Marrakesh Accords". The CDM scheme allows Annex I countries to invest projects that reduce GHGs or can remove GHGs by carbon sequestration in the territories of non-Annex I countries(Nussbaumer 2009). Those invested projects can afterwards generate Certified Emission Reductions (CERs) that can then be announced by the Annex I countries to help them meet their reduction allocations(Gao *et al.* 2007). There are also unilateral CDM projects that can be initiated by non-Annex I countries alone, in which case non-Annex I countries need to find buyers for CERs of unilateral CDM projects(Wong *et al.* 2009).

The Executive Board (EB) is the major supervisor at UNFCCC for CDM, which operates under authority of the Conference of Parties (COP) that are signatories to the KP Convention. Independent organizations known as Designated Operational Entities (DOEs) are accredited by EB. DOEs take the responsibilities of validating proposed CDM projects, verifying resulted emission reductions, then certify the CERs (see CDM project cycle in Chapter 2.3.2). Designated

National Authority (DNA) is the national CDM authorities of countries ratified in the KP. DNAs are in charge of ensuring CDM projects to be valid under their national legal and institutional frameworks in order to meet the national sustainable development targets. DNAs also operate and manage the national emissions inventory and account of the sale and purchase of CERs. There are three main criteria for eligible CDM projects specifically indicated under the KP: 1) voluntary participation by parties; 2) real and measurable emission reductions; 3) emission reductions under CDM should be additional(Boyd *et al.* 2009). Additional requirement is the key criteria of CDM, so the EB has stipulated an additionality assessment tool for CDM project participants (see Fig. 2.3 in Chapter 2.3.2)

Economists estimated that emission reductions via CDM market could achieve 200–250 MtCO2e (million tonnes carbon dioxide equivalent) per year during the commitment period (2008–2012)(Wong *et al.* 2009). CDM projects can generate certified emission reductions (CERs) by the investors, which are tradable credits in the carbon market known as carbon financing. Because of the financial attractiveness of carbon market, after several years' capacity building programme since 2002, CDM reached 1915 projects registered in CDM pipelines[1] on 1st/December/2009. Among those CDM projects in the pipelines, China alone has accounted for 192 million carbon credits (one carbon credit is one tonne carbon dioxide equivalent), which worth more than $1bilion. Chinese CDM takes up almost one third of the total issued projects

1 CDM pipeline is managed by United Nations Environment Programme (UNEP), Risoe Laboratory. The CDM pipeline is an Excel Data sheet containing all CDM project activities such as registration, reviewing, monitoring etc.

(673 projects)[2]. In fact, Chinese economic development highly relies on fossil fuel consumptions, comprising 67.1% of energy supply from coal, 22.7% from oil by 2005(Helten 2005). Due to the benefits of CDM, hydro and wind power have been deemed as the most optimal alternatives for conventional energy in China(Wu *et al.* 2008).

China is a big country with large landmass and long coastline(Helten 2005). The China Meteorology Research Institute has estimated that China has abundant exploitable wind resources, which represents total wind generation capacity of 253 giga-watts (GW) for land-based and 750 GW for ocean-based(Helten 2005). Following CDM hydro power projects, wind power projects take up the second largest market in China (838 hydro power projects and 410 wind power projects according to UNEP CDM pipelines in December 2009). However, in the end of 2009 an interruption of Chinese wind CDM registrations (called the wind tariff controversy[3]) at UNFCCC has exposed cracks at the core of how to verify credible and realistic carbon credits in non-Annex I countries. The controversy of wind power projects between the Chinese government and UNFCCC was ascribed to the wind power benchmark feed-in-tariff issued by the Chinese government in July 2009. The UNFCCC suspended the validation of Chinese CDM wind power projects based on suspicion that wind power subsidies were deliberately cut to make them eligible for the CDM additionality[4] requirement. As a result,

2 UNEP CDM pipeline is available online. URL: http://www.cd4cdm.org/CDMJIpipeline.htm

3 Detailed information is available in Chapter 3

4 Additionality is used to verify credible emission reductions that would not have happened otherwise compared to business as usual (detailed information is available in chapter 2.3.2)

dozens of Chinese wind CDM projects lost their chances to obtain the international carbon financing and became commercially unable to operate.

1.1 Importance of the study

With the largest population, China consumes about 10% of the world's energy(Helten 2005). In addition, China is likely to increase its energy demand with an economy growing rate at 9% annually(Helten 2005). Moreover, according to the renewable energy development plan of Chinese government, after 2020, wind power should achieve the commercialization stage, and by 2030, its total capacity should reach 150–200 GW(Han *et al.* 2009). The global carbon financing can play a crucial role in promoting wind power in terms of financial and technology transfer(Dechezlepretre *et al.* 2009). Promoting wind power development via CDM is a significant approach for climate change mitigation and energy security solution in China. Given the abundant wind resources in China, the CDM implementation gap in wind sector should be immediately resolved so that Chinese wind power can resume its booming development(Van der Gaast *et al.* 2009).

Furthermore, as a major cause of the Chinese wind tariff controversy, the feed-in-tariff is a popular policy for renewable energy around the world(Verbruggen and Lauber 2009). The challenges of Chinese wind CDM registration would be relevant in other non-Annex I countries, as long as there are feed-in-tariffs. If the structural flaws of applying CDM in China are not highlighted, the fissure of implementing wind CDM will undermine the long-term mitigation strategies for climate change in other non-Annex I countries.

It is important to identify barriers from various perspectives of implementing wind CDM in China and to draw out broader implications with regard to how other non-Annex I countries constitute their domestic energy policies under CDM's framework. Thus, opportunities of reforming CDM implementation can be found for more efficient CDM approval and the integrity of global carbon markets.

1.2 Aim and objectives

1.2.1 Aim

The present study aims to identify implementation gap of Chinese wind power projects under the CDM scheme, in the context of increasing wind project portfolio globally, and analyze interactions between the global carbon offset policy and feed-in-tariff for wind sector, as well as seek opportunities to increase the CDM registrations in wind power sector in China and where the lessons can be applied in other non-Annex I countries.

1.2.2 Objectives

This thesis comprises two major objectives. The first objective is to address the Chinese wind tariff controversy in 2009, and to identify detailed institutional as well as structural barriers of additionality assessment that resulted in suspensions of registering Chinese wind CDM projects at UNFCCC.

The second objective of this thesis is to focus on addressing institutional strengths and reform opportunities for improving wind CDM projects in China. Besides, long-term structural amendments of additionality assessment and feed-in-tariff policy guidance recommendations will be included in this part as well, which is applicable in other non-Annex I countries and relevant renewable energy sectors.

The overall objective of this thesis is to specify lessons learned from the Chinese wind controversy under CDM scheme from institutional and structural perspective, so that more wind CDM projects can be developed as for mitigating climate change and ensuring energy security.

1.3 Methodology

1.3.1 Methodology of the study

This thesis relies greatly on experience and lessons that are drawn and summarized on the basis of previous registrations of CDM projects until 2009, especially in wind sector (see Chapter 4.1).

Apart from empirical analysis of previous CDM projects, literature review and desk study compose major parts of the methodology in addressing the targeted aim and objectives. In addition, experts' insights and communications play important roles in developing this research on some of the key findings.

1.3.2 Scope of the study

CDM has a complicated project cycle such as domestic approval, validation at national authority, registration at UNFCCC, monitoring, verification and certification etc (detailed information is available in Chapter 2.3.2). Moreover, there are several barriers as for demonstrating CDM's additionality such as financial additionality, technical additionality, environmental additionality etc.(Ringius *et al.* 2002). However, the Chinese wind tariff controversy in 2009 happened at project registration stages at UNFCCC and was mainly ascribed to the financial additionality argument of the feed-in-tariff.

Even though CDM is a project-based scheme, the feed-in-tariff of wind power by its nature has to follow a top-down policy framework. As one type of renewable energy, wind power can mitigate GHG emissions either through reducing new instalment capacity of conventional power (capacity margin) or through reducing operational capacity of conventional power (operation margin)(Painuly *et al.* 2005). Thus, wind power additionality assessment should be analyzed at a wholly structural level, and then comes to specific project types, e.g. centralized wind farms, localized wind mills, offshore wind farms etc. The emission baselines are different under various wind project types in terms of their alternative functions for electricity generation(Boccard 2009). Moreover, barriers of operating new wind projects are not identical for each type(Schroeder 2009), so it is imperative that the scope of the study is defined.

The thesis study will be based on validation and registration stages at UNFCCC and financial barriers of additionality assessment of wind CDM. Because only wind power projects connected to the state grid can benefit from the feed-in-tariff, this study will focus on how to register CDM wind projects that are connected to the state grid. Furthermore, it should be noted that several institutional barriers of DNA causing the wind tariff controversy are merely specific in China. Thus, without minor adjustment, lessons learned from some DNA institutional barriers are not applicable to other non-Annex I countries. By contrast, additionality assessment is widely compulsory for all project participants, lessons learned from structural barriers of additionality assessment are applicable to various countries' CDM registrations and other renewable energy types, e.g. hydro power, solar power etc.

1.3.3 Limitations

This thesis focuses on finding resolutions and potential opportunities to the Chinese wind tariff controversy, which means some of the finding, can not address project-level specifics. Although the thesis attempts to strengthen approvals of wind CDM projects, specific Chinese wind CDM projects that failed to register due to other reasons (e.g. inconsistent technical parameter, wrong calculation methodologies for emission reductions) are not covered.

Moreover, because CDM is a regulatory framework driven scheme(Boyd *et al.* 2009), much of the thesis study will be regulations and policies focused. A key limitation for this thesis is that comprehensive resolutions involve with institutional reforms, policy amendments etc, so those resolutions require long-term political discussions before they come into force. Considering the financial risks of wind power investments due to the suspended carbon financing, this thesis might not be of practical importance for wind project participants as they intend to register their projects as soon as possible.

1.4 Structure of this thesis

The thesis consists of five chapters as following:

Chapter 1 has introduced the background of climate change and CDM scheme, as well as highlighting the importance of promoting CDM wind power in China. Chapter 2 will provide background of wind power development in previous years, which outlines how the feed-in-tariff came into practice. CDM framework, institutions involved in CDM and CDM project cycles have also been included in Chapter 2. Deep understanding of the CDM facts is essential for all project participants, since they have to follow the CDM regulations in order to register their CDM projects at UNFCCC. Then, relevant information involved in registering Chinese wind CDM have been provided, such as the Internal Return Rate (IRR) and E+/E- policy guidance.

Chapter 3 will concentrate on addressing barriers leading to the wind tariff controversy in China based on background information provided in literature review in Chapter 2. This Chapter will identify the reasons for the suspensions of Chinese wind CDM projects in 2009 in terms of the institutional and structural barriers demonstrating the CDM additionality.

Based on barriers identified in Chapter 3, Chapter 4 will propose resolutions for helping project participants register their wind CDM projects from institutional, structural and policy perspectives.

Chapter 5 will conclude the barriers and opportunities of registering CDM wind projects identified in previous chapters, and come to appropriate implications for improving CDM wind power projects in China.

CHAPTER 2 - LITERATURE REVIEW

In order to achieve the aim and objectives of this thesis research, a thorough literature review has been undertaken. For outlining the significance of wind power as renewable energy to mitigating climate change, emphasis has been put on: studying previous incentives of wind energy; introduction to Clean Development Mechanism (CDM) regulatory framework; assessing CDM's influences on wind power; key issues involved in promoting wind power under CDM.

2.1 Climate change and wind power

Climate change has become a core topic among scientific and political scholars over the last decades. The concentrations of so called Green House Gases (GHGs) in the atmosphere have been rapidly increasing after the industrial revolution - 1900s(Catelin 2008). The main cause for the excessive GHGs is the anthropogenic burning of fossil fuels. Because of retaining heat around the earth, carbon dioxide (CO_2) is believed to result in growth of average temperature, leading to climate change(Gupta 2009).

As for substituting burning of tradition fossil fuels, renewable energy has become the best potential for mitigating GHGs emissions and energy security concerns(Akella *et al.* 2009). Generally, renewable energy is defined as being able to replenish from natural resources such as hydraulic power, wind, sunlight, tides, geothermal heat etc(Andersen *et al.* 2009). Among these natural resources, nowadays wind power takes up the second largest renewable energy market around the world (following hydropower)(Bolinger and Wiser 2009). Currently, wind power is deemed as a mature technology, which is viable and competitive with conventional energy technologies, particularly at windy sites(Ringius *et al.* 2002). By the end of 2009, total world wind generation capacity exceeded 150,000 Megawatts(Martinot *et al.* 2002). According to Blueprints for Wind Power Development – Wind Force 10 and Wind Force 12, which is published by Greenpeace and European Wind Energy Association (EWEA) in 1999 and 2002, 10% and 12% of the world's electricity would be generated by wind power respectively(Painuly *et al.* 2005). The development of wind power around the world is not evenly dispersive, because approximately 80% of the total wind power is generated in only five countries: Germany, Spain, USA, Denmark and India(Painuly *et al.* 2005). Usually, development of wind farms is under a couple of constrains, such as: 1) national and regional development strategies and policies; 2) land suitability, wind speed, access and transportation infrastructure; 3) present and future situation of power system, stand-alone system or grid-connected; 4) wind turbine technologies, sizes; 5) financing viability, the electricity market; 6) environmental impacts, visual impact, noise and the risk of bird-collisions(Blanco and Rodrigues 2008).

2.2 Previous incentives of wind energy

It could be tracked back to the early 1970s that many development assistance projects had been launched to stimulate small-scale renewable-energy technologies like wind turbines in developing countries(Barthelmie *et al.* 2008). Much of the stimuli of wind energy were concentrated on technical transfer possibilities or on independent projects that were barely self-sustaining and could not be applied widely(Martinot *et al.* 2002). As the focus had been on initiative installations, in developing countries those wind power pilot projects did not take institutional and commercial viability into account(Martinot *et al.* 2002). Thus, many such projects failed because of rather poor technical performance and bad suitability to indigenous situation(Martinot *et al.*

2002). Moreover, due to lack of involvement of relevant stakeholders, lack of sustainable credit and expertise and lack of incentive structures and lack of mechanisms for turbines maintenance, lots of initiated wind power projects could not sustain their prime operating performance(Da and Aldo 2009). The major concern was that public sectors in developing countries rarely showed a high interest in promoting commercial dissemination as a result of their heavy dependence on donor-aid stimuli for developing wind power(Benitez *et al.* 2008).

Until the end of the 1980s, several large-scale grid-connected wind power initiatives by developing countries were started, for instance, in India(Martinot *et al.* 2002). Also a number of success projects began with donor assistance from industrialised countries in the 1980s, and they became growing private sector-led markets gradually afterwards(Martinot *et al.* 2002). Nevertheless, Martinot et al. (2002) found that many of the projects during this period were still not successful, often because many scholars in the research of Martinot et al (2002). had argued that factors of sustainability and replication possibilities were still missing. Some of the reasons were following: even though original installations of wind turbine could meet those relevant technical guidelines and local legislative requirements, sale contracts of electricity generated by wind power were instable and not long term due to the fierce price competition with conventional fossil fuels(Martinot *et al.* 2002). Therefore, the local operating companies could not afford loan arrangements for equipment maintenance, which resulted in low repayment rates and lack of credits for projects' replication(Martinot *et al.* 2002).

A new political era started in the 1990s, as the UN Conference on Environment and Development (called the Rio Earth Summit) accompanied by establishment of the UN Framework on Climate Change have introduced new forms of multilateral assistance for wind energy(Tompkins and Amundsen 2008). Those multilateral collaborations aim to promote sustainable technology diffusion and market growths in developing countries through eliminating key barriers involved with skills, financing, institutional structures and business models(Liverman 2009). Wind power projects thus transferred from their emerging stages into self-learned and self-evolved approaches(Martinot *et al.* 2002). This is because those bilateral donors under UN Framework on Climate Change have focused more on market-oriented approaches with regard to local demand and consumers' needs. The donors assisted enterprise development for sustained services, and established market mechanisms independent of continuous donors, instead of the simple equipment provision(Martinot *et al.* 2002). An industrial chain for installation, distribution, and maintenance of wind power has begun to thrive. Local governments in developing countries (e.g. India, China, Brazil etc) have also implemented some wind technology promotion policies. For instance, national research grants for Research and Development teams of local wind turbines manufacturing; subsidies for purchase of locally produced wind power equipments; tax exemptions for renewable energy; low interest loans for wind power installations; subsidized electricity tariff for wind power etc.(Zhang 2006)

Furthermore, Feed-in-Tariff has become the most successful experience for renewable energy around the world. Three key provisions have been outlined in Feed-in-Tariff: "*1) guaranteed access to electricity-grid; 2) long-term concession contracts for electricity generation; 3) purchase prices to electric grid* *utilities are methodologically based on the cost of renewable energy generation*"(Mendonca 2007) (page 17). Donor projects seem to be more valuable, because they help developing countries familiarize with wind technologies and demonstrate market viability(Martinot *et al.* 2002). One obvious drawback is donor-subsidized wind turbines created perceptions among electricity utilities that wind energy was not commercial and required further donor aid(Mendonca 2007). At the early development stage, higher wind power purchase prices could be attributed to lack of commercial competition, but situation has changed since the introduction of feed-in-tariff(Mendonca 2007). It should be concluded that feed-in-tariff plays an important role in promoting renewable energy and it is a popular energy policy around the world currently(Martinot *et al.* 2002).

2.3 Introduction to CDM regulatory framework

As a mitigation to climate change, the Clean Development Mechanism (CDM) was stipulated by Article12 of Kyoto Protocol (1992) aiming at: 1) helping industrialized countries (Annex I countries) meet their greenhouse gas (GHGs) reduction targets; 2) assisting developing countries in promoting environmentally friendly investment from industrialized countries (Liang 2007).

2.3.1 CDM regulatory framework

There are five roles involved in the CDM regulatory framework: The Conference of Parties served as the Meeting of the Parties (COP/MOP) to UNFCCC; Designated National Authority (DNA); the CDM Executive Board (EB) and its panels and working groups; Designated Operational Entity (DOE); Project Participants (PPs). Table 2.1 demonstrates the specific roles of the five stakeholders mentioned above.

Table 2. 1 Stakeholders involved in CDM and their detailed responsibilities

COP/MOP	*The COP/MOP shall provide guidance to the Executive Board by taking decisions on:* *(a) The recommendations made by the Executive Board on its rules of procedure;* *(b) The recommendations made by the Executive Board, in accordance with provisions of decision 17/CP.7, the present annex and relevant decisions of the COP/MOP;* *(c) The designation of operational entities accredited by the Executive Board.* *The COP/MOP shall further:* *(a) Review annual reports of the Executive Board;* *(b) Review the regional and sub-regional distribution of designated operational entities and take appropriate decisions to promote accreditation of such entities from developing country Parties;* *(c) Review the regional and sub-regional distribution of CDM project activities with a view to identifying systematic or systemic barriers to their equitable distribution and take appropriate decisions, based, inter alia, on a report by the Executive Board;* *(d) Assist in arranging funding of CDM project activities, as necessary.*
DNA	*The DNA is the national focal point in charge of CDM matters under a Kyoto Protocal party's central government and in order to participate in the CDM parties must set up a DNA. The role and function of DNA is to grant written approval (Letter of Approcal, LoA) of voluntary participation for the project participant involved in the project activities*
EB	*The CDM EB is the international regulatory body, under the COP/MOP, that supervises the daily operation of the CDM, the CDM EB shall:* *(a) Make recommendations to the COP/MOP on further modalities and procedures for the CDM, as appropriate;* *(b)Review provisions with regard to simplified modalities, procedures and the definitions of small-scale project activities and make recommendations to the COP/MO;* *(c) Be responsible for the accreditation of operational entities and make recommendations to the COP/MOP for the designation of operational;* *entities, responsibilities include decisions on re-accreditation, suspension and withdrawal of accreditation;* *(d) Report to the COP/MOP on the regional and sub-regional distribution of CDM project activities with a view to identifying systematic or systemic barriers to their equitable distribution;* *(e) Make any technical reports commissioned available to the public and provide a period of at least eight weeks for public comments on draft methodologies and guidance before documents are finalized and any recommendations are submitted to the COP/MOP for their consideration;* *(f) Address issues relating to observance of modalities and procedures for the CDM by project participants and/or operational entities, and report on them to the COP/MOP.* *The Meth Panel (MP) is under the supervision of EB and is responsible for making recommendations to the EB as to baseline and monitoring methodologies, both proposed and approved, as well as revisions to project design documents (PDDs).)* *Small Scale CDM Working Group (SSC WG): The SSC WG is in charge of making recommendations to the CDM EB as to baseline and monitoring methodologies for SSC activities.*
DOE	*DOEs are the organizations accredited by the CDM EB and formally designated by the*

	COP/MOP, which is either a legal entity with key functions in validating and subsequently requesting for registration of a proposed CDM project activity as well as verifying the emission reductions of a registered project activity and certifying such ERs and requesting the CDM EB to issue them accordingly.
PPs	*The Project Participants submit their PDDs to be validated and registered at UNFCCC, so as to acquire Certified Emission Reductions (CERs), which are tradable in the market.*

Source: (Liang 2007) (page 15 - 25)

2.3.2 CDM project cycle

The detailed modalities and procedures of the bilateral climate change policy structures and regulations of CDM were instituted in December 2001, formulated as the Marrakesh Accords(Helten 2005). In order to obtain CERs from wind power projects as results of reductions of GHGs, project participants should get wind power projects approved by the EB. The general CDM project cycle contains:

"*1) development a wind power project idea;*

2) decide whether the project is small-scale or full scale, an wind power project can be eligible as a small-scale project if the installed capacity is less than 15 MW;

3) decide whether it is a unilateral project or choose a project participant in an Annex I country[5]*;*

4) contact the DNA in the country to ask for local eligibility criteria and procedures;

5) start to develop the PDD;

6) choose an approved baseline and monitoring methodology or suggest a new one;

7) invite local stakeholders to make comments on the project;

8) an agreement must be written on how the CERs generated will be split among the PPs;

9) choose a DOE to validate the PDD;

10) the DOE will ask the involved DNA's for approval letters;

11) hopeful no request for project review at request for registration at the EB;

12) project implementation and monitoring;

13) select a DOE to verify and certify the emission reductions;

[5] This was stipulated by Article12 of Kyoto Protocol (1992)

14) issuance of the CERs;

15) PPs trade the CERs on market." (Figure 2.1 below demonstrates the specific project cycle of CDM.)(Helten 2005; Liang 2007) (page 24 - 25)

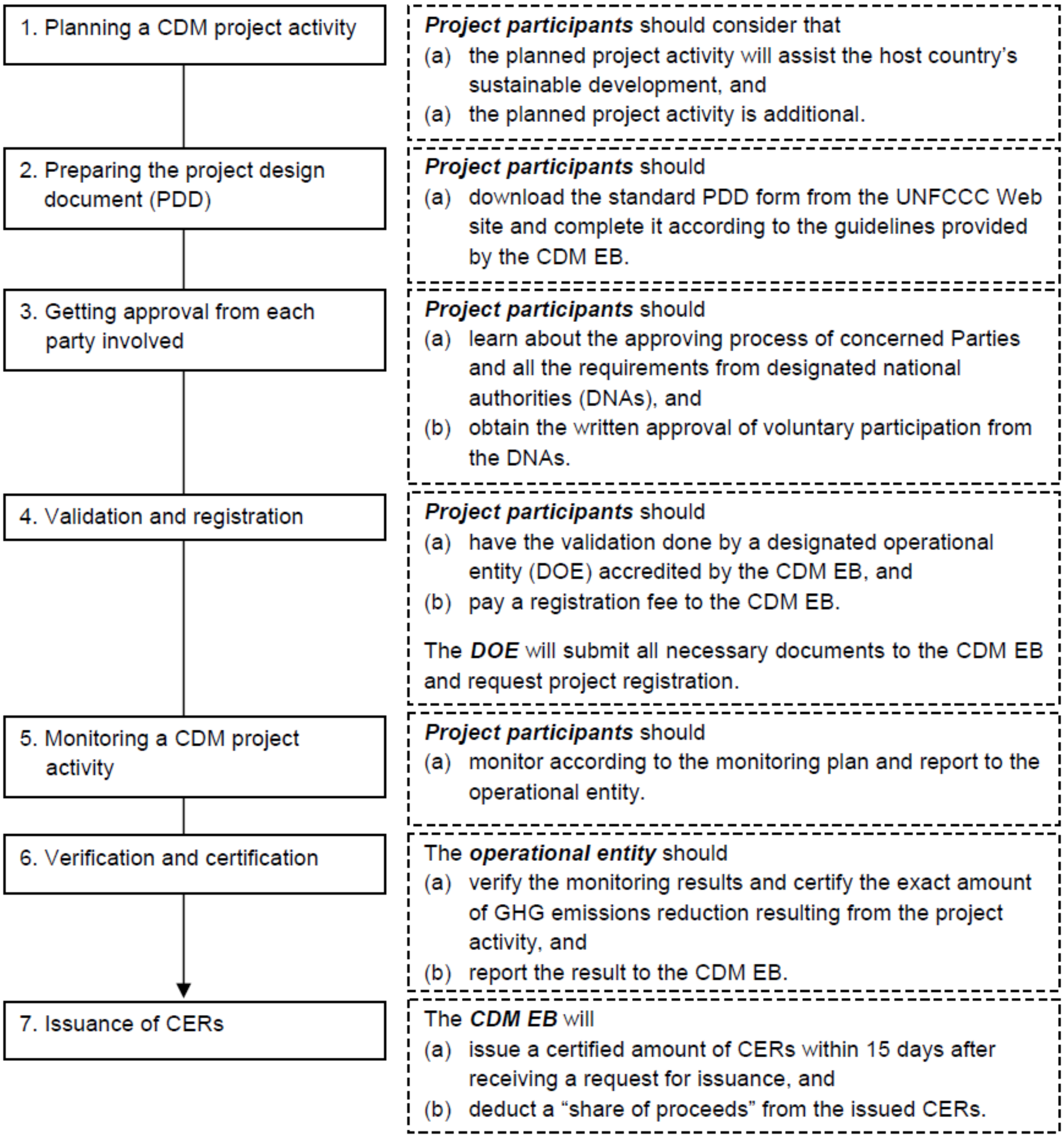

Fig. 2. 1. Typical CDM project cycle

Source: (Helten 2005)

As shown in Table 2.2, about half of the total CDM projects are waiting for validation at EB according to CDM pipeline (by 1st December 2009)[6]. Among those project procedures

[6] UNEP CDM pipeline is available online. URL: http://www.cd4cdm.org/CDMJIpipeline.html

mentioned in proceeding paragraphs, CDM projects' validation and registration at EB (see step 4 in Figure 1) usually are the most crucial steps. In order to get wind CDM projects' validation and registration at EB, project participants must prove that the suggested GHGs reductions are real and measurable, and would not have occurred in absence of the proposed CDM project activity(Painuly *et al.* 2005). This procedure for validation is called "Additionality". In addition, after establishing a "baseline scenario" (this is defined as description with regard to the current level of GHGs is prior to introducing the suggested wind power CDM projects)(Painuly *et al.* 2005), wind power projects must be able to reduce accounted direct emissions within a given boundary during a certain crediting period (either seven years with the option of renewing twice=21 years; or 10 years without the renewal option). (See Fig. 2.2)

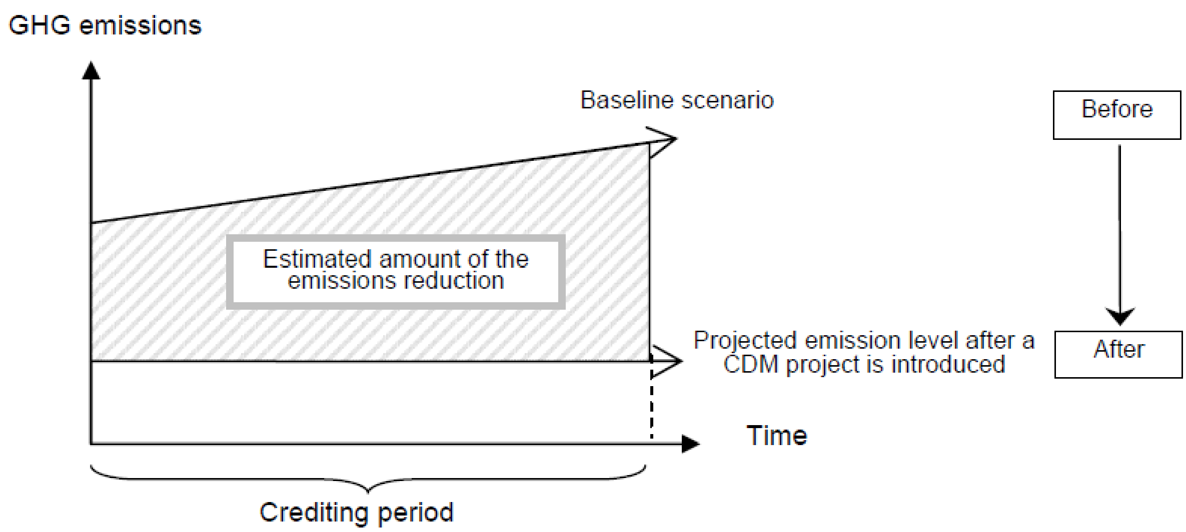

Fig. 2. 2. CDM project baseline and how emission reductions calculated

Source: (Helten 2005)

Table 2. 2 CDM project activities in CDM pipeline by December 2009[7]

Status of CDM projects	Number
At validation	2590
Request for registration	97
Request for review	74
Correction requested	91
Under review	15
Total in the process of registration	277
Withdrawn	43
Rejected by EB	126
Rejected by DOEs	653
Registered, no issuance of CERs	1310
Registered. CER issued	605
Total registered	1915
Total number of projects (incl. rejected & withdrawn)	5604

Additionality assessment is a crucial aspect of CDM, which is the justification of a proposed wind power CDM project according to the baseline scenario without presence of project activity(Schroeder 2009). Methodology tool ACM0002 was implemented at EB 16 (16th EB meeting). There are six major steps to assess project's additionality in the tool ACM0002 (see Fig. 2. 3).

7 The CDM pipeline is available online. URL: http://cdmpipeline.org/

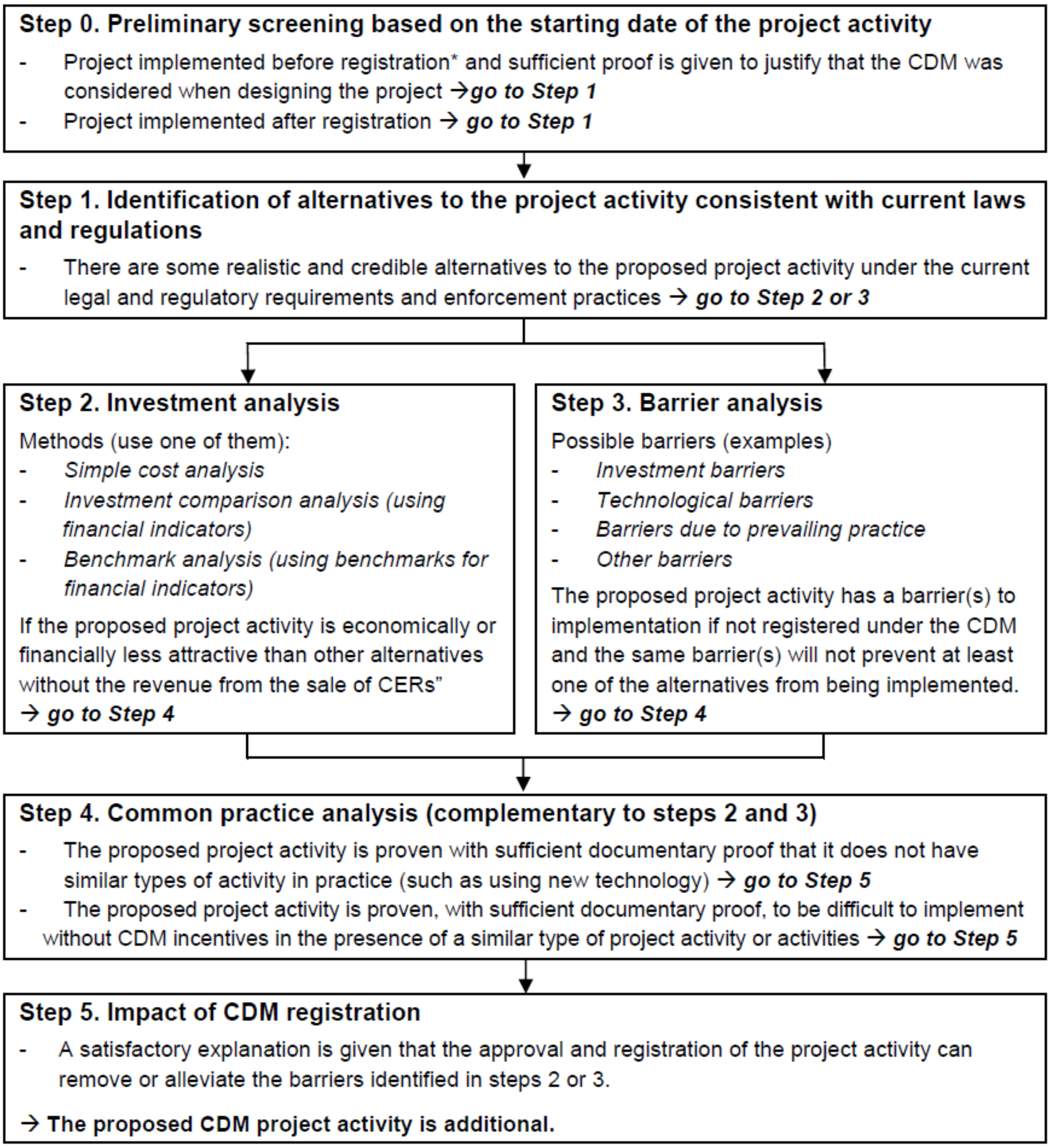

Fig. 2. 3. Project assessment flow chart using the additionality tools ACM0002

Source: (Helten 2005)

2.4 CDM's influences on wind power

CDM has been attracting foreign capital for wind projects and assisting developing countries towards a more prosperous but low carbon-intensive economy(Al-Badi *et al.* 2009). Hundreds of sustainable wind power projects are encouraged and validated involving both private and public sectors' participations(Schroeder 2009). Wind CDM projects are also hoped to introduce local environmental side benefits and poverty alleviation through income and potential employment(Bhattacharya and Jana 2009). Diffusion of wind power relies on a tool of technology transfer among bilateral collaborations under CDM scheme as well (Annex I Parties and non-annex I parties referred to Kyoto Protocol in 1997). Fig. 2.4 shows the soaring trend of wind energy development from 1983 to 2004, particularly after 2000. At the early stage of CDM, wind power installation capacity in developing countries was only 5837 MW(Painuly *et al.* 2005), however, the capacity applied under CDM scheme alone increased seven fold in 2009 due to a mature CDM markets (see Table 2.3). It is worth mentioning that not all the wind power projects in developing countries were established through CDM, so the rise of wind power installations should be higher than seven fold.

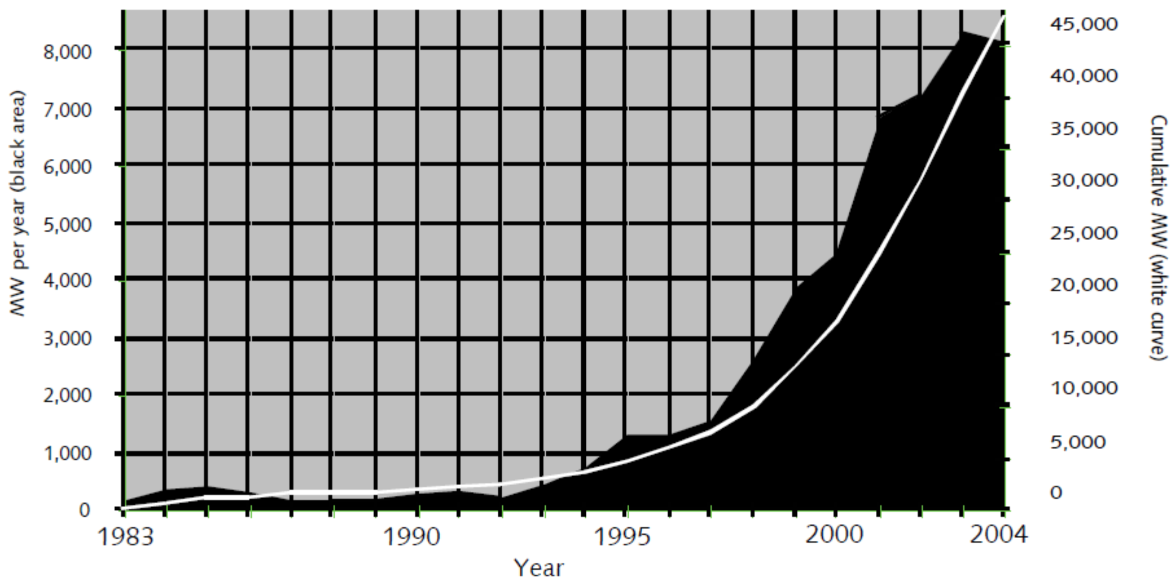

Fig. 2. 4. The annually global wind energy development from 1983 to 2004

Source: (Painuly *et al.* 2005)

Table 2. 3 Installed wind capacity in 2005 and 2009 in the CDM pipeline[8]

2005	5837 MW
2009	33784 MW

2.5 Key issues involved in promoting wind power under CDM

It should be noted that wind power CDM scheme is an extraordinary market-based approach for promoting renewable energy. The thesis study will focus on validation and registration stages and financial barriers additionality assessment of wind CDM according the defined scope in Chapter 1. Thus, there are two key issues to be discussed: Internal Return Rate and E+/E- policy.

2.5.1 The Internal Return Rate (IRR)

The likelihood of the development of the proposed wind power CDM project would be determined by comparing the proposed project's Internal Return Rate (IRR)[9] with the benchmark of interest rate available to any local investors(Helten 2005). For wind power projects, the financial gain derived from the sale of generated electricity to utilities (electricity tariff) and revenues of CERs in the carbon market demonstrate the main financial viability of the proposed CDM projects, although up-front transaction costs are very high, for instance, market exploration costs, registration fees at EB, monitoring costs etc). By comparing the financial returns of proposed wind projects, logical investment will come into force with higher projected IRR(Ringius *et al.* 2002). Project participants must demonstrate their proposed wind CDM projects are not economically viable under the Business As Usual (BAU) scenario, so that the

[8] The UNEP CDM pipeline is available online: http://cdmpipeline.org/

[9] Internal Return Rate (IRR) is calculated on the gross cash flow (income minus operating expenses but excluding the cost of financing, e.g. taxes, commercial loans, interest payments etc divided by the total capital cost of the project).

CDM finance seems to be indispensable in comparison with alternative investments(Painuly *et al.* 2005) (see Fig. 2.5) There are two credible indicators of additionality according to the Marrakesh Accords: 1) the baseline scenario proposed must represent actual and tangible BAU in the relevant energy market; 2) IRR must be crucial in determining investments' behaviour and patterns in the relevant energy market(Helten 2005). Table 2.4 shows the impact of CERs on IRRs in wind power projects in some countries, compared with selected other renewable technologies.

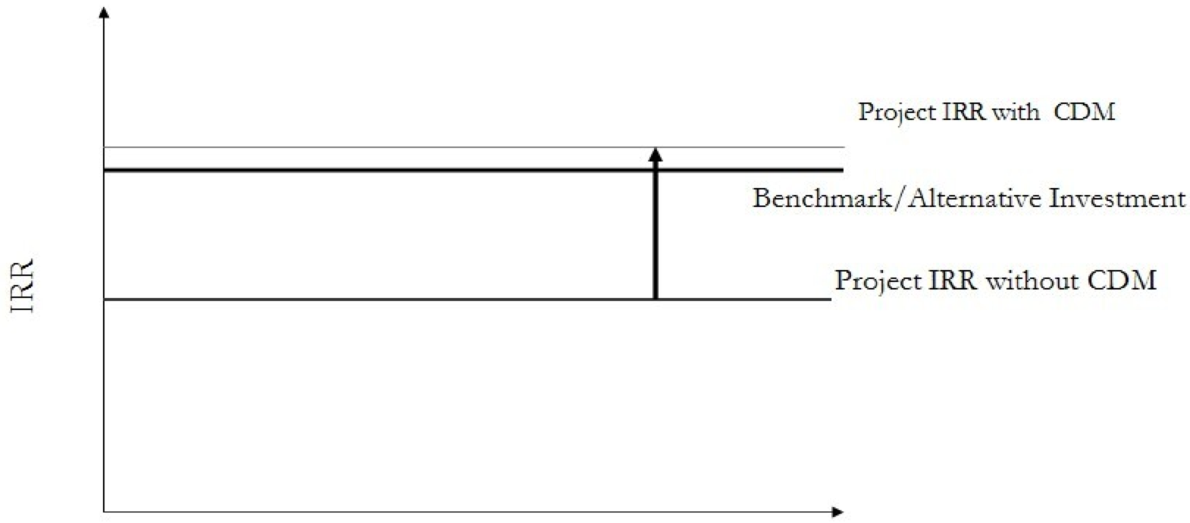

Fig. 2. 5. The idea of using financial analysis to demonstrate additionality

Source: (Helten 2005)

Table 2. 4 Impacts of Certified Emission Reductions (CERs) on Internal Return Rates (IRRs)

Country	Project	IRR without carbon finance (%)	IRR with carbon finance (%)	Change in IRR (%)
Costa Rica	wind power	9.7	10.6	0.9
Jamaica	wind power	17.0	18.0	1.0
Morocco	wind power	12.7	14.0	1.3
Chile	Hydro	9.2	10.4	1.2
Costa Rica	Hydro	7.1	9.7	2.6
Guyana	Bagasse	7.2	7.7	0.5
Brazil	Biomass	8.3	13.5	5.2
India	solid waste	13.8	18.7	5.0

Source: (Painuly *et al.* 2005)

2.5.2 The E+/E- policy for wind power CDM

E+/E- discussions are another main factor determining the CDM projects' validations. Table 2.5 below is the E+/E- policy's definition according to EB. "*The EB require relevant DOEs to provide information as to whether the tariffs could be considered to be an E- policy and if not to assess in a quantitative manner whether the observed changes in the applicable tariff had resulted in a change in the incentives for investors. If the EB considered that the DOE and project participant had failed to either clarify that the tariff could be considered an E- policy or provide a quantitative assessment, then registration of CDM projects will fail.*"(EB 2010) (page 16-20). The EB could therefore not assess the suitability of the applied tariff and therefore could not register the proposed CDM project activity. Thus, if project participants could demonstrate that certain renewable power tariffs fall into E- policy categories, and it has implemented since 11th November 2001(the adoption date by the COP), so this E- policy may not be taken into account in developing an emission baseline scenario. For example, for the "China Qinghai 42 MW Jiangyuan hydropower project" (Reference number: 2769), EB would give feedback as

> "*While the concern of the Board on the trend of tariff for similar projects exporting electricity to the same grid has not been fully substantiated, the Board considers the project activity additional as with the application of the highest reported tariff in the province since 11 November 2001, the project IRR does not cross the benchmark*" (EB 2010)

Table 2. 5 Definition of E+/E- Policy

EB 16 Report, Annex 3: *Clarifications on the treatment of national and/or sectoral policies and regulations (paragraph 45 (e) of the CDM Modalities and Procedures) in determining a baseline scenario* *1. The Executive Board agreed to differentiate ways to address the following four (4) types of national and/or sectoral policies in determining a baseline scenario:* *(a) Type E+: Existing national and/or sectoral policies or regulations that create policy driven market distortions which give comparative advantages to more emissions-intensive technologies or fuels over less emissions-intensive technologies or fuels.* *(b) Type E-: National and/or sectoral policies or regulations that give positive comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy or to finance energy efficiency programs).* *2. Only "Type E+" national and/or sectoral policies or regulations that have been implemented before adoption of the Kyoto Protocol by the COP (decision 1/CP.3, 11 December 1997) shall be taken into account when developing a baseline scenario. If "Type E+" national and/or sectoral policies were implemented since the adoption of the Kyoto Protocol, the baseline scenario should refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place.*

3. "Type E-" national and/or sectoral policies or regulations that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001) may not be taken into account in developing a baseline scenario (i.e. the baseline scenario should refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place).

Source: (UNFCCC 2008)

CHAPTER 3 - CHINESE WIND CDM: BARRIERS AND LESSONS LEARNED FROM A CONTROVERSY

In the second half of 2009, there was a serious controversy of Chinese wind CDM projects arising from proving additionality for registration. At the centre of the controversy was the concern that China might be intentionally cutting subsidies through a beneficial CDM scheme, which was ascribed to benchmark prices of wind feed-in-tariff issued by the China National Development and Reform Commission (NDRC) on 24th July 2009. The tariffs range between 0.51 and 0.61 yuan[10] per kilowatt-hour in four regions after abandoning a public bidding system, showing an obvious price discrepancy compared to previous Chinese wind CDM projects submitted to EB. At meeting EB47, EB48 and EB49, more than 50 Chinese wind CDM projects were put under review, because EB worried that the Chinese government artificially manipulated the wind tariff attempting to strengthen additionality claims of those wind CDM projects.

As a response to the EB's suspension of wind CDM in China, the NDRC published the "China Wind Power and Electricity Price Development Research Report" on its website by the Chinese - Danish Wind Energy Development Project Office and Professional Commission of China Renewable Energy jointly. NDRC (2009) claimed that the Chinese government's policy of wind tariff was based on its own objective of development, the capacity of power grid. According to the report, when determining the price, NDRC never considered CDM factors and China's pricing process had nothing to do with CDM. NDRC pointed out that the price of domestic

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[10] yuan= RMB, the Chinese currency, and ten yuan is about one Euro

wind power had shown an overall upward trend, but also admitted that in a few areas there was a downward price of wind power under special circumstances as following: 1) lower costs of wind power in Heilongjiang Province were due to the faster growth of wind power equipments; 2) tariff had slid in recent years, because local constructions of transmission lines could enable enterprises to reduce the related costs, reflecting a lower electricity price trend in some regions was normal(NDRC 2009). The NDRC presented a bar chart indicating the government's subsidies on wind power had never decreased, but showing a steady ascending trend instead (see Fig. 3.1)

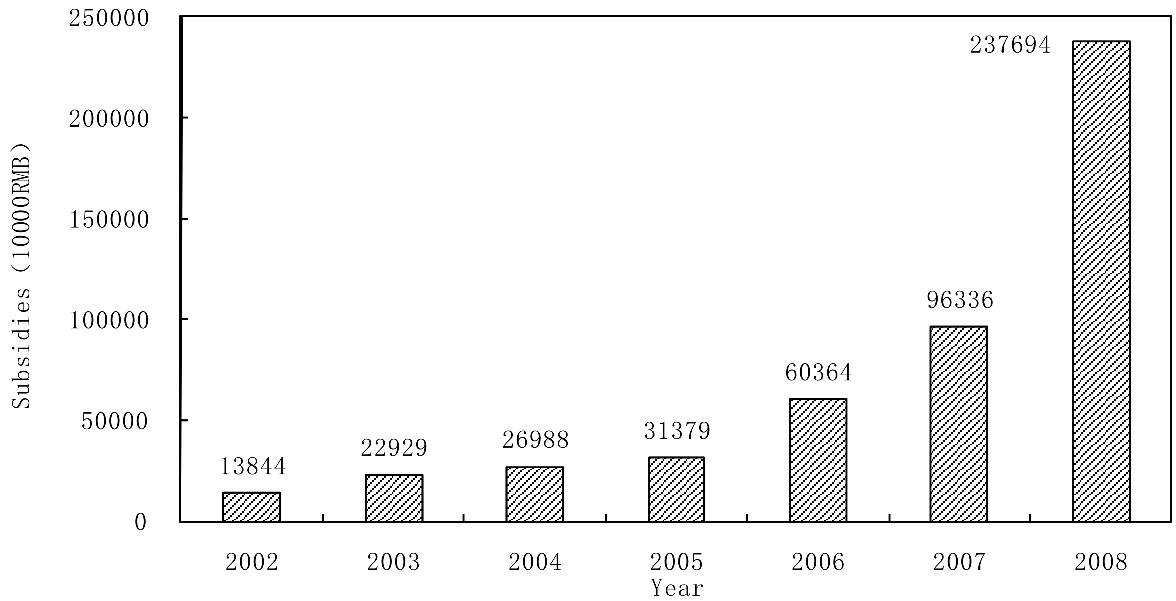

Fig. 3. 1. The subsidies of the Chinese government to wind power show an increasing trend

Source: (NDRC 2009)

When the EB officially rejected ten Chinese wind CDM projects with combined investments of six billion yuan in EB 51 Report on 4th December 2009, the controversy reached a boiling point. Afterwards, there was an intense political debate over this controversy at COP15 in Copenhagen.

Due to the suspension of potential CERs revenues, the Chinese wind power became the riskiest CDM investment(Gang and Morse 2010). The controversy induced serious influences on the carbon market, which provoked consecutive criticism from project participants and advocates of CDM scheme[11].

3.1 Background of Chinese wind tariff and wind power CDM

On account of influences of CDM scheme since 2005, wind power in China has experienced a striking growth[12] (see Fig. 3.2). To encourage investments, NDRC implemented a policy of feed-in tariff for renewable energy power in January 2006[13]. Purchasing electricity from renewable energy for long-term is guaranteed, and risks of investors have been largely reduced (Li and Colombier 2009). NDRC issued the Renewable Energy Development Plan setting a target of 15% of total primary energy generated from renewable energy by 2020 and total wind power capacity should reach 150–200 GW by 2030(Helten 2005). The wind tariff has been implemented under preferential policy consideration and supported by national-wind electricity surcharge on consumers.

[11] At EB52 in February 2010, six more Chinese wind CDM projects were blocked, 32 were approved and two rejected from the prior meeting for reviewing (Gang and Morse 2010).

[12] It should be noted that some of installed wind capacity were not due to CDM.

[13] By that time, feed-in wind tariff was decided by a bidding system but not benchmark prices, so feed-in-tariff was not determined by the government.

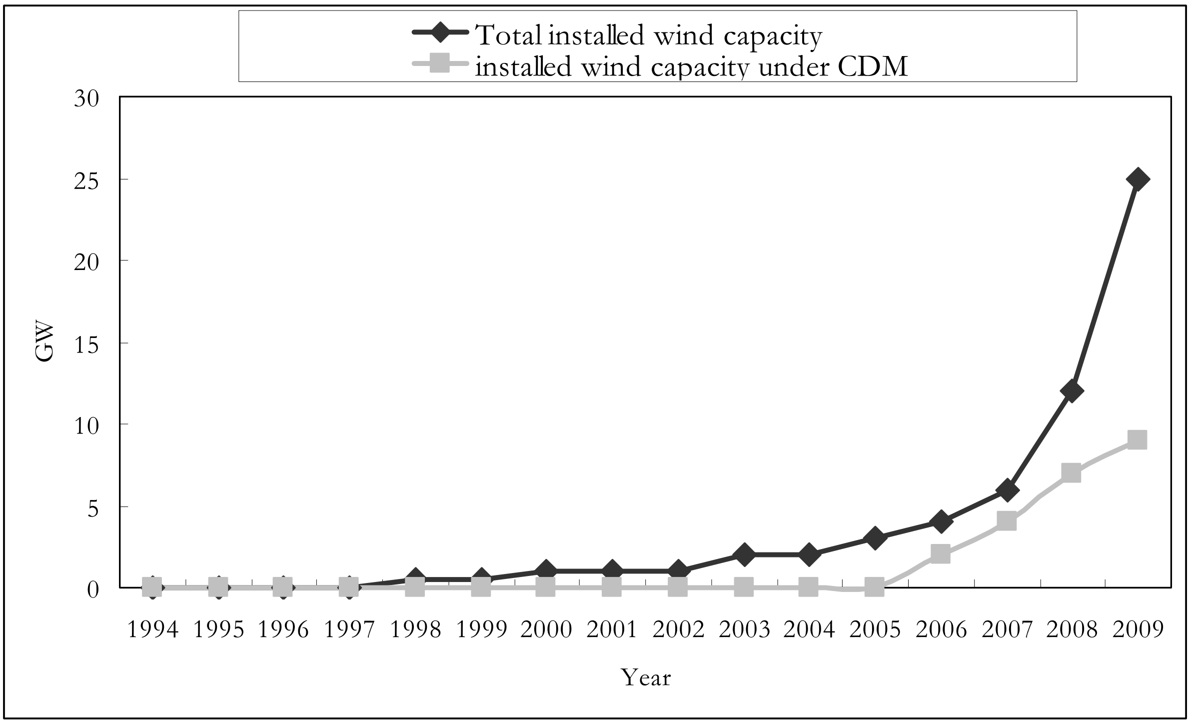

Fig. 3. 2. Total wind installed capacity and wind installed capacity under CDM in China

Data source: (Han *et al.* 2009) and UNEP CDM pipeline updated until 1 February 2010

The development history of Chinese wind power tariff could be categorized into four stages: International aid stage; Commercialization stage; Scaling stage; Benchmark Feed-in tariff stage (so called Regional flag price)(Gang and Morse 2010) (see Fig. 3.3). The evolution of Chinese wind tariff experiences the same process as incentives of wind energy in other countries around the world (see literature review in Chapter 2.2). During the first stage, wind power projects were initiated and fully funded by international aids and the tariff was paid at the same levels with coal-fired power, less than 0.3 yuan/KWh. After intervened by the government, wind power tariff ranged from the relatively low price of 0.3 yuan/KWh up to 1.2 yuan/KWh in the second stage. During that period, wind tariff was proposed by the local government and approved by the central government(Xia and Song 2009).

In the third stage, tariff was decided by a concession bidding system. However, only wind projects that were larger than 50MW or in special wind-rich regions applied this system. Smaller projects were still subject to tariffs assigned by local regulatory framework, in which wind tariff was submitted as bids to the NDRC including proposed wind electricity prices and share percentages of domestically produced wind turbines(Xia and Song 2009). NDRC then made the final decisions of approved projects(Xia and Song 2009).

In accordance with the principles of the previous bidding, usually the lowest bidder should be awarded. In that mode, in order to seize the wind resource and enter the wind power market, several large-scale companies would win wind projects bidding at extremely low electricity prices(Wang 2008). Because these companies or their parent energy corporations heavily rely on traditional thermal power projects, their wind power concession projects could temporarily survive through the profit offset from their traditional power(Wang 2008). Low-bid system easily led to price wars, resulting in fierce competition. Investors reported that electricity prices were artificially low, leading to wide-spread loss of wind instalment capacity, not making any profit margin, and waste of resources in some high-quality wind energy areas(Xia and Song 2009). As a result, NDRC issued the existing Regional Benchmark Wind Tariff (Regional Flag price system) policies in July 2009, trying to push an effective restraint mechanism on wind power tariff. The benchmark wind tariff in four regions was mandated under the principle "*Cost + reasonable return with consideration of available wind resources*"(NDRC 2008). However, the detailed calculation equations are not publicly available(Gang and Morse 2010).

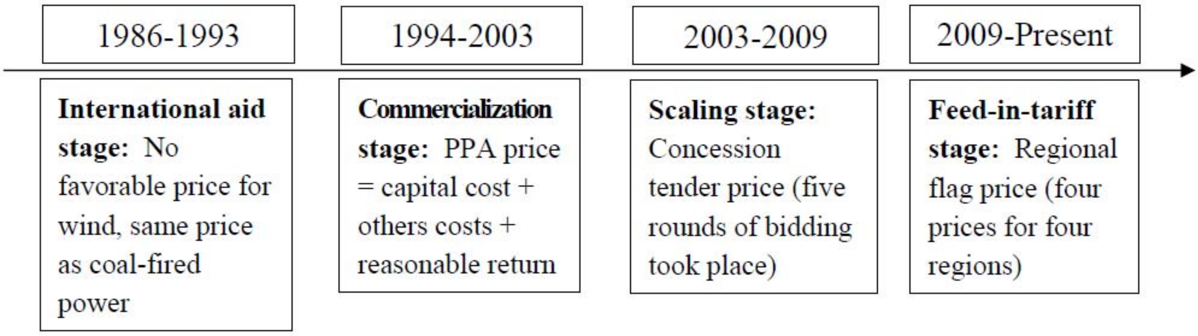

Fig. 3. 3. The evolution of Chinese wind tariff

Source: (Gang and Morse 2010)

As Fig. 3.2 shows, domestic policies mentioned above should be deemed as successful measures in terms of stimulating deployment of wind power. By early 2010, total wind installed capacity has almost reached the government's 2020 target. International carbon finance has well exerted its function through CDM scheme to boost Chinese wind power development. Since the first Chinese wind CDM project submitted in 2005, at least 30% of China's total wind instalment capacity was originated from CDM finance. Fig. 3.4 illustrates that wind CDM in China has been a successful experience, which accounts for 22% of total CDM project numbers in China. In addition, CERs generated by wind power have been informally considered as some of the best in the carbon market in terms of environmental concerns(Schroeder 2009). Given an overlap of international carbon finance and several favourable domestic renewable energy policies, it would not be a surprise that wind CDM projects are subject to the scrutiny of EB. Since the suspension of Chinese wind CDM approvals as a result of the wind tariff controversy in 2009, investments in the Chinese wind power have become less attractive due to the loss of CERs revenues.

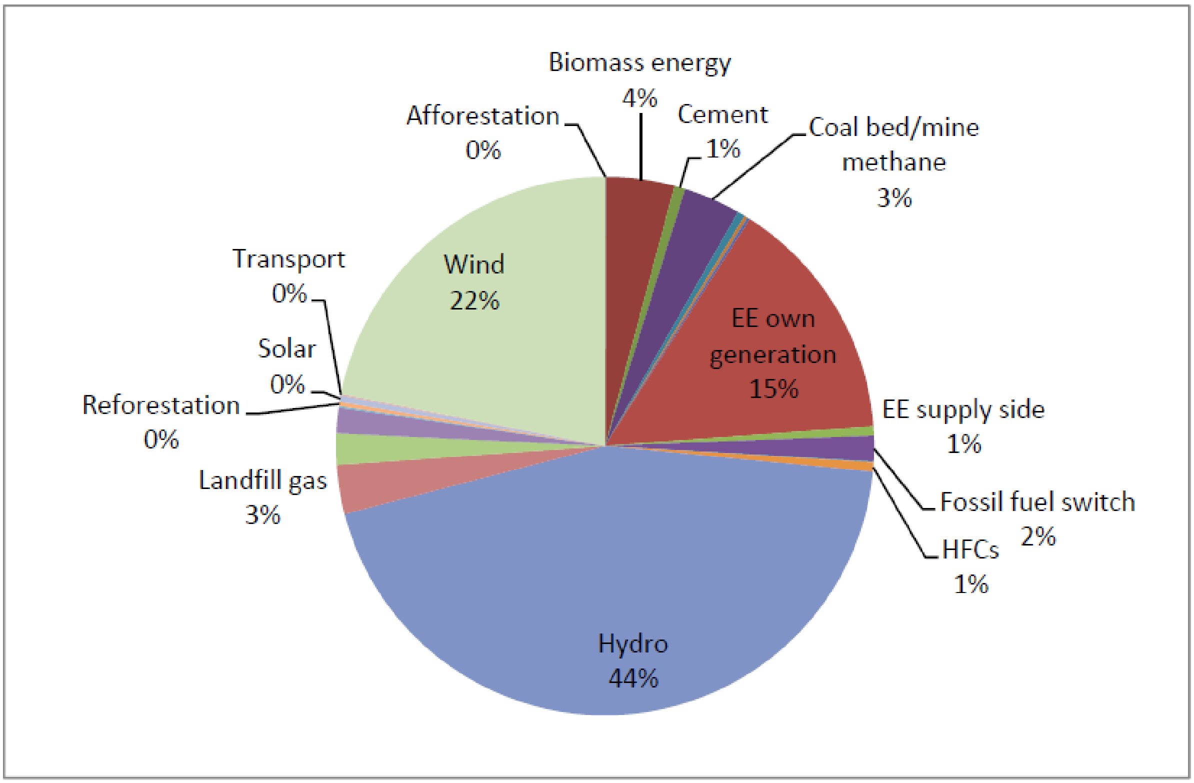

Fig. 3. 4. Total number of China's CDM projects summarized to percentages of types[14]

Source: (Gang and Morse 2010)

3.2 Institutional barriers

As mentioned in Chapter 2.3.1, local DNA in host countries and EB are the key decision makers for validating and approving CDM projects. NDRC as the local DNA in China definitely plays a significant role in this controversy of wind power CDM projects. As stipulated in legal framework of UNFCCC, EB is a crucial regulatory body in executing and deploying CDM procedures among COP/MOP. NDRC and EB both have their own roles, rights and responsibilities involved in CDM implementations. As a serious dispute happened in 2009 between the two institutions under CDM-specific frameworks, various barriers to CDM market expansion might occur in other developing countries as well.

[14] This is updated until UNEP CDM pipeline on 1st February 2010

3.2.1 Designated National Authority (DNA)

In the additionality assessment tool, financial barriers discussions are vital for demonstrating the benefits of CDM revenues. Therefore, wind power tariffs can greatly determine the financial balance for investors. In fact, China's NDRC is the only institution who can set up wind power tariff under the current Chinese legal framework[15]. Given the unique political situation in China, NDRC has rights to make sovereign decisions based on the government's development plan(Gao *et al.* 2007), instead of a market-based manner, which means wind tariff is a proprietary of socialism. When come to CDM project cycles, the role of NDRC becomes vague between Chinese regulators or an arbiter of additionality in terms of wind tariff(Ganapati and Liu 2008). To a large extent, NDRC introduces a great number of barriers in defining a factual and tangible Business As Usual (BAU) baseline. Hence, it would be absurd to determine additionality if the wind tariff is set by NDRC via regulatory decree, rather than by market pricing(Ganapati and Liu 2009). However, the national concession scheme (bidding system, which was abandoned in the Chinese wind tariff stage three) would seem to be more market-based price discovery mechanism because of involvement of project participants. Of course, the problems behind the bidding system for promoting renewable energy are not negligible, for instance, fierce and distorted price competitions, waste of installed capacity etc.(Gang and Morse 2010).

[15] NDRC was established by the State Development Planning Commission in 2003. "*The NDRC is a powerful central agency under the State Council for National Economic and Social Development, who has higher central power than all ministries. Environmental policies are formulated by the National Coordination Commission for Climate Change. NDRC is the central agency that formulates the national five year plans. There is little political room for CDM policies and other aspects of environment to be debated and contributed to by NGOs and related bodies* " Ganapati, S. and L. Liu. 2008. The clean development mechanism in China and India: A comparative institutional analysis. *Public Administration and Development* 28 (5): 351-362., page 355- 356)

Unfortunately, NDRC's possibility to make full BAU wind tariff is constrained by three reasons as following:

First of all, a couple of major state-owned enterprises (SOEs) want to enter and manipulate wind power prices, because they are required to meet certain investment quotas in renewable energy, which are allocated by the central government and called Renewable Portfolio Standard capacity requirements(Wang 2008). SOEs have stubborn financial support from the government, and they are mainly motivated by government development polices instead of financial returns(Schroeder 2009). If considering their influences in the BAU, there would be no sense in determining additionality.

Secondly, preferential wind power projects are requested to use high portions of domestically manufactured wind turbines, which is a government policy to protect the domestic wind industries. For example, Beijing government required that 70% of parts in wind turbines used there should be domestically made(Ganapati and Liu 2009). This rule has significantly resulted in barriers for foreign turbine producers to establish business in China, not mentioning setting electricity prices for wind projects afterwards.

Thirdly, due to China's sovereign right, NDRC dare to set wind tariff according to its own judgements(Ganapati and Liu 2008). Available public information is simply "cost + reasonable return"(Gang and Morse 2010). It is not possible for the public to specify how the reasonable return levels are determined. Nevertheless, it is understandable that NDRC has to determine the "reasonable return" through the wind tariff, which is subject to appropriate IRR for project participants.

Therefore, NDRC's role has key authority in influencing CDM's additionality of IRR through setting wind tariffs. Chinese regulator controls of NDRC are fundamentally incompatible with BAU determination of additionality(Gang and Morse 2010). EB has already been aware of the fact that wind power prices can be easily manipulated by Chinese government since EB49 meeting(Gang and Morse 2010). Furthermore, as a result of NDRC, it is not possible to know the exact BAU in China and how the Chinese government constitutes CDM under political concerns. Because of the influences of NDRC in wind tariff and IRR in the context of additionality, no wonder lots of scholars have put forward the argument that the real wind CDM approval procedures are commanded in Beijing rather than Bonn(Gang and Morse 2010)[16].

3.2.2 Executive Board (EB)

According to the analysis in preceding paragraphs, because wind tariff is out of the control of projects participants, it is not justifiable for them to bear risks during approving wind CDM in China. Acting as a legislatively executive body, EB should streamline project registration and CERs issuance procedures, as well as avoid the duplicated work done by process auditors in CDM, known as DOEs(Gao *et al.* 2007) (see Chapter 2.3.1). EB was established to help deploy CDM activities in developing countries and is hoped to review projects and to give feedback for amending project documents under CDM legal frameworks(Zhang 2006). If the executive role

[16] EB is located in Bonn, Germany.

of EB became more of an administrative function in final approving, consequences like long queuing up of suspended Chinese wind CDM projects for registration would be frustrating for all advocates of CDM. The Chinese government blamed EB at Copenhagen conferences for its *"arbitrary, opaque and unfair"* (Gang and Morse 2010) decision-making, which only aimed at a single country and a single sector.

It has been recognized by most of project participants that CDM is a long-term and complicated bureaucratic process(Jane and Sami 2007). EB's decisions likely lead to CDM implementation barriers without mutual trust with DNA and without taking into account the specific country's situation. China' premier Mr. Wen Jiabao presented a kind wish at COP15: *"To meet the climate change challenge, the international community must strengthen confidence, build consensus, make vigorous efforts and enhance co-operation"*(Wang 2010). The institutional barriers of EB can be categorized into three aspects:

Firstly, EB did not provide authentic proof to support their suspicion concerning the reduced wind tariff in China, neither did EB refute or explain the reasons of ignoring all the testimony and documents submitted by Chinese government and relevant institutions(Gang and Morse 2010). After series of empirical data analysis for Chinese wind CDM projects, there is no obvious evidence showing a dramatic wind tariff slump in China since EB47[17], EB49 (see the vertical line marked in Fig. 3.5. Moreover, Fig. 3.6 demonstrates that wind tariffs for CDM projects in several provinces in China are in a rather random situation. There is no sign showing the CDM

[17] EB47 means the 47th Executive Board Meeting.

wind tariff has been markedly influenced by the wind benchmark tariff (Regional flag price) issued by NDRC in July 2009. A final satisfying answer is still being expected concerning how EB came to a conclusion that China intentionally lowered the wind tariff to enhance CDM additionality.

Secondly, EB did not consistently and fairly apply its own E+/E- guidance concerning how to treat Chinese domestic wind tariff as a renewable energy policy. As mentioned in Chapter 2.5.2, if Chinese benchmark wind tariff issued in July 2009 could be ruled as an E- policy, then all the price differences of wind power could be irrelevant for both baseline determination and additionality assessment. Considering EB has taken into account the benchmark prices for determining additionality[18], there are four understanding gaps of E+/E- policy for EB's attitudes: 1) whether EB made its judgement that wind tariff had been reduced, so the benchmark wind tariff should be considered as E+ policy in China; 2) whether EB required project participants to assess additionality by comparing their wind projects with the wind tariff provided historically, which is the historically highest in the whole country or in certain regions or could be certain average levels; 3) whether EB would believe that the net income to project participants did not fall despite the wind tariff was reduced, which can be due to capital investments' decrease in wind sector, e.g. cheaper wind turbines, by using existing transmission lines; 4) whether it would be justified for project participants to assess additionality as long as the wind tariff they proposed was higher than any of those of conventional energy sources.

[18] Because this renewable energy policy of Chinese government came into force after December 1997, which is defined in E+ policy in Chapter 2.5.2

Thirdly, EB rashly put more than 50 Chinese wind CDM projects under review in EB48[19] and EB49, and there was no specific mandated timeline for review and registration processes. In addition, there were several divided understandings of the current E+/E- policy guidance inside of EB(Gang and Morse 2010). Thus, EB kept silent until EB51, and it seemed that EB could not be satisfied by all responses offered by project participants until EB could come to a consensus internally. It might be argued that Chinese wind tariff controversy should not be considered as aiming at specific projects, but an emergent bifurcation on E+/E- guidance. Due to the three months' suspension of approval, Chinese wind CDM investors had to bear financial risks such as interests, loans and loss of large portfolio of pre-2013 CERs. Because of the EB's continued delay, also because EB's review feedbacks were not provided with substantiated and detailed arguments over the second half of 2009, a great deal of extra work load had been put onto project participants and DOEs(Gang and Morse 2010). So, EB's efficiency was quite low and its executive and supportive role was also blurry.

All in all, EB's institutional barriers for CDM deployment are quite obvious in the context of lack of transparency, inconsistency and lack of impartiality and low operation efficiency(Gang and Morse 2010). EB is hoped to increase its transparency of decision-making, to help increase project participants' understanding of CDM's legal standards. So, quality of projects submissions could be improved greatly.

[19] EB48 means the 48th Meeting of Executive Board, likewise for EB49, EB50 etc.

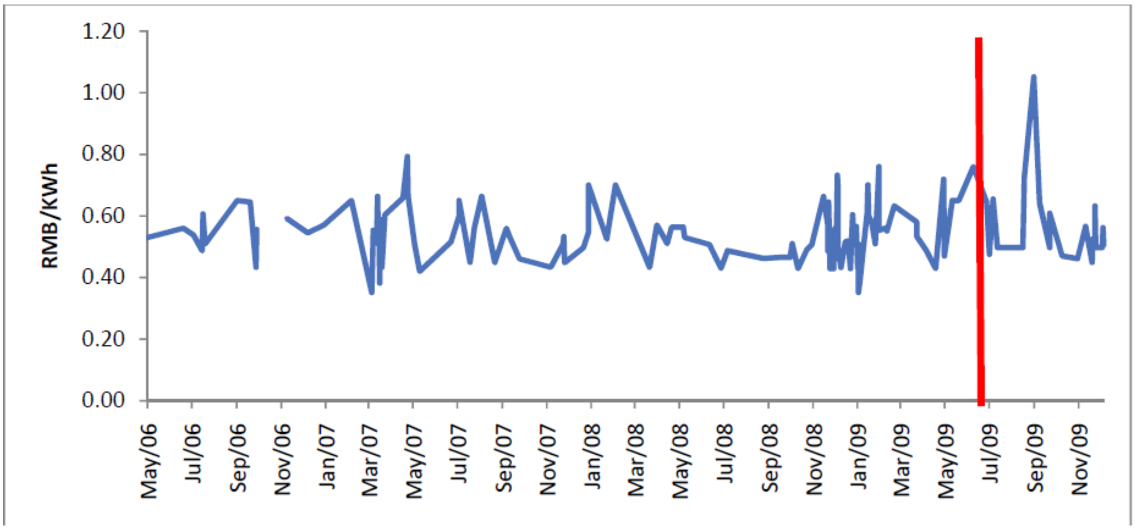

Fig. 3. 5. Chinese Wind Tariff in CDM projects submitted to EB from 2006 to 2009

Adapted from (Gang and Morse 2010)[20]

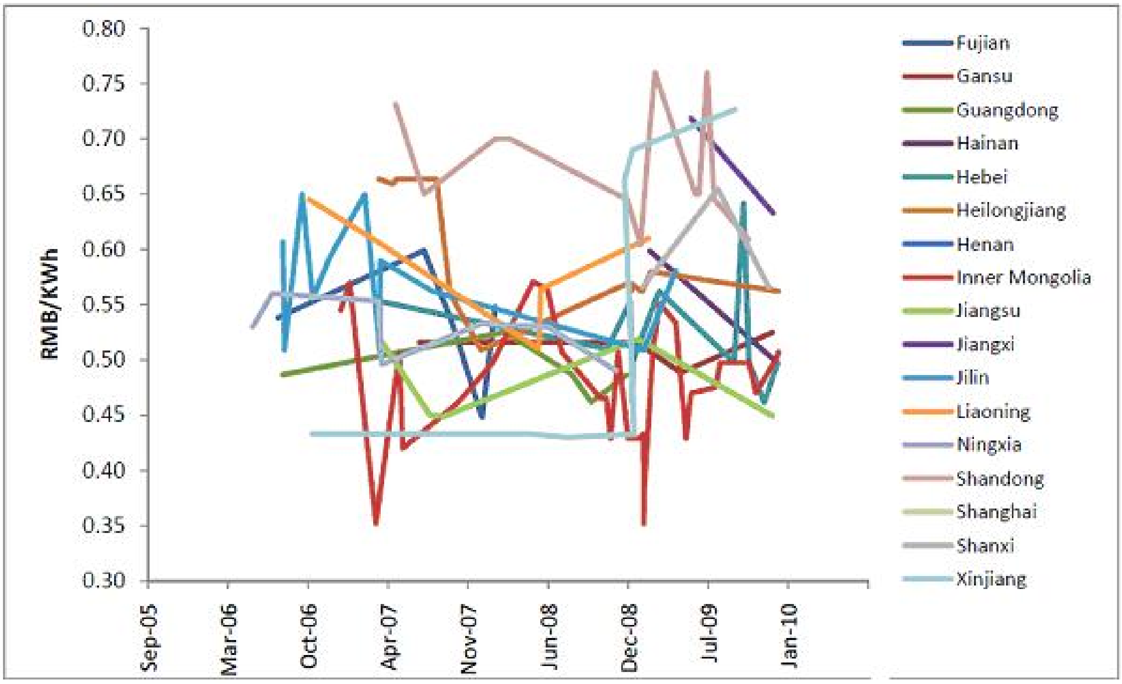

Fig. 3. 6. Wind Tariff by province for CDM projects in China from 2005 to 2010

Source: (Gang and Morse 2010)

20 Note: all wind tariffs exclude Value Added Tax (VAT), one exceptionally high wind tariff in September 2009 was an offshore wind project, and the tariff granted was more than one yuan/KWh.

3.3 *Structural failure of CDM's additionality assessment*

According to the principle of CDM, project participants can generate CERs by investing wind power that is less carbon dioxide-intensive energy, which is referred to as the alternative(Boyd *et al.* 2009). The GHG emissions that would have happened otherwise are referred to as base case or reference case (see detailed information in Chapter 2.3.2). Usually, the base case is a counterfactual estimate or prediction, which can not be measured empirically (called *ex ante*)(Painuly *et al.* 2005). The theory of CDM additionality assessment is to avoid free-rider projects so that real emission reductions would not have occurred in the absence of a CDM project. Financial additionality[21] means CERs should be only obtained by those projects that would not be sufficiently profitable without the revenues of selling CERs in the carbon markets. It has been universally admitted that financial additionality is the most difficult assessment to apply for three reasons: 1) projects' financial parameters succumb to manipulating of third-party; 2) financial parameters in a private company could be confidential business information; 3) financial issues might not be significant factors influencing investment flows(Jane and Sami 2007).

However, the controversy of Chinese wind power in 2009 should not be considered as a simple dispute on their additionality or non-additionality. As discussed in Chapter 3.2.1, since NDRC is the most powerful arbiter of wind tariff, Chinese wind CDM's additionality is determined by NDRC as long as the financial additionality depends on IRR comparisons. If NDRC continues

21 There are four categories of additionality of CDM project: environmental additionality, financial additionality, program additionality, technology additionality (see Chapter 2.3.2)

to decide wind tariffs based on proprietary system rather than market-based, an additionality assessment that is price-oriented would be inherently contradictory, and the controversy seems to be inevitable(Gang and Morse 2010). Therefore, there is an incompatible interaction between Chinese wind CDM projects and a widely structural failure of current additionality assessment scheme. Fig. 3.7 demonstrates a detailed additionality assessment tool in cases of Chinese wind power, the following sections will analyse how the tool's structural failure plagues Chinese wind CDM (a general additionality tool ACM 0002 is available in Chapter 2.3.2). Fig. 3.7 shows there are three options in Investment Analysis[22]. For acquiring realistic and measurable CERs, setting up credible alternatives that represent BAU should be completed in Step One of the assessment tool. There are three main principles of demonstrating wind power's additionality: 1) decide what would be happening without presence of comparable energy services provided by wind power; 2) the proposed projects must comply with domestic legal framework; 3) conduct a financial comparison between wind power and offered alternatives(Schroeder 2009).

Among four steps of additionality assessment of Chinese wind CDM projects, the controversy in 2009 happened in Step Two. Option I in Step Two is applicable to projects that only require purely cost-based analysis, but wind power CDM can generate benefits of revenues from both CERs as well as selling electricity, so only Option II and Option III are relevant in structural barriers discussions.

[22] Appendix 1 is "*Tool for the demonstration and assessment of additionality (Version 05.2)*", page 4- 6.

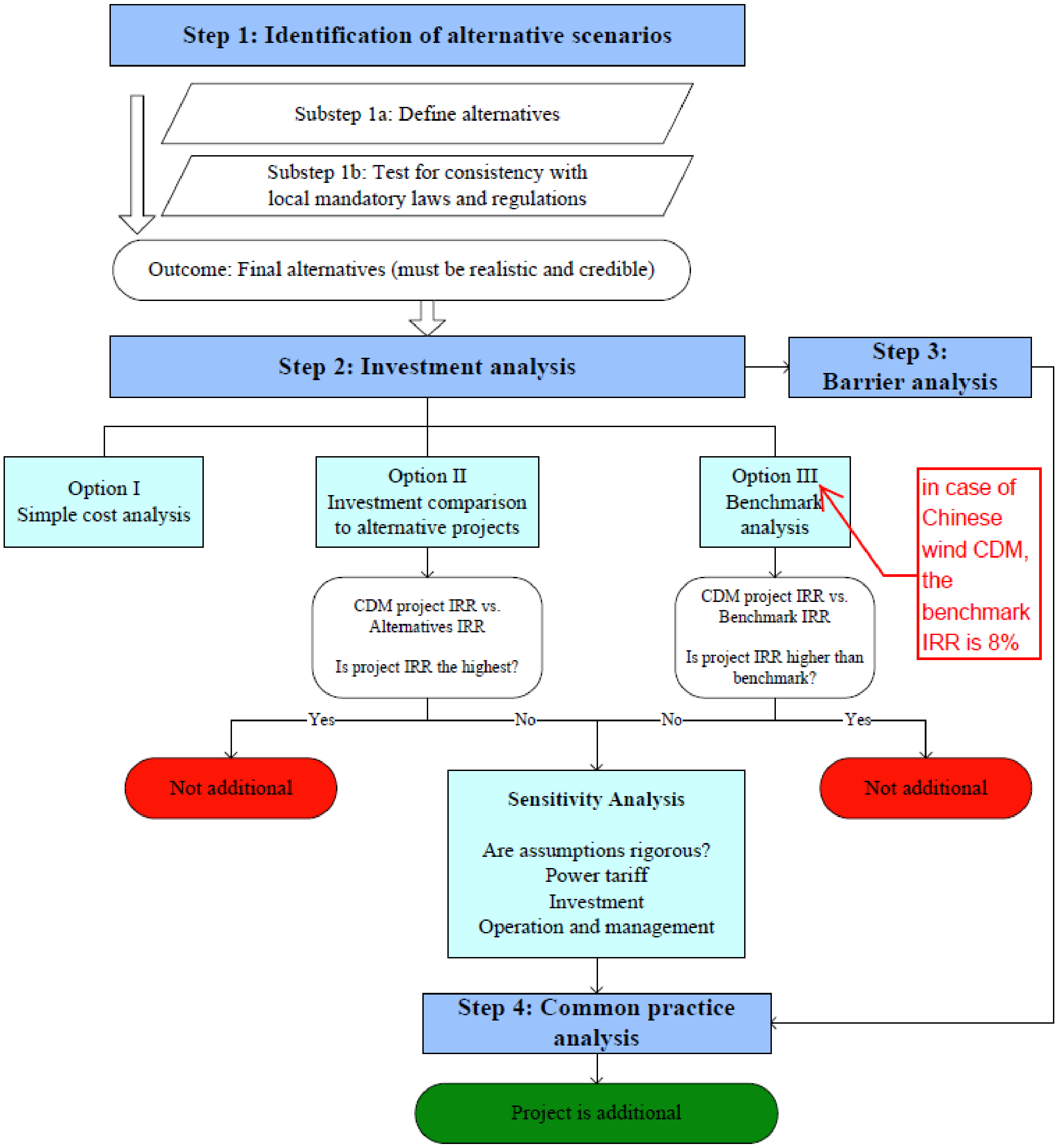

Fig. 3. 7. Tool for additionality assessment in Chinese wind CDM

Adapted from (Gang and Morse 2010)

3.3.1 Barriers of Option II: Principal arguments on accurate alternative baselines

Option II is a procedure that compares the proposed wind CDM project with alternative BAU projects via IRR, for example, alternatives like coal plants and other renewable energy plants.

According an empirical data study of Chinese wind CDM in pipeline[23], it is striking that only one CDM wind project in China has been compared to coal-fire power via Option II (the wind project is Ningxia Helanshan Wind farm project[24])(Gang and Morse 2010). It should be noted that 70% of power supply is provided by coal-fired plants in China(Helten 2005). Thus, without comparing wind with coal-fired power, it is not convincing to claim that Chinese wind CDM projects have chosen credible baselines that can represent real BAU in the Chinese energy market in order to prove wind power's additionality. Furthermore, as a result of favourable domestic policies and CDM scheme, renewable energy has a promising future in China, which obtains annual installed capacity 90 GW(Helten 2005). Nevertheless, in Option II of Step Two, project participants also evaded comparing their wind projects with coal and other alternative renewable projects, but directly adopted Option III – the Benchmark IRR comparison(Gang and Morse 2010). So, what are the reasons behind this phenomenon?

3.3.1.1 How Chinese wind CDM projects sidestepped Option II

Usually, in Chinese wind CDM projects, several alternatives have been referred to for additionality assessment in Step One: 1) the proposed wind projects carried through without CDM scheme; 2) other renewable energy projects as alternatives; 3) conventional thermal power plants; 4) offset power from the national electricity grid. Below is a typical list of alternatives offered in Project Design Documents (PDD) for EB' registration:

> " *(a)The thermal power plant with the same capacity or the same annual electricity output as the proposed project.*

23 UNEP CDM pipeline is available online: http://cdmpipeline.org/

24 This wind project was the first wind CDM registered in China.

(b) The proposed project not undertaken as a CDM project activity but as a commercial project.

(c) The other renewable energy power plant with the same capacity or the same annual electricity output as the proposed project.

(d) The Northeast Power Grid as the provider for the same capacity and electricity output as the proposed project.'[25]

It is obvious that Choice (b) is the first alternative quickly rejected by project participants, because if they think their projects are viable and would like to deploy their projects as normal commercial investments, they would not being submitting their PDDs for CDM validation. Then, Choice (c) would be deleted under a few rational reasons: 1) other renewable energy like solar panel or geothermal are much more expensive and not mature compared with wind power; 2) the regions proposed do not have considerable natural resources for deploying biomass and hydro power via some geographical argumentations; 3) project participants are lack of certain expertise for developing alternative projects, so called technical barriers(Gang and Morse 2010).

Referring to Choice (a), project participants can easily eliminate it in Sub-step 1b of additionality tool (see Appendix 1), because of a technicality rule of coal plant size according to domestic legislations of China(Gang and Morse 2010). The rule is called "135 MW rule", which means constructions of coal plants with capacity less than 135 MW are prohibited[26]. However, it is worth mentioning that the installed capacity of wind projects are subject to Equivalent

[25] Source: CDM project number: 2764, Yantai Dongyuan Laizhou 48.5 MW Wind Farm Project Phase I, page 8- 14, available online: http://cdm.unfccc.int/Projects/index.html

[26] The Chinese government wishes to control the domination of coal power for social and environmental wellbeing, so the government prohibits coal plants smaller than 135 MW.

Utilization Hours in certain regions, which is a flexible parameter controlled by project participants(Ringius *et al.* 2002). Furthermore, wind is intermittent natural resource, and their utilization rate is only about 21.24%(Ringius *et al.* 2002). On the contrary, coal power's utilization rate is about 55.24%(Gang and Morse 2010). So, if a wind power is needed for substituting a 135 MW coal plant, the wind power capacity must exceed 135 * 55.24% / 21.24% MW = 350 MW. Fig. 3.8 illustrates the distribution of Chinese wind CDM projects in terms of installed capacity, but none of them can exceed 350 MW. In addition, more than 80% of them used the 135 MW rule to eliminate Choice (a) by definition of project participants, and no single wind project can approach the capacity of 350 MW to replace coal power (Gang and Morse 2010). So, although Choice (a) can be eliminated by the 135 MW rule, it is rather absurd.

Finally, it seems that the only realistic and credible alternative is Choice (d): increased power from the National Grid. Because this alternative relies on existing grid assets and it is not an actual project that can generate IRR, it would be so logical and normal to abandon Option II thoroughly so that projects have to proceed to Option III. Besides, in fact, electricity demand growth in China is so rapid that the only plausible solution would be to build new capacity(Xia and Song 2009).

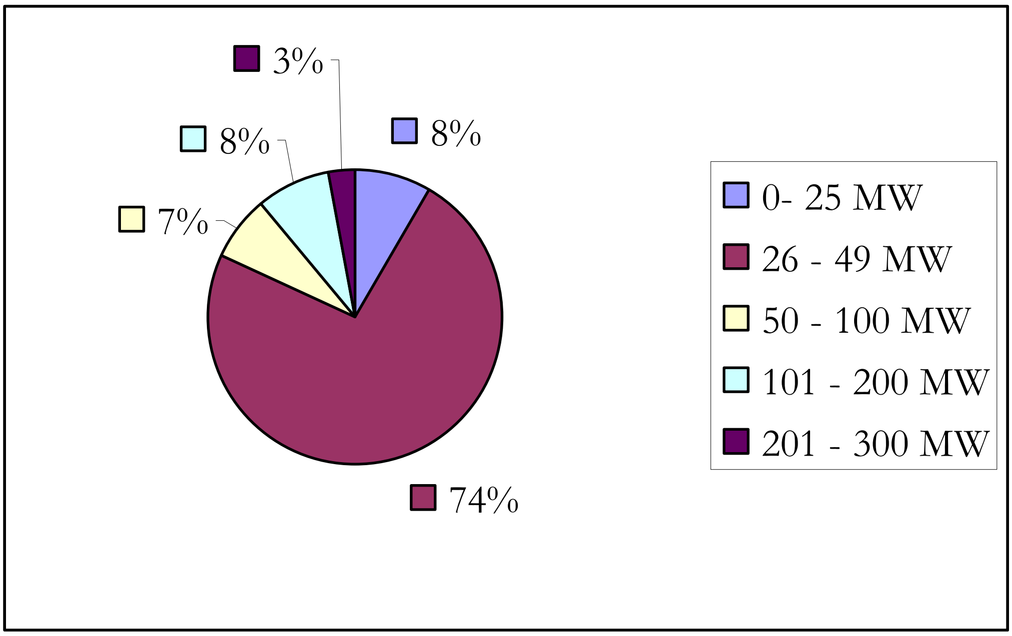

Fig. 3. 8. Pie chart of installed capacity of Chinese CDM wind projects

Data source: UNEP CDM pipeline[27]

3.3.1.2 Problems of Option II

If none of Chinese wind CDM projects has been compared with baselines of coal power, there would be no additionality at all(Gang and Morse 2010). This is because that coal power dominates 70% of the Chinese energy markets, which should be referring to as what would have happened otherwise(Helten 2005). Because Chinese wind CDM projects fail to refer to the baselines of coal power, wind power projects seem to be more profitable than coal and have a higher IRR compared with coal, which is very bizarre as conventional wisdom implies wind power should be more expensive than coal(Gang and Morse 2010).

[27] UNEP CDM pipeline is available online. URL: http://cdmpipeline.org/

There could be two major reasons for the failure to compare wind power with coal: 1) the structure of China's energy markets is rather complex so that project participants avoid it intentionally; 2) a misapplication of key additionality and concepts in CDM modalities and procedures (could be deliberate or otherwise)(Gang and Morse 2010). Moreover, a scrutiny of Chinese wind CDM reveals that PPDs show some hints of duplicated additionality justification from previous projects(Gang and Morse 2010). Imitating approaches of PDDs could minimize workload to be devoted to and maximize chances of approval(Gang and Morse 2010). The cursory skip of Option II is subject to overseeing CDM's additionality.

Project participants have strategically avoided baselines of coal in China may have two reasons. Firstly, most of coal power plants are state owned, so IRR of coal power is not available under existing regulatory scheme of Chinese coal and energy markets(Gang and Morse 2010). Those coal plants are manipulated by the government's policies instead of profit-driven. Therefore, IRR of coal can not be a BAU baseline that can influence investment flows. Secondly, IRR of coal could be lower than wind IRR due to subsidies from the government, but wind power can only generate profits through the current feed-in tariff and potential CERs revenues(Ganapati and Liu 2009; Wang 2008). Coal prices are determined by political priorities of the Chinese government(Gang and Morse 2010). In order to boost economic development and keep low inflation rate in China, the coal power prices are artificially capped by the government, even below the normal operation costs(Gang and Morse 2010). Therefore, if project participants refer to coal IRR as a baseline, Chinese wind CDM are not additional any more.

Furthermore, it should be argued that projects participants' inappropriate application of the 135 MW rule does breach the original intention of additionality. The comparison to 135 MW is a erroneous application of a legal technicality, because project participants would intentionally adjust their projects capacity below 135 MW and evade comparisons of coal plants in China(Gang and Morse 2010), which are substantially dominant in the Chinese energy markets (Gang and Morse 2010). Thus, wind projects would not be real and credible alternatives to existing energy supplies. Besides, it also should be noted that coal plants smaller than 135 MW are less commercially attractive indeed and are almost never built, because they are less efficient and more expensive per kilowatt(Gang and Morse 2010). If those coal plants are so unrealistic themselves, how can they become baseline scenarios for alternative's comparisons? In addition, additionality tool has been absurdly applied due to a distort interpretation of "comparable services"[28]. The legal requirement only stipulates that proposed alternatives must provide the comparable energy output (electricity) in terms of quality, properties and application areas(Gang and Morse 2010). However, additionality assessment does not require the output must have the same energy quantity, but only capacity. It is worth mentioning that wind and coal do not have the identical utilization hours and they operate on crucial different technical parameters(Da and Aldo 2009). A fact can not be ignored that wind is intermittent natural resource but coal is the supplier for base load power[29](Schroeder 2009). So, a capacity comparison based on utilization hours inevitably undermines credibility of alternatives (wind) to the base-load (coal). As a result,

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[28] Detailed information is available in appendix 1 "Tool for demonstration and assessment of additionality" (Version 05.2), page 4, UNFCCC

[29] But this would not affect the financial additionality assessment if the electricity quantity parameters taken into account, which means KWh instead of MW.

project participants tend to utilize set of options that are available and beneficial for them, instead of considering what would have happened otherwise.

To sum up, there is no coherent justification of sidestepping a comparison to China's real emission baseline that consists of existing coal power plants. In fact, if wind IRR can be compared with the coal plants, additionality assessments would be more realistic and credible, then Chinese wind CDM projects should obtain faster approvals.

3.3.2 Barriers of Option III: IRR benchmark analysis

As Fig. 3.7 illustrates, Option III is an IRR benchmark analysis that utilizes a proxy for a project itself if there is no specific alternative comparison can be conducted. According to analysis of Chapter 3.3.1, except one Chinese wind CDM, other wind projects used the Option III. The benchmark IRR for cases of Chinese wind is 8%, which is on the basis of the "Internal Notice on New Project Feasibility Assessment" issued by State Power Company in 2002. Typically quoted statement in PDDs is

> "*For the project scenario without sales of CERs, the only revenue is from selling of electricity to the grid. According to the Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects9,, issued by Operation Department of Power Generation and Transmission, State Power Corporation, the benchmark of power industry is stated to be 8% of the total investment IRR (after tax), which has been used in feasibility studies of new power plants, including wind power projects in China. Therefore the figure of 8% is chosen as the benchmark of the total investment IRR of the proposed project*"[30].

[30] See "Yantai Dongyuan Laizhou 48.5 MW Wind Farm Project Phase I", project reference number: 2764, available online. URL: http://cdm.unfccc.int/Projects/index.html, Page 14

Theoretically speaking, if a wind project wishes to register as CDM, its IRR will be less than 8% without CERs revenues, but with CDM it can exceed 8% (refer to Chapter 2.5.1). Data analysis[31] of all registered Chinese wind CDM portfolio through 2009 reveal that CDM could raise IRR by about 2.5% on average (see Fig. 3.9).

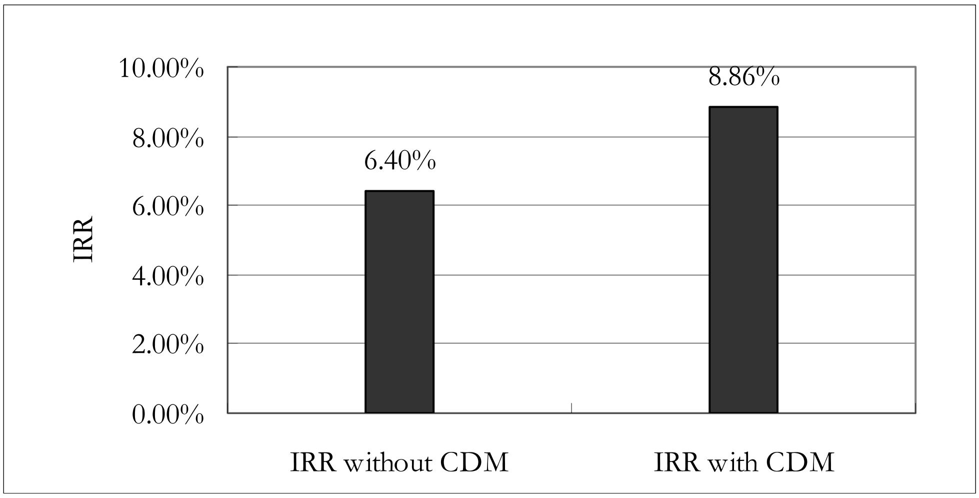

Fig. 3. 9. Internal Return Rate (IRR) of registered Chinese wind projects with/without CDM by 2009

Data source: UNEP CDM pipeline[32]

As discussed in Chapter 3.2.1, wind tariff is a significant factor influencing Chinese wind IRR, and then the additionality of projects. In the additionality assessment tool (see Fig. 3.7), project participants also have to conduct sensitivity analysis to discuss several factors that might be influencing the credibility of IRR, such as capital investment costs, power price, utilization hours, and operation and maintenance costs(Painuly *et al.* 2005). As all PDDs demonstrated,

31 Key data were gathered from registered PDDs of Chinese wind CDM at UNFCCC CDM website, 143 projects were analyzed through 2009.

32 UNEP CDM pipeline is available online. URL: http://cdmpipeline.org/

non-additionality of Chinese wind power is due to either increases of wind power prices (increase by 11.35%) or sufficient decreases of investment costs (decrease by 12.03%) (Gang and Morse 2010). Operation and maintenance costs as well as utilization hours do not play important roles, because: 1) operation and maintenance are comparatively low, and they have to decrease by 100% so that they can influence IRR, which is not possible in the short term; 2) utilization hours are determined by nature rather than human(Ringius *et al.* 2002).

However, the 8% IRR benchmark analysis would lead to significant barriers of setting a credible Chinese energy baseline, as it is arbitrary and antiquated under the control of Chinese government (see Chapter 3.2.1). The 8% IRR benchmark was issued by State Power Corporation (SPC) in 2002(Gang and Morse 2010). But until 2003, SPC had held a vertically near-monopoly position across power generation, transmission and distribution(Dechezlepretre *et al.* 2009). Even though the SPC broke up into market segments and formed a multitudinous State Owned Enterprises (SOEs), two National Grid corporations and dozens of regional distribution companies afterwards, the dominance of SPC in Chinese energy market has not changed(Ma *et al.* 2009).

Therefore, the 8% IRR benchmark should be considered as an obsolete decree and is not legitimate for CDM additionality assessment due to the integrated SPC monopoly (the best proof of the monopoly is that 70% of Chinese energy markets are dominated by coal power). As a result of unfair market competitions, the 8% IRR benchmark can not indicate project participants would have strong enough motivation to invest in wind power. Moreover, from

2002 to 2010, this benchmark has never been updated, credibly justified and regularly reviewed for eight years(Gang and Morse 2010). It is absurd to compare a benchmark IRR issued in 2002 when there was no CDM at all (the first wind CDM was in 2005). Thus, the true wind CDM's additionality in Option III relies heavily on how to revise a credible and accurate benchmark IRR.

3.4 An intrinsic E+/E- paradox

The calculation of Certified Emission Reduction (CER) is to prove a comparison between a base-line of Business As Usual (BAU) with a low GHG emission trajectory (See Fig. 2.2 in Chapter 2.3.2). E+/E- discussions for additionality can influence the establishment of baselines. Fig. 3.10 shows that tradable CERs are generated from the difference between baselines of BAU and target GHGs trajectories, which means the higher the BAU is, the more CERs can be if based on the same target reductions (BAU1 is higher than BAU2, so the CER1 is greater than CER2). Of course, since project participants wish to obtain higher profits via CERs, they would prefer to choose BAU1 if possible. In reality, domestic incentive policies for less carbon-intensive technology can markedly lead to lower BAU, thus CDM project participants' CER revenues can be greatly cut down, for instance, the feed-in-tariff for renewable energy. Furthermore, it has been revealed that some countries delayed the introduction of several proactive policies for less-carbon intensive technologies, because those policies would be integrated into the baseline and could divert international carbon financing due to disqualifying the additionality of domestic CDM projects. Therefore, E-/E+ policy guidance has been introduced by EB for two reasons: 1) not discouraging the establishment of domestic incentive policies for less carbon-intensive technologies; 2) not jeopardizing the CER revenues of CDM project participants(Gang and Morse 2010) (specific E-/E+ guidance is in Chapter 2.5.2).

While looking at the Chinese wind CDM controversy, it can be seen that EB itself has been struggling with applying E-/E+ guidance in crediting projects(Gang and Morse 2010). This guidance has resulted in misunderstandings concerning how to incorporate domestic energy policies into projects registrations. This is because that the E-/E+ guidance has an intrinsic paradox for policy makers as following:

On the one hand, taking into account the less carbon-intensive domestic policies as BAU (not deeming those policies as E-), baseline comparisons from this BAU lead to lower CERs, resulting in a perverse attitude towards implementing those policies. On the other hand, not incorporating the less carbon-intensive domestic policies into additionality assessment does not represent a credible baseline (E- leads to a non-authentic BAU). The CERs generated under E- are subject to being exaggerated, which is not credible and real emission reductions. The consequences of exaggerated CERs are contradictory to the principles of additionality assessment. Thus, the integrity of emissions caps under the Kyoto Protocol has been harmed. A target of keeping global warming below two degrees agreed at Copenhagen Conference 2009 (COP 15) has a vague future.

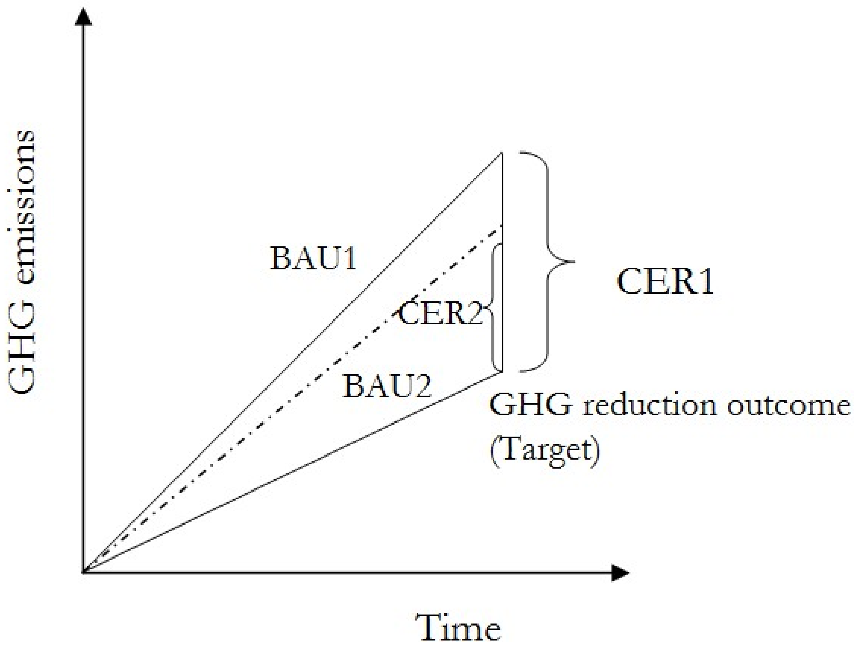

Fig. 3. 10. The baseline influences of Business As Usual (BAU) on CERs generations

Source: (Helten 2005)

CHAPTER 4 - OPPORTUNITIES FOR IMPROVEMENT

4.1 Institutional opportunities

Fundamentally, there are two criteria for the CDM scheme: additionality and sustainable development(McLaughlin *et al.* 2008). On the one hand, the composition and role of the EB are clarified by UNFCCC for supervising CDM activities, along with procedures such as initiating, registering, monitoring and certifying CDM projects and CERs. So, EB determines CDM's additionality criteria(Liang 2007). On the other hand, Non-Annex I countries have their national sovereignty to establish their own sustainable development standards. The DNA's principle role is to approve CDM projects that can meet the country's sustainable development goals(Ringius *et al.* 2002). Thus, DNA can validate CDM projects according to national priorities in terms of project types, for example, in China renewable energy has higher priority than energy efficiency and Hydrofluorocarbon (HFC) projects. So, DNA determines CDM's sustainable development criteria(Ganapati and Liu 2008).

The controversy of China's wind CDM in 2009 is caused by a set of institutional barriers of two key decision makers: EB and NDRC in China. As discussed in Chapter 3, current IRR-based additionality assessment is incompatible with China's energy market, due to NDRC's proprietary, non-market oriented wind tariff. Moreover, EB lacks a flexible and appropriate mechanism that can coherently cope with domestic preferential policies for wind power, for example, the feed-in-tariff of wind power(Gang and Morse 2010). Given the intrinsic paradox of E+/E- policy guidance, this policy guidance can not be considered as a well designed policy to address the tariff controversy. Nevertheless, there are still institutional opportunities for both NDRC and EB to handle and avoid the wind tariff controversy.

4.1.1 Institutional strengths of DNA

NDRC is the DNA of CDM in China, which is the national agency approving the country's CDM project(Helten 2005). In addition, NDRC is in charge of constituting national development policies, while ensuring China's sustainable development plans(Helten 2005). Although NDRC has unique power in terms of domestic energy policies and is the arbiter of wind tariff (see Chapter 3.2.1), there are some positive strengths in the context of CDM and potential institutional strengths for NDRC as following.

First of all, because NDRC is a powerful agency above all ministries in China that constitutes central planning, it is able to maintain national policy priorities(Ganapati and Liu 2008). Since 2005 NDRC has well established CDM institutional framework to hep reduce CDM transaction costs by streamlining validation procedures. For instance, CDM projects are submitted directly to NDRC and are not subject to provincial level approval(Helten 2005). Moreover, NDRC formulates the national five year plans, and it is able to promote CDM projects that comply with nationally broader goals of climate change mitigation and sustainable development plans(Ganapati and Liu 2008). As for scaling up CDM project markets, NDRC puts emphasis on priority sectors, which can effectively lower CDM's transaction costs and push priority sectors into a market development stage(Helten 2005). Other non-Annex I countries, for example India, take a project-by-project approach, so that CDM in those countries results in diverse project types but higher costs and CDM is only limited to rich regions(Ganapati and Liu 2008). By contrast, NDRC takes the central control and validates CDM applications, CDM projects in China are more evenly distributed among provinces and a few project types are dominant(Ganapati and Liu 2009). For example, as hydro and wind power has been placed at the top of energy development by NDRC, these two types of renewable energy account for around 70% of China's total CDM number. Hence, future wind power development benefits, at least partly, from the central preferential policies.

Secondly, NDRC emphasizes CDM policies for technology transfer(Teng and Zhang 2009). This is because NDRC requests most of China's CDM projects to have foreign cooperation, and unilateral CDM projects are not encouraged. Inter-country transfer of wind technology, especially from developed countries, can greatly promote domestic wind power development in China(Li 2009). Furthermore, NDRC levies taxes from CERs revenues for national sustainable development. Tax rates are different for sectors, for example, the levy on CERs from hydro and wind power is 2%, while the levies on non energy-related projects like HFC and N_2O are 65% and 30% respectively(Ganapati and Liu 2008). All CERs taxes are collected and deposited as national CDM fund managed by the Finance Ministry(Helten 2005). The CDM fund is spent on supporting other activities related to sustainable development, for instance, science and technology researches, raising climate change adaptation and mitigation capacity(Ganapati and Liu 2008). Domestic wind factories and investors can also use this CDM fund to promote wind power CDM in China benefiting from technology development.

4.1.2 Institutional reforms of EB

Lots of EB institutional barriers have been revealed after the wind CDM controversy, several reforms related to CDM offset scheme have been agreed at COP15, Copenhagen 7-18 December 2009. The major proposals are to streamline project registration and CERs issuance procedures as well as to establish a transparent scheme for project participants to appeal against EB's decisions. Lex de Jonge, the former chairman of the CDM EB welcomed the reforms at COP15 saying "*reforms can enhance the efficiency of the mechanism, enhance its reach, and maintain its environmental integrity*"(Wang 2010). The main targets of the reforms are to improve EB's efficiency, transparency, and impartiality in its work.

EB's efficiency can be achieved through amending its timelines and review process as mandated by deadlines. There should be independent actions to ensure compliance with established deadlines for each project's procedure and decision. Moreover, incoming registration requests can be handled efficiently in EB's executive and supervisory structures, if initial screening has been enhanced, and if adequate resources are ensured in a timely manner in terms of effective use of its panels, expertise and the secretariat(UNFCCC 2010). In addition, EB is authorized to prioritize the consideration and development of baseline and monitoring methodologies for different project types or in different regions, so that the work efficiency of additionality analysis can be improved(UNFCCC 2010).

Transparency of EB should be achieved by consulting decisions with stakeholders, establishing an appeal scheme that involves stakeholders directly for approving or implementing CDM activities. Secondly, EB should publish detailed and substantial explanations for its decisions related to CDM activities but without compromising confidential materials of stakeholders, for instance, sources of information EB refereed to, name lists of decision panel etc. EB should also establish modalities and procedures for direct communication with project participants and stakeholders with regard to individual projects(UNFCCC 2010). Furthermore, EB should welcome and take into account opinions from relevant international organizations and institutions involved besides project participants and DOEs.

Impartiality in EB's work should be ensured among regions and sectors. EB should consistently comply with inputs of support structure, the laws and regulations, specific policies, standards and guidelines applied in individual host countries(UNFCCC 2010). Besides, EB should appropriately consolidate, clarify and amend its guidance on the treatment of individual national policies, especially in the case of treatment of feed-in-tariff in the additionality assessment for renewable energy(Gang and Morse 2010). Moreover, additionality and selection of baseline should be demonstrated in consistent and standardized methodologies, particularly for demonstrating financial barrier parameters(Schroeder 2009). Supervisory guidance should be established to eliminate imparity on assessment of common practice for all regions and sectors.

4.2 Structural amendment of additionality assessment

As discussed in Chapter 3, the Chinese wind tariff controversy can be ascribed to the inability of the additionality assessment to capture a realistic and credible baseline, either through evading alternative comparison in Option II or the benchmark IRR in Option III. There are difficulties in applying the additionality assessment in China's specific context, due to lack of more rigorous application standards of additionality. The Chinese wind sector failed to compare with the factual energy BAU in the Chinese energy markets such as coal, other renewable energy, or a credible and updated IRR benchmark. Since the proprietary, non-market oriented Chinese wind tariff led to incapability of dealing with wind additionality in Chinese markets, IRR-based additionality assessment is incompatible with China's energy markets. Moreover, without a structural amendment, additionality assessment is subject to influences of preferential renewable energy policies as long as IRR relies on feed-in-tariff(Gang and Morse 2010). So, it can not be guaranteed that the additionality controversy is confined to China alone. There are two possibilities to overcome these structural barriers of additionality assessment: either by introducing Independent Power Producer (IPP) coal as the alternative in Option II, or by comprising a benchmark on the basis of IPP coal in Option III.

4.2.1 Capture China's true baseline for comparison

It should be noted that the most credible IRR coal comparison in Option II is the baselines of coal projects that are fully in market conditions and are not manipulated by political priorities. These coal projects are not SOEs, they are referred to as Independent Power Producers (IPP coal) in CDM. In the way of IPP coal, the additionality assessment is possible to capture China's true electricity emission baseline(Gang and Morse 2010).

Although the IPP coal plants account for only 10% of Chinese coal energy, the IPP coal is the most credible market-oriented share of private electricity generation assets(Gang and Morse 2010). Firstly, these IPP coal plants are established by private investors, rather than built by the government(Gilau *et al.* 2007). On condition that these coal plants are in deficit or have negative

IRR, they will definitely lose the subsidies from the central government's balance support sheet(Gang and Morse 2010). Secondly, operation decisions of IPP coal are more sensitive to market profits rather than policy, so the market-based IRR of IPP coal is logical. If the generation profit margin of IPP coal plants is too low or negative, they actually have to shut down(Mestl *et al.* 2005).

Given IPP coal plants differ from SOEs coal plants in terms of ownership and operational styles, IPP coal could render the IRR calculation more realistic and should be a reasonable indicator of investment motives(Gang and Morse 2010). However, it is worth mentioning that the electricity tariff is still fundamentally manipulated by NDRC in China. As a result, the IRR of IPP coal would be still greatly influenced by the Chinese government. The IPP coal as baseline scenario can not thoroughly overcome the additionality controversy related to capturing an optimal baseline, whereas IPP coal should be the most credible baseline option under current Chinese energy markets.

Nevertheless, using IPP coal as baseline can lead to an immediate benefit for additionality implementation. Wind power CDM only needs to demonstrate that wind power is more expensive than IPP coal, thus wind power additionality is obvious under the existing standards as long as CERs could significantly raise commercial viability of wind power(Da and Aldo 2009). The IPP coal baseline could benefit both project participants and the Chinese government, since it can mitigate regulatory barriers and eventually attract more wind power investments.

4.2.2 Establishing an appropriate IRR benchmark

As mentioned in Chapter 3.3.2, the existing IRR is rather obsolete and should not be credible as an additionality benchmark. Moreover, it is a fundamental problem to peg a benchmark determined by SOE's IRR, because politics usually trump profits in SOEs instead of basic rational investments and operation(Gang and Morse 2010).

Thus, the benchmark IRR should fully take into account market influences of non-SOEs and should be updated, justified and reviewed for capturing a current energy market. If the benchmark IRR has to reflect the updated real market conditions, pegging the benchmark by considering the market share of IPP coal would be subject to returning back to Option II. So, demonstrating wind additionality through IPP coal baseline in Option II should be the best of imperfect options.

4.3 Enhance E+/E- policy guidance

It is illustrated in Fig. 3.10 that E- policy guidance can raise the baseline emissions from BAU2 to BAU1 through ignoring domestic mitigation policies, so that there would not be perverse incentives due to the reduced CERs revenues. The average on-grid electricity price is 0.34734 yuan/KWh (mainly through coal power), but the average wind tariff in four regions granted by NDRC is 0.5443 yuan/KWh (both excluding VAT)(Gang and Morse 2010). According to the definition of E+ policy guidance, it is not convincing to consider a lowered feed-in-tariff as E+. In the case of Chinese wind power, the preferential feed-in-tariff should be deemed as E-subsidies in the end. Thus, there are two options regarding Chinese wind tariff according to E- policy guidance: either taking the wind tariff into baseline scenario or ignoring it.

On the one hand, if the wind tariff is taken into account in the baseline, as wind power only takes up less than 10% of the total Chinese energy inputs, the project participants' losses can not exceed 10% of their total CERs revenues (from BAU2 to BAU1 of GHG reductions)(Helten 2005; Wang 2008). On the other hand, if the wind tariff is ignored in the baseline, all 50 suspended Chinese wind CDM projects are fully additional comparing with on-grid electricity price (0.34734yuan/KWh is much lower than the feed-in-tariff and CERs revenues seem more significant). Besides, other wind projects that have been built anyway are also eligible for CDM financing. Over 100 million tonnes of CO_2 reductions of the 50 suspended wind CDM projects become exaggerated for diluting Annex I emission gaps(Gang and Morse 2010). Hence, the risk of ignoring wind tariff in baseline is greater than its potential perverse investment incentives. Incorporation of wind tariff in additionality assessment is more rational.

Although the E+/E- is still far from a comprehensive solution, EB must carefully analyze and respond to the intrinsic paradox of E+/E- policy guidance mentioned in Chapter 3.4. In addition, EB policymakers should have consistent attitudes towards its application in domestic energy policies, particularly for feed-in-tariff of renewable energy.

4.4 Sectoral crediting

The structural barriers of additionality assessment have implications far beyond the Chinese wind tariff controversy, as long as IRR-based additionality have dependency on domestic regulatory controls and IRR is incompatible with non-market-oriented power sectors. It is pathetic that one national favourable energy policy could affect the credibility and efficacy of the entire wind sector of CDM.

Sectoral crediting CDM (S-CDM) has been considered a possible mechanism supplementing the current CDM(Liang 2007). The S-CDM would allocate baseline standards for key energy sectors in light of emission intensity, and reduction credits would only be granted to those sectors that have less emission per unit of production than the baseline standards(Boyd *et al.* 2009). Thus, S-CDM is a top-down policy approach and can encourage nationally incentives to enact policies reducing relevant sectors' emissions over time.

The wind power sector in China would have the potential to demonstrate reductions as a utility sector and could choose to submit some broader project activities via S-CDM. If there are certain emission baseline standards for utilities, the feed-in-tariff of wind power is definitely a GHG-friendly policy that could generate verifiable emission reductions. Nevertheless, additionality is still the core theory of carbon credits. S-CDM of wind power also has to demonstrate the improved emission performance by contrast to what would have happened otherwise(Figueres 2006). However, the good news is that because wind power is integrated into an entire utility sector, incompatibility inside of China's energy markets such as BAU of coal power, inappropriate IRR benchmark would be bypassed(Gang and Morse 2010). However, it is worth mentioning that the amounts of carbon credits of S-CDM would be much greater than project-based CDM activities(Liang 2007). If there is lack of corresponding demand of carbon credits, S-CDM could reduce current carbon price and discourage mitigation in Kyoto Protocol.

The Programme of Activities (POA) is the existing scheme that has functions of S-CDM. UNFCCC stated in its 2009 annual report:

> "*The PoA approach is an example of untapped potential that can contribute to the scaling up of the CDM. In some countries, single projects are often too small to be commercially viable. Programmatic CDM could dramatically change this, as a PoA might cover an entire city, or entire state. This is expected to increase CDM.s applicability and help the mechanism come closer to achieving its vast potential. Under the present CDM framework, in order to realize the large abatement potential in all sectors, project participants need to take a programmatic approach that allows the involvement of multiple activities of various technologies, implemented at differing time and located at multiple sites under a single programme*"(UNFCCC 2009).

By far, POA has been successful in the energy efficiency sector, for instance, energy saving bulbs. Whereas experience of POA application in wind power sector is limited, wind power's additionality is still not fully understood under POA.

CHAPTER 5 – CONCLUSION

This thesis has identified detailed institutional and structural barriers of CDM additionality assessment that resulted in the suspensions of registering Chinese CDM wind projects. Interactions between the CDM carbon-offset policy and feed-in-tariff for wind sector have also been analyzed via E+/E- policy guidance. This thesis has attempted to address institutional strengths and reform opportunities for improving CDM wind projects in China, as well as to propose long-term structural amendments of the CDM additionality assessment and feed-in-tariff policy guidance recommendations.

5.1 Main findings

The National Development and Reform Commission (NDRC), which is the Designated National Authority (DNA) approving CDM projects in China, introduces a great number of barriers for defining a factual and tangible Business As Usual (BAU) baseline of CDM. The wind feed-in-tariff is set by NDRC via regulatory decree, rather than by market pricing, thus it is not possible to determine the additionality of CDM wind power projects through a market-based manner. Chinese regulator controls of NDRC are fundamentally incompatible with BAU determination of additionality (Gang and Morse 2010).

Executive Board (EB)'s institutional barriers for CDM deployment are quite obvious in the context of lack of transparency, inconsistency and lack of impartiality and low operation efficiency. EB is hoped to increase its transparency of decision-making, to help increase project participants' understanding of CDM's legal standards. However, EB's executive and supportive role is blurry.

Furthermore, because the financial additionality of CDM depends on Internal Return Rate (IRR) (a market-based manner), Chinese wind CDM's additionality is actually determined by NDRC. Besides, there is a widely structural failure of current additionality assessment, as project participants could evade comparing their wind projects with coal and other renewable projects for establishing baselines. As a result, the CDM wind power projects failed to reflect a realistic and credible emission baseline in China. The IRR benchmark is an obsolete decree and is not legitimate for CDM additionality assessment.

In addition, there is an intrinsic paradox for E+/E- policy guidance: On the one hand, taking into account the less carbon-intensive domestic policies as BAU (not deeming those policies as E-), baseline comparisons from this BAU lead to lower Certified Emission Reductions (CERs), resulting in a perverse attitude towards implementing those policies. On the other hand, not incorporating the less carbon-intensive domestic policies into additionality assessment does not represent a credible baseline (E- leads to a non-authentic BAU). The CERs generated under E- are subject to being exaggerated, which is not credible and real emission reductions(Gang and Morse 2010).

5.2 Resolutions for the CDM wind controversy

Although NDRC has unique power in terms of domestic energy policies and is the arbiter of wind tariff, NDRC is able to maintain national policy priorities for wind power sector. Moreover, NDRC emphasizes CDM policies for wind power's technology transfer, as NDRC encourages inter-country cooperations for wind sector and levies lower CERs tax on wind sector compared with other CDM project types. So, there are great opportunities for Chinese wind sector to benefit from those nationally favourable policies.

Furthermore, EB's efficiency can be achieved through amending its timelines and project review process as mandated by deadlines. Transparency of EB should be achieved by consulting decisions with stakeholders, establishing an appeal scheme that involves stakeholders directly for approving or implementing CDM activities(UNFCCC 2010). Besides, EB should publish detailed and substantial explanations for its decisions related to CDM activities. In addition, impartiality in EB's work should be ensured among regions and sectors. EB should consistently comply with inputs of support structure, the laws and regulations, specific policies, standards and guidelines applied in individual countries (UNFCCC 2010).

There are two possibilities to overcome the structural barriers of additionality assessment, either by introducing Independent Power Producer (IPP) coal as the alternative baseline in Option II, or by comprising a benchmark on the basis of IPP coal in Option III (see the additionality tool in Fig. 3.7). Currently, the IPP coal is the true market-oriented share of private electricity generation assets in China (Gang and Morse 2010), so it can be a credible BAU baseline of determining the CDM wind power's additionality.

Last but not least, sectoral crediting CDM can be a potential approach to solve the wind tariff controversy in 2009. If wind power is integrated into an entire utility sector, incompatibility inside of Chinese energy markets such as BAU of coal power, inappropriate IRR benchmark would be bypassed (Gang and Morse 2010).

5.3 Recommendation for future research

As discussed in previous paragraphs, this study has taken a top-down approach (top-down structural analysis of CDM additionality) to identify barriers and opportunities of registering Chinese CDM wind projects. Because CDM wind power investment is a financial activity, it would be meaningful to continue this study with more measure-specific research or risk control analysis. This policy study needs to enhance the mutual interpretations with various stakeholders, so that it can resolve the financial risks of CDM project participants immediately in terms of the suspended carbon financing. Further investment simulations based on precise quantitative analysis by performing statistical models can effectively help project participants evade financial risks due to the political and legal controversies.

However, this study does not encourage project participants to totally go beyond the CDM framework. This is because CDM is a regulation-based scheme anyway. The institutional reforms, future Programme of Activities (POA), establishing IRR benchmark as well as policy guidance studies will require lots of political discussions, and will definitely have a long way.

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Appendixes

Appendix 1 Tool for the Demonstration and assessment of additionality, UNFCCC

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Define realistic and credible alternatives3 to the project activity(s) through the following Sub-steps:

Sub-step 1a: Define alternatives to the project activity:

(1) Identify realistic and credible alternative(s) available to the project participants or similar project developers4 that provide outputs or services comparable with the proposed CDM project activity.5. These alternatives are to include:

(a) The proposed project activity undertaken without being registered as a CDM project activity;

(b) Other realistic and credible alternative scenario(s) to the proposed CDM project activity scenario that deliver outputs services (e.g., cement) or services (e.g. electricity, heat) with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology;

(c) If applicable, continuation of the current situation (no project activity or other alternatives undertaken).

If the proposed CDM project activity includes several different facilities, technologies, outputs or services, alternative scenarios for each of them should be identified separately. Realistic combinations of these should be considered as possible alternative scenarios to the proposed project activity.6

For the purpose of identifying relevant alternative scenarios, the project participant should include the technologies or practices that provide outputs (e.g. cement) or services (e.g. electricity, heat) with comparable quality, properties and application areas as the proposed CDM project activity and that have been implemented previously or are currently being introduced in the relevant country/region.

Outcome of Step 1a: Identified realistic and credible alternative scenario(s) to the project activity

Sub-step 1b: Consistency with mandatory laws and regulations:

(2) The alternative(s) shall be in compliance with all mandatory applicable legal and regulatory requirements,

even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. (This Sub-step does not consider national and local policies that do not have legally-binding status.)

(3) If an alternative does not comply with all mandatory applicable legislation and regulations, then show that, based on an examination of current practice in the country or region in which the law or regulation applies, those applicable legal or regulatory requirements are systematically not enforced and that noncompliance with those requirements is widespread in the country. If this cannot be shown, then eliminate the alternative from further consideration;

(4) If the proposed project activity is the only alternative amongst the ones considered by the project participants that is in compliance with mandatory regulations with which there is general compliance, then the proposed CDM project activity is not additional.

Outcome of Step 1b: Identified realistic and credible alternative scenario(s) to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

"Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both Steps 2 and 3.)"

Step 2: Investment analysis

Determine whether the proposed project activity is not:

(a) The most economically or financially attractive; or

(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

Please note guidance provided by the Board on investment analysis (attached as annex to this tool) shall be taken into account when applying this Step.

To conduct the investment analysis, use the following Sub-steps:

Sub-step 2a: Determine appropriate analysis method

(1) Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis (Sub-step 2b). If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I).

Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III).

Sub-step 2b: Option I. Apply simple cost analysis

(2) Document the costs associated with the CDM project activity and the alternatives identified in Step 1 and demonstrate that there is at least one alternative which is less costly than the project activity.

"If it is concluded that the proposed CDM project activity is more costly than at least one alternative then proceed to Step 4 (Common practice analysis)".

Sub-step 2b: Option II. Apply investment comparison analysis

(3) Identify the financial indicator, such as IRR, NPV, cost benefit ratio, or unit cost of service (e.g., levelized cost of electricity production in $/kWh or levelized cost of delivered heat in $/GJ) most suitable for the project type and decision-making context.

Sub-step 2b: Option III. Apply benchmark analysis

(4) Identify the financial/economic indicator, such as IRR, most suitable for the project type and decision context.

(5) When applying Option II or Option III, the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer. Only in the particular case where the project activity can be implemented by the project participant, the specific financial/economic situation of the company undertaking the project activity can be considered.7

(6) Discount rates and benchmarks shall be derived from:

(a) Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data;

(b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;

(c) A company internal benchmark (weighted average capital cost of the company), only in the particular case referred to above in paragraph 5. The project developers shall demonstrate that this benchmark has been consistently used in the past, i.e. that project activities under similar conditions developed by

the same company used the same benchmark;

(d) Government/official approved benchmark where such benchmarks are used for investment decisions;

(e) Any other indicators, if the project participants can demonstrate that the above Options are not applicable and their indicator is appropriately justified.

Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III):

(7) Calculate the suitable financial indicator for the proposed CDM project activity and, in the case of Option II above, for the other alternatives. Include all relevant costs (including, for example, the investment cost, the operations and maintenance costs), and revenues (excluding CER revenues, but possibly including inter alia subsidies/fiscal incentives,8 ODA, etc, where applicable), and, as appropriate, non-market cost and benefits in the case of public investors if this is standard practice for the selection of public investments in the host country.

(8) Present the investment analysis in a transparent manner and provide all the relevant assumptions, preferably in the CDM-PDD, or in separate annexes to the CDM-PDD, so that a reader can reproduce the analysis and obtain the same results. Refer to all critical techno-economic parameters and assumptions (such as capital costs, fuel prices, lifetimes, and discount rate or cost of capital). Justify and/or cite assumptions in a manner that can be validated by the DOE. In calculating the financial/economic indicator, the project's risks can be included through the cash flow pattern, subject to project-specific expectations and assumptions (e.g. insurance premiums can be used in the calculation to reflect specific risk equivalents).

(9) Assumptions and input data for the investment analysis shall not differ across the project activity and its alternatives, unless differences can be well substantiated.

(10) Present in the CDM-PDD submitted for validation a clear comparison of the financial indicator for the proposed CDM activity and:

(a) The alternatives, if Option II (investment comparison analysis) is used. If one of the other alternatives has the best indicator (e.g. highest IRR), then the CDM project activity can not be considered as the most financially attractive;

(b) The financial benchmark, if Option III (benchmark analysis) is used. If the CDM project activity has a less favourable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive.

Sub-step 2d: Sensitivity analysis (only applicable to Options II and III):

(11) Include a sensitivity analysis that shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favour of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially/economically attractive (as per Step 2c para 11a) or is unlikely to be financially/economically attractive (as per Step 2c para 11b).

Outcome of Step 2: If after the sensitivity analysis it is concluded that: (1) the proposed CDM project activity is unlikely to be the most financially/economically attractive (as per Step 2c para 11a) or is unlikely to be financially/economically attractive (as per Step 2c para 11b), then proceed to Step 4 (Common practice analysis) Otherwise, unless barrier analysis below is undertaken and indicates that the proposed project activity faces barriers that do not prevent at least one alternative from occurring, the project activity is considered not additional.

Step 3: Barrier analysis

If this Step is used, determine whether the proposed project activity faces barriers that:

(a) Prevent the implementation of this type of proposed project activity; and

(b) Do not prevent the implementation of at least one of the alternatives.

The identified barriers are only sufficient grounds for demonstration of additionality if they would prevent potential project proponents from carrying out the proposed project activity undertaken without being registered as a CDM project activity.

If the CDM does not alleviate the identified barriers that prevent the proposed project activity from occurring, then the project activity is not additional.

Use the following Sub-steps:

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity:

(1) Establish that there are realistic and credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity was not registered as a CDM activity. Such realistic and credible barriers may include, among others:

(a) Investment barriers, other than the economic/financial barriers in Step 2 above, inter alia:

- *For alternatives undertaken and operated by private entities: Similar activities have only been implemented with grants or other non-commercial finance terms. Similar activities are defined as activities that rely on a broadly similar technology or practices, are of a similar scale, take place in a comparable environment with respect to regulatory framework and are undertaken in the relevant country/region;*
- *No private capital is available from domestic or international capital markets due to real or perceived risks associated with investment in the country where the proposed CDM project activity is to be implemented, as demonstrated by the credit rating of the country or other country investments reports of reputed origin.*
- *Skilled and/or properly trained labour to operate and maintain the technology is not available in the relevant country/region, which leads to an unacceptably high risk of equipment disrepair and malfunctioning or other underperformance;*
- *Lack of infrastructure for implementation and logistics for maintenance of the technology (e.g. natural gas can not be used because of the lack of a gas transmission and distribution network);*

(b) Technological barriers, inter alia:

- *Risk of technological failure: the process/technology failure risk in the local circumstances is significantly greater than for other technologies that provide services or outputs comparable to those of the proposed CDM project activity, as demonstrated by relevant scientific literature or technology manufacturer information;*
- *The particular technology used in the proposed project activity is not available in the relevant region.*

(c) Barriers due to prevailing practice, inter alia:

The project activity is the "first of its kind".

(d) Other barriers, preferably specified in the underlying methodology as examples.

Outcome of Step 3a: Identified barriers that may prevent one or more alternative scenarios to occur.

Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the *alternatives (except the proposed project activity):*

(2) If the identified barriers also affect other alternatives, explain how they are affected less strongly than they affect the proposed CDM project activity. In other words, demonstrate that the identified barriers do not prevent the implementation of at least one of the alternatives. Any alternative that would be prevented by the barriers identified in Sub-step 3a is not a viable alternative, and shall be eliminated from consideration.

(3) In applying Sub-steps 3a and 3b, provide transparent and documented evidence, and offer conservative interpretations of this documented evidence, as to how it demonstrates the existence and significance of the identified barriers and whether alternatives are prevented by these barriers. Anecdotal evidence can be included, but alone is not sufficient proof of barriers. The type of evidence to be provided should include at least one of the following:

(a) Relevant legislation, regulatory information or industry norms;

(b) Relevant (sectoral) studies or surveys (e.g. market surveys, technology studies, etc) undertaken by universities, research institutions, industry associations, companies, bilateral/multilateral institutions, etc;

(c) Relevant statistical data from national or international statistics;

(d) Documentation of relevant market data (e.g. market prices, tariffs, rules);

(e) Written documentation of independent expert judgments from industry, educational institutions (e.g. universities, technical schools, training centres), industry associations and others.

Step 4: Common practice analysis

Unless the proposed project type has demonstrated to be first-of-its kind (according to Sub-step 3a), the above generic additionality tests shall be complemented with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region. This test is a credibility check to complement the investment analysis (Step 2) or barrier analysis (Step 3). Identify and discuss the existing common practice through the following Sub-steps:

Sub-step 4a: Analyze other activities similar to the proposed project activity:

(1) Provide an analysis of any other activities that are operational and that are similar to the proposed project activity. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to

regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis. Provide documented evidence and, where relevant, quantitative information. On the basis of that analysis, describe whether and to which extent similar activities have already diffused in the relevant region.

Sub-step 4b: Discuss any similar Options that are occurring:

(2) If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity is financially unattractive (as contended in Step 2) or faces barriers (as contended in Step 3). Therefore, if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is financially/economically unattractive or subject to barriers. This can be done by comparing the proposed project activity to the other similar activities, and pointing out and explaining essential distinctions between them that explain why the similar activities enjoyed certain benefits that rendered it financially/economically attractive (e.g., subsidies or other financial flows) and which the proposed project activity cannot use or did not face the barriers to which the proposed project activity is subject. If necessary data/information of some similar projects are not accessible for PPs to conduct this analysis, such projects can be excluded from this analysis. In case similar projects are not accessible, the PDD should include justification about non-accessibility of data/information.

(3) Essential distinctions may include a serious change in circumstances under which the proposed CDM project activity will be implemented when compared to circumstances under which similar projects were carried out. For example, new barriers may have arisen, or promotional policies may have ended, leading to a situation in which the proposed CDM project activity would not be implemented without the incentive provided by the CDM. The change must be fundamental and verifiable.

"If Sub-steps 4a and 4b are satisfied, i.e.(i) similar activities cannot be observed or (ii) similar activities are observed, but essential distinctions between the project activity and similar activities can reasonably be explained, then the proposed project activity is additional)".

"If Sub-steps 4a and 4b are not satisfied, i.e. similar activities can be observed and essential distinctions between the project activity and similar activities cannot reasonably be explained, the proposed CDM project activity is not additional."

Source: (EB 2008)