THE CDM AND ITS CONTRIBUTION TO RENEWABLE ENERGY DEPLOYMENT IN CHINA

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Abstract

The CDM is a market-based mechanism with a dual goal: it is designed to lead to cost-efficient reductions of greenhouse gases and it is supposed to contribute to sustainable development. In China, it has not fully lived up to the expectations it had raised: while the majority of projects are renewable energy projects, the bulk of revenues is raised by a dozen of HFC projects, which have almost no sustainable development benefits. Although the Chinese government has set out ambitious targets for the deployment of renewable energies, the CDM contributes so far only marginally. Studies so far have shown that the CDM is only increasing the internal rate of return of renewable energy projects by 1-2.4% (Bode/Michaelowa 2003), and only by 0.33% for wind energy projects in China (Yang 2004). Thus, projects that pass the feasibility threshold must have been very close to financial viability even before they were turned into CDM projects.

Drawing on innovation theory, the article argues that is it the task of the host governments to lead RE technologies to a stage of commercialisation when CDM financing can become crucial. For an assessment of the current policy mix in place in China for the deployment of renewable energies, the article compares the national Chinese regulations for renewable energies and China’s specific CDM rules for their impact: where do national and CDM regulation for the promotion of renewable energies provide synergies, where does the policy-making on these two levels collide? After a description and analysis of the two-level set of policies in place for the promotion of renewable energies in China, the article concludes with lessons-learnt from China’s current governance framework for renewable energies for future policies that are able to take renewable energy projects closer to the financial viability threshold, making the CDM better applicable.

Acknowledgements

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INTRODUCTION

Contribution of renewable energies to an avoidance of a carbon lock-in in China

The deployment of renewable energies (RE) in China has a great potential for climate protection as RE can help to avoid a carbon-lock in of China’s energy production and instead foster a low-carbon development (Unruh/Carrillo-Hermosilla 2006). In addition, RE deployment can reduce China’s increasing import dependence on fossil fuels. The Chinese government acknowledges the importance of RE for its energy security and has voiced ambitious targets: the current 8% share of RE in the total installed electricity generation capacity is supposed to be raised to 10% in 2010 and 16% in 2020 (Zhang 2005). Targets for wind energy are especially high: its installed capacity is supposed to reach 5 GW in 2010 and 30 GW in 2020, increasing its capacity by more than 30 times from the current level of 1266 MW (He/Zhang 2005; GTZ 2005). RE are not new to China: wind mills have been used in rural areas since the 1980s, China is the world’s frontrunner in production and installation of solar thermal energy, and its local industry is quickly picking up in production and installation of solar cells and wind turbines. Nevertheless there is a huge gap between the current use of RE, the political ambitions and the technological potentials for RE in the country.

Chart 1: Development and projections for the installed capacities of selected RE between 2000-2020 in MW

![Chart 1: Development and projections for the installed capacities of selected RE between 2000-2020 in MW](source)

This gap expands by the large need for investments in power generation capacity, which China faces in the next two decades (see chart 2 below). With the total power generation capacity increasing in size, the target of having a 16% share of power production by RE in 2020 would imply a large absolute growth for RE. However in China, but also in many other countries, renewable energy technologies face the dilemma of being politically wanted, but commercially unattractive. This is not true for all RE technologies in China: some of them, e.g. solar thermal and to some extent wind energy have already entered the stage of commercialisation (AHK Peking 2006). Financial investment, e.g. by the Clean Development Mechanism (CDM) and adequate national political policies could greatly advance RE deployment by pushing them towards the stage of commercialisation.

Chart 2: Electricity generation capacity needs

![Chart 2: Electricity generation capacity needs](source)
This article is a first attempt at examining the contribution the CDM has made so far for the deployment of renewable energies in China. It starts by giving a brief introduction to the background of the CDM, its contribution to the deployment of RE technologies worldwide and in China. In a second step, a model derived from innovation theory is introduced for an explanation of how government regulations impact on RE project risk. The final analysis compares the Chinese general regulations for RE deployment with the international and Chinese CDM specific requirements. The conclusion identifies synergies and contradictions between these two sets of regulations relevant for RE projects in China.

USING MARKET-BASED MECHANISMS TO DEPLOY RENEWABLE ENERGIES

The CDM as an instrument to finance low carbon development

The CDM has been developed as a means to reduce greenhouse gas (GHGs) emissions cost-efficiently by allowing for emission reductions in developing and newly industrializing countries, which become credited for but also financed by industrialised countries of the Kyoto Protocol. The CDM is thus mainly a financing tool to lead investment into clean energy technologies, thereby contributing to the transition to a low carbon economy in developing countries. As RE are a major project category under the CDM, expectations are high that the CDM would also help to speed up the deployment of RE by providing finance, technology transfer and a demand for greenhouse gas reductions.

The CDM is one of three flexible mechanisms of the Kyoto Protocol, which poses legally binding reduction targets for six greenhouse gases for industrialised countries. Agreeing on the principle of “common but differentiated responsibilities” industrialised countries committed themselves to make the first step of reducing GHG emissions as they had been contributing the most GHG into the atmosphere during their process of industrialisation. Listed in Annex I of the Kyoto-Protocol, these “Annex I countries” agreed on fixed emission reduction targets based on 1990 emission levels for the first commitment period of 2008-2012. Developing countries – referred to as “Non-Annex I countries” in the Kyoto Protocol - are not yet obliged to any fixed targets, but can become host countries to CDM projects. Each tonne of CO₂ equivalent reduced in a Non-Annex I country becomes – if all CDM requirements are met – registered as one “Certified Emission Reduction” (CER) and become tradable on the carbon market.

The market for CERs has grown considerably since it was initiated by the coming into force of the Kyoto Protocol in February 2005. An additional boost gave the initiation of the European Emission Trading System (EU ETS) in January 2005 that allocates emission allowances to European companies responsible for high GHG emissions. The system of CDM and EU ETS are connected by the EU Linking Directive, which allows European companies to meet up to 12% of their reduction obligations by buying CERs from CDM projects. Despite a clear mandate and the 2% administration charge on each CDM project devoted to a fund for CDM projects in least developed countries, the current CDM portfolio shows that the carbon market is bypassing the poorest countries and instead focuses on countries like China, India and Brazil, which offer less risk and more market potential.

The CDM as a tool to promote renewable energies

Renewable energies are central for the transition towards low carbon economies as they reduce the consumption of fossil fuels, which produce an average of 2.3 tonnes of CO₂ for each tonne of oil equivalent (Waller 2004). As any other emission trading scheme, the CDM assigns a price on emission reductions, so that CERs become a commodity which can be traded and which provide an extra financial incentive to developers of RE projects in developing countries. While RE projects reduce GHG emissions on the supply side of electricity production, energy efficiency CDM projects are important to address energy consumption on the demand side. CDM projects reduce not only GHGs emissions cost-efficiently and enable Annex I countries to meet their emission reduction targets, but they can also be drivers for emerging RE markets in the CDM host countries. The CDM is a mechanism that provides not only additional finance, but also brings together project developers, validators, and project investors from developed and developing countries. While unilateral CDM projects are also allowed, bilaterally implemented CDM projects ideally should facilitate knowledge exchange and technology transfer among its partners and open up new business opportunities.

Especially renewable energy projects deliver not only GHG emission reductions, but also sustainable development benefits to their local environment. In the context of the CDM, RE projects support local sustainable development e.g. by providing access to electricity and heating in remote areas or by creating jobs in the local RE industry. RE CDM projects should therefore be considered to be the core of the CDM project fleet, as the Kyoto Protocol mandates the CDM with a dual goal - GHG emission reduction and sustainable development – which RE and energy efficiency projects are best able to achieve.
World wide achievements of the CDM in promoting renewable energies

Exactly two years after the coming into force of the Kyoto Protocol, the CDM has proven to be successful in terms of project numbers: nearly 500 CDM projects in 55 host countries are registered and about 1000 CDM projects are under preparation. In June 2006 the threshold of one billion tonnes of CO₂ equivalent ad the expected reduction volume of CERs up to 2012 has been passed (UNFCCC 2006), showing that the CDM is making a substantial contribution to the cost-effective reduction of GHGs.

Concerning RE projects the contribution of the CDM needs to be differentiated along the following line: although renewable energy projects are the most common type of approved projects (see chart 3), they only generate about 40 million or 20% of all carbon credits up to 2012 (see chart 4). In contrast, 40 million credits will be generated by two HFC-23 projects in China and 70 million – almost half of all credits – will be generated by a large N₂O project in South Korea (Fenhann 2007). While these projects on industrial gases with a high potential of warming up the climate do contribute to climate protection, they do not deliver any sustainable development benefits.

The CDM and its contribution to renewable energy deployment in China

China took a relatively slow start in the CDM market until institutions for the administration and approval of CDM projects had been set up. In the beginning of 2007, China has caught up to such an extent that its CDM projects make up 19.9% of the world’s total (see chart 5), while the CERs generated up to 2012 by Chinese CDM projects are expected to reach 47.2% of the total (see chart 6). Despite such a large share of China in the CDM market, the contribution of the CDM for a transition towards a low carbon economy has been low as 47% of all CERs generated in China come eleven CDM projects of HFC23 destruction.

Chart 3: Share of renewable energy CDM projects of world’s total in February 2007

Source: Own calculation based on Fenhann 01.02.2007

Chart 4: Share of CERs up to 2012 of renewable energy CDM projects in world’s total in February 2007

Source: Own calculation based on Fenhann 01.02.2007

Chart 5: Share of no. of China’s CDM projects in world’s total in February 2007

Source: Own calculation based on Fenhann 01.02.2007

Chart 6: Share of China’s CERs generated up to 2012 in world’s total in February 2007

Source: Own calculation based on Fenhann 01.02.2007
While China can account for a large share of the worldwide CDM market in general, the revenues derived from RE projects in China are relatively low. As the chart 7 below displays, only a percentage of 12% of China’s CERs are generated by renewable energy projects, despite their large number of 184 in February 2007 (see chart 8) (Fenhann 2007). This ratio of high revenues for a small number of HFC projects and low revenues for a large number of renewable energy projects signifies the major shortcoming of the CDM for the deployment of renewable energies: compared to other CDM project types, RE projects are not the most profitable ones.

**Chart 7: Share of CERs up to 2012 of renewable energy CDM projects in China’s total in February 2007**

Source: Own calculation based on Fenhann 01.02.2007

**Chart 8: Share of no. of renewable energy CDM projects in China’s total in February 2007**

Source: Own calculation based on Fenhann 01.02.2007

Although for-profit CDM market actors naturally choose to pick the “low hanging fruits” first, the absolute number of RE projects in the Chinese CDM portfolio raises optimism: the 184 RE projects make up 62% of all Chinese CDM projects. From such a high share, the conclusion must be that it is financially worthwhile also to invest in renewable energy CDM projects. However, the chart 7 also shows clearly the differences in attractiveness of renewable energy technologies and mirrors worldwide trends of RE investment: almost 50% of all CDM projects registered are wind power projects. In contrast, no single photovoltaic (PV) project has been established as a CDM project in China. The chart however also reflects general trends in worldwide CDM project type distribution: only seven out of 1586 projects in the pipeline involve PV. Based on these figures, one could conclude that the CDM is able to push many hydro and wind energy projects over the financial viability threshold, but so far no PV projects.

**Barriers to the CDM for financing renewable energies**

The figures of the status quo of the CDM in relation to RE projects show that while RE project are highest in terms of number, they do not generate the most revenue in terms of CERs. While it makes certainly sense to quickly phase out highly climate destructive gases like HFC23, the potential of RE (and energy efficiency) projects as drivers for a transition towards low carbon economies is not fully tapped in the present situation. Two main barriers can be identified why RE projects do not as good as they could in the present situation.

1. **Barrier: Low quantity of CERs versus high transaction costs**

   Cost is one of the most obvious explanations for the lagging deployment of renewable energies in general. Unfortunately, this barrier for RE projects is also valid for CDM projects since they have higher transactions costs and gain less CERs than other CDM project types. Transaction costs for CDM emerge due to the CDM registration procedures. A project needs to be designed by a project developer, validated by a so called “Designated Operational Entity (DOE)”, approved by the host country, registered with the Executive Board, monitored during implementation, and GHG emission reductions need to be verified by a DOE before CERs are issued. In addition, all projects have to pay a 2% fee for the adaptation fund, which finances projects that help communities adapt to climate change. A registration fee ranging between 5000 and 30,000 USD has to be paid for each project depending on its size. As a consequence the thumb rule applies that the smaller the project, the higher the transaction costs.

   CERs are calculated based on projections of the emission reductions the CDM project is going to make. Since the six GHGs of the Kyoto Protocol are evaluated differently according to their potential to drive global warming, one prevented tonne of e.g. HFC 23 receives 12,000 CERs, while one prevented tonne of CO<sub>2</sub> receives only one CER. Because the profit margin becomes larger the more CERs are issued for a project, project developers and buyers have a strong preference of large CDM projects generating millions of CERs with low transaction costs. Since most RE projects produce only small amounts of CERs, they are at a comparative disadvantage compared to other types of CDM projects. There are also differences among RE projects with regard to their implementation and maintenance costs: hydro and wind power projects are often financially viable projects even without additional
CDM financing, while even extra financing by the CDM is often not sufficient to lead to financial closure of solar projects. Prices for CERs from RE CDM projects vary according to project risk, the buyer, and on any additional quality requirements like the CDM Gold Standard.\(^1\) With a current floor price of 5 USD/CER in China, the CDM does not provide much additional finance to RE projects. Studies so far have shown that the CDM is only increasing the internal rate of return of RE projects by 1-2.4% (Bode/Michaelowa 2001) and by 0.33% for wind energy projects in China (Yang 2004), while CDM financing can increase the IRR of biomass power generation projects by around 5%.

2. Barrier: Dilemma of additionality
The regulative rules for the CDM as set out in the Marrakesh Accords require CDM projects to be additional to the business-as-usual scenario. The additionality requirement is justified because it upholds the environmental integrity of the CDM process: only additional emission reductions can be accounted for the reduction targets of Annex I countries in order to ensure a global net reduction of GHGs. In practice, the project developer has to prove that the project under consideration would not have been implemented without the CDM. Evidence for the additionality can be achieved by one of three tests: CDM finance leads to financial closure; and/or the technology used for the CDM project is more advanced than the conventional technology; and/or any other barriers due to ‘prevailing practice’ are overcome thanks to the CDM.

As finance through the CDM increases the internal rate of return only marginally, projects have to be near to financial closure even without the CDM, but they must not be financially viable by themselves because this would disqualify them for the first additionality criterion. Even if in practice this dilemma is not posing a strict barrier for RE CDM projects yet, RE technologies like hydro, wind and solar thermal, which (almost) have reached the commercialisation stage, might face difficulties in proving their additionality in the future.

The additionality criterion was also cause for a ‘perverse’ incentive by encouraging host countries not to implement progressive policies for renewable energies and energy efficiency. The reason was that national policies intended for the promotion of renewable energies change the “business as usual” scenario, thus diminishing the chances of CDM RE projects to become additional in the sense of using RE technology beyond the usual standard in the country. This potential dilemma has been solved for the time being by a decision of the Executive Board of the CDM not to account national policies into the baseline calculation that have been implemented after November 2001 in order not to “punish” national governments of developing countries that e.g. pass progressive policies for the deployment of renewable energies (UNFCCC 2003).

EFFECTIVE GOVERNANCE FOR RENEWABLE ENERGY DEPLOYMENT
The description of the status quo of CDM RE projects worldwide and in China has shown that the CDM provides additional financing, but still faces barriers and cannot be considered to be the main driver of RE deployment. From a political scientific perspective, two main roads for a more effective deployment of RE technologies exist in the context of the CDM: either the member states of the Kyoto Protocol agree on measures that would give RE projects a preferential treatment under the CDM or each host country sets up a national regulatory framework that guides CDM investment into preferred project types. While an international agreement on preferential treatment of renewable energy projects is unlikely, experiences have shown that national regulations can develop synergies with the current CDM procedures for a more effective deployment of renewable energies. The following chapters will therefore first examine already existing assumptions in the literature about best practices for government and private actors to promote renewable energies. In a second step, the experiences and approaches of the Chinese government are described and analysed for their effects on RE CDM projects and for the general deployment of renewable energies.

\[^1\] The CDM Gold Standard has stricter requirements for sustainable development impacts and community participation in CDM projects than required by the Kyoto Protocol. More information at: [www.cdmgoldstandard.org](http://www.cdmgoldstandard.org) [15.01.2007].
RE technologies in China. This analysis will show whether national policies are able to steer the international CDM processes towards tapping more of the RE potential in China.

Role of the CDM in the life-cycle of renewable energy deployment
Innovation theory has become an extensive source for the debate about effective governance of renewable energies. Starting from the general debate on the relation between regulation and innovation (e.g. Frauenhofer 2004), a discussion has emerged on the application of innovation theory for the deployment of RE for climate protection (e.g. Carbon Trust 2003, Grubb 2004, Stern 2006). Scientists and practitioners share the viewpoint that a deployment of RE depends on a well-matched interplay between private and public incentives as a support for the commercialisation of renewable energies. According to innovation theory, technologies follow a life-cycle (see Chart 10) from their invention by research mainly funded by public money via a stage of commercialisation towards the final stage of diffusion in which a level playing field with conventional energy technologies is reached, easily measurable by the break-even point of costs compared to conventional energy production (Carbon Trust 2003, Grubb 2004). Once this stage is reached, the role for public incentives declines and the further diffusion of RE technologies is left to the ‘invisible hand’ of market forces.

Chart 10: The life-cycle of RE deployment and the status of PV, Wind and solar thermal technologies in China

Taking China as an example, the status quo of RE diffusion displays their position along the phases of the life-cycle model: PV is mainly covering niche markets (e.g. in remote areas without grid-connection) and thus is still in the demonstration phase. Wind energy has become competitive with conventional energy but only due to supporting government policies and finance, and has thus almost reached the commercialisation phase. Only solar thermal energy has reached the break-event point in China with no more need for government support and can thus be described as having reached full commercialisation status even if it has not yet become the “business-as-usual” scenario for water heating, which would identify solar thermal of being fully diffused (AHK Peking 2006).

The status of individual RE technologies in the life-cycle model has to be taken into consideration for designing an adequate governance strategy for their deployment. An almost 25-year-old scientific debate exists about the best policy instruments to strengthen deployment of RE. The debate draws mainly on the economic dichotomy of price-versus-quantity incentives (e.g. Mananteau et al. 2002; Lewis/Wiser 2007), and follows the overall trend to recommend market-based approaches for triggering innovation (e.g. Sonneborn 2004). Critical voices doubt the transferability of economic instruments to countries with economies in transition and draw attention to the preconditions needed for such a transfer (e.g. Panayotou 1998, O’Connor 1996), especially in relation to RE (Kammen 2004). The question of whether the preconditions are in place to make an instrument fully effective also applies to the CDM as a market-based instrument that is applied in newly industrialising and developing countries in which economies – and especially the energy sector – are just beginning to be transferred into a liberalised market.
The CDM is mainly a market-based instrument which – even if it was designed and brought to life by the state parties to the Kyoto Protocol – is intended to bring private investments from Annex I countries’ companies to RE projects in Non-Annex I countries. Private investment is attracted to CDM projects which give a decent rate of internal return, thus preferring RE technologies like wind and hydro, which are nearly fully commercialised. For this reason, the CDM becomes important for technologies which are in the phase of commercialisation, but are not yet fully diffused. If they would be fully diffused, meaning that they had reached the status of being the “business as usual” technology in a country, they might be even more attractive to private investors. However, projects that have reached full diffusion status would not be eligible any more as CDM projects because they would not be able to pass the additionality test of being either not financially viable by themselves or of using technology that is above the “business as usual”-scenario.

If a government with ambitious plans for the deployment of renewable energies would like to attract CDM investment also for RE technologies that have so far been left out, its task would be to use policies to push the respective technology exactly to the status of deployment where it becomes commercially attractive, but is not yet able to reach financial closure by common sources of finance alone or is not yet the “business as usual” technology. Two options of raising the attractiveness of RE technologies for the CDM exist: general national regulation supporting RE can speed up their deployment process and specific CDM rules can steer foreign private investment into directions which are the priorities of the host government. Taking China as a case study, the remaining parts of the article examine the impact of national regulations and specific CDM rules on the contribution of the CDM to the deployment of RE.

CHINESE POLICIES FOR THE DEPLOYMENT OF RENEWABLE ENERGIES

With ambitious targets fixed for the deployment of RE at the national level, the Chinese government has passed several regulations independent from the CDM to increase the installed capacity of RE. China has already made some experiences with the employment of market-based policy instruments at the national level and has a set of Chinese CDM regulations tailor-made to steer financial investment in RE. Currently, the Chinese government is using policy instruments with an impact on RE projects on the macro- and micro-level of policy making:

- National regulations set the general framework conditions for all renewable energy projects,
- Chinese CDM regulations further set the specific rules for CDM projects such as approval procedures.

This kind of two-level regulation is not always in harmony: both levels can create synergies when e.g. a heavy CDM fee on non-renewable projects is supposed to steer more investments into RE projects. Both levels can collide, if e.g. the Chinese CDM procedures request a 51% project ownership by domestic firms and a 70% local content of equipment, which is diminishing profit margins for foreign investors and is thus shrinking their potential engagement in RE projects. The puzzle is thus on the right mixture of national policies and CDM regulation to tap the whole potential of the CDM for the deployment of RE in China. In the following paragraphs, the Chinese national regulations with effect on the deployment of RE and China’s specific CDM rules are first described and in a second step analysed for their interplay.

Policies for RE deployment at the national level

The Chinese Renewable Energy Law. The Chinese Law for the Promotion of Renewable Energies (“RE law”) has become enacted since 1 January 2006. In general, the RE law supports the deployment of wind-, solar-, biomass-, geothermal- and oceanic energy. Hydro power is regarded as eligible, but further guidelines for hydro power still need to be drafted. In its current form, the RE law includes mainly general guidelines for the deployment of renewable energies, which need to be further specified. Quantitative targets are supposed to be included in the guideline for „Mid- and Long-term Targets for Renewable Energies“(§7), which is supposed to guide the development of plans for the deployment of renewable energies on the national and the local level (§8). Subsequent to the RE law, an executive order on electricity prices („Pricing and Cost Sharing for Renewable Energy Power Generation“) has become effective since January 1st, 2006, and allows producers of electricity producers that use renewable energies to demand a higher tariff from grid operators in comparison to conventional power producers. Additional costs have to be borne by the grid operators and by consumers respectively.

Local content requirement. The local content requirement of 70% on wind power plants came into force in 2001 with the objective of protecting the emerging national renewable energy industry. The local content requirement also applies to other RE technologies such as PV installations, gas turbines, desulphurization plants and highly efficient coal power plants, but varies in its percentage of local content requirement (NREL 2004b).

Favourable taxation. China is introducing tax reduction for companies in the renewable energy industry (see overview in table 1). The regular tariff for value-added tax in China is 17%, but it is discussed to delete it for
renewable energy equipment. The income tax on revenues from biogas and wind power has already been reduced from 33% to 15%. Since 2006, there is no more value-added tax on Ethanol.

Table 1: Tax tariffs for selected renewable energy equipment

<table>
<thead>
<tr>
<th>Category</th>
<th>Value-Added Tax (VAT)</th>
<th>Value-Added Annex Tax</th>
<th>Income tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>17%</td>
<td>8% of VAT</td>
<td>33%</td>
</tr>
<tr>
<td>Biogas</td>
<td>13%</td>
<td>8% of VAT</td>
<td>15%</td>
</tr>
<tr>
<td>Wind</td>
<td>8.5%</td>
<td>8% of VAT</td>
<td>15%</td>
</tr>
<tr>
<td>Small hydro (&lt;25 MW)</td>
<td>6.5%</td>
<td>8% of VAT</td>
<td>33%</td>
</tr>
<tr>
<td>Ethanol production</td>
<td>0%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Landfill gas</td>
<td>0%</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

Source: NREL 2004a, AHK 2006

Concession law for wind power. In 2001 the Chinese government has introduced the Wind concession law, which runs in parallel to the individual negotiations on power purchase price and contract. The Chinese wind concession law draws on experiences from the British Nonfossil Fuel Obligation. The general idea is that a local government invites tender from domestic and international investors for a wind energy project sized 100-200 MW and with an installation size not smaller than 600 kW. Under the concession model, contract duration is 25 years and payments are made in two phases: In the first 10-15 years or for the first 30,000 full load hours, the feed-in-tariff is determined by the respective offer. In the second phase, the price is purchased according to the average local price for electricity. It is planned to have 3,000 MW in 100 MW batches on offer for bidding in the years to come (Albers 2005). Up to 2006, four rounds of tenders have been initiated for wind parks with a total installed capacity of 1,100 MW with an investment of approximately US$ 1.1 billion. The offered feed-in-tariffs vary between 3.8 and 5.2 €-Cent/kWh, which is quite a substantive reduction compared to common prices of the past. The price for wind power form concession projects has decreased by 37% from an average of 7.2 €-Cent/kWh at the end of 2004 to an average of 4.7 €-Cent/kWh at the end of 2005 (Ku et al. 2005 und Haugwitz 2006).

CDM rules relevant for RE projects

Although the CDM is a part of an international agreement, host countries to the CDM have the responsibility to approve CDM implementation in their countries. This opens a window of opportunity for national governments to set incentives for CDM project types they consider to be especially important for their sustainable development. By the right policy mix the gap between the political RE deployment targets and actual implementation of RE projects can be diminished and the disadvantage of renewable energy CDM projects in comparison with other CDM project types can be mitigated. The competitiveness of RE CDM projects in China can be supported in comparison to other project types and in comparison to other host countries by adequate national regulation and risk reduction.

Regulative structure for the CDM. Most of China’s specific CDM rules are part of the “Measures for Operation and Management of Clean Development Mechanism Projects in China” (www.ccchina.gov.cn). The National Development and Reform Commission (NDRC) has been assigned as China’s Designated National Authority (DNA) and has the mandate to give host country approval to CDM projects. The approval procedure includes a consultation with the National CDM Board, which is part of the National Coordination Committee on Climate Change (NCCCC). The NCCCC is the authority responsible for CDM coordination of CDM-related issues and drafting CDM policies (IGES 2005). On the provincial level, several regional CDM centres have been set up by the government to promote the CDM and for offering consulting services to local and international companies interested in setting up CDM projects in the respective regions.

Priority areas for sustainable development. Since an international valid definition of sustainable development is hard to achieve and individual countries demand their own right to determine what they perceive necessary for their development, the responsibility for the approval of CDM projects project according to its own criteria of sustainable development is left to each host country. China has chosen three priority areas for CDM investment: First, improvement of energy efficiency; second, increased use of renewable energies, and third avoidance respectively usage of methane. Out of the 297 CDM projects registered or in the pipeline for China, 36 are energy efficiency projects, 184 are RE projects, and 26 are avoiding methane or using it for electricity production (Fenhann 2007). With regard to the number of projects, the project types implemented in China and the priority areas of the Chinese government match. However, with regard to generation of CERs, the eleven HFC projects receive 47% of the total revenues due to their high number of CERs assigned.

CDM project fee. The match between China’s priority areas and the actual CDM implementation can partly be explained by the so-called “royalty fee” China imposes on all CDM projects. The fee is 2% for CDM projects of the priority areas, 30% for N₂O projects, and 65% for HFC and PFC projects (Bfai, 2005). Revenues from the fee are
apparently paid into a China Climate Fund, which is still in the process of being set up. The fee on CDM projects imposed by China is innovative because it leads investment into China's priority areas and because it diminishes the comparative disadvantage of RE project which are not taxed highly in comparison to N₂O, HFC, and PFC projects. From a governance perspective, the fee measure illustrates how a national government is able to bend an international regulation towards its own priorities.

**Government approval for CER price.** In order to avoid selling emission reductions at dumping prices, the Chinese government requires its approval for CERs prices based on the criteria that CER prices must reflect international average (Bfai 2006). Again, this interference by the government in negotiations between two private parties of a CDM project is unique in host countries' measures to influence CDM implementation.

**Project ownership.** The Chinese CDM rules require that a CDM project is to 51% owned by a Chinese company and restrict foreign ownership to 49%. This rule ensures Chinese firms keep controlling interest, but it limits risk management possibilities for foreign partners. For this reason, foreign companies currently are mainly found as mere buyers of CERs generated by CDM projects which have been conducted by Chinese companies and respective consultancies. Project that are only implemented for the reduction of greenhouse gases, e.g. landfill gas projects, which are more in need of foreign financial and technical assistance than projects for which CDM financing plays only a marginal role, are thus hampered by the 51% Chinese ownership rule.

**Synergies and contradictions between national regulations for the deployment of RE technologies and specific CDM rules for the deployment of RE in China**

The general Chinese regulations in general help to provide CDM project investors with relatively stable and predictable political framework conditions which reduce the country risk of projects. Targets for RE set in Chinese government plans give an indication of the current political stand towards RE, but their realisation depends on the effectiveness of governance at the provincial and local level for their implementation.

**Economic viability.** Economic instruments like reductions on value-added and income tax for certain RE equipment and operation help to raise the internal rate of return of RE projects. Fixed feed-in-tariffs as promised by the RE law, will – if implemented – increase the profit security, making it easier for project owners to raise additional financing from credit institutions. On the other hand, the concession law on wind energy has disappointed many wind power developers who had hoped for fixed feed-in tariffs. Instead the concession law has led to a highly competitive price market for wind power that is in danger of dumping prices which cannot guarantee a successful delivery. However, the Wind concession law supports the Chinese wind turbine industry which on the price level is more competitive than the foreign wind turbine producers who might offer more advanced technology. Thus the wind power concession law is a typical example for the balancing act the Chinese government makes by trying to strengthen the local RE industry while simultaneously trying to attract foreign investment and technology transfer for the expansion of the Chinese capacity of RE power production. This dual approach is viable as long as it provides a middle route that still makes investment in Chinese RE projects attractive for foreign companies.

**Technology transfer.** Both in the UNFCCC and in the Kyoto Protocol developed countries have committed themselves to the promotion of technology transfer to developing countries as a strategy to reduce greenhouse gases (UNFCCC article 4.5; Kyoto Protocol Article 3 and 11). In addition, the Chinese "Measures for Operation and Management of Clean Development Mechanism Projects in China“ (www.ccchina.gov.cn) also demand in Article 10 that "CDM project activities should promote the transfer of environmentally sound technology to China". Despite the call for technology transfer, the Chinese government is also aiming at protecting the emerging domestic renewable energy industry. Consequently, in 2001, the law on a local content requirement of 70% for wind energy converters has been passed (NREL 2004b). The local content requirement can also be fulfilled by establishing a Joint Venture with a Chinese production company or by selling the product license to a Chinese producer. However, the weak protection of intellectual property rights (IPRs) in China is often a barrier for Sino-foreign cooperation with high-tech equipment and limits technology transfer from foreign companies.

**Managerial capacity.** The CDM provides new opportunities for cooperation between private actors from developing and developed countries, thereby facilitating the exchange of knowledge on technologies, project management and finance. CDM projects themselves but also the establishment of Chinese institutions responsible for CDM project approval on the national level and the set up of CDM Regional Centres on the provincial level has increased the knowledge base on CDM procedures and on renewable energy project management. In the private sector, the consultancy branch is growing due to the demand for experts on CDM project development, monitoring, verification and validation. Thus, the CDM has led to the emergence of a broad array of Chinese consultancies specialising on CDM project development (more information available at http://cdm.ccchina.gov.cn/english/ReferList.asp). On the other hand, the work of international project developers, consultancies and DOEs in China contributes to knowledge sharing. The internationally valid CDM rules on
baseline setting, CER calculation, and project planning, monitoring and evaluation set new standards on renewable energy project development in China.

Political risk. The mixture of internationally binding CDM approval criteria set up by the parties of the Kyoto Protocol and supervised by the CDM Executive Board and the national Chinese rules for CDM project implementation and approval gave more political security to the implementation of RE projects. Newly established institutions like the National CDM Board channel potential rivalries between ministries and the National Coordination Committee on Climate Change serves as a new information hub on rules and status quo of CDM projects in China. New is also the emergence of private sector associations for CDM projects like the China CDM Federation and the CDM Business Club with about 380 members (Bfai 2006), which are an additional source of lobbying for effective CDM governance besides associations like the Chinese Renewable Energy Industry Association (CREIA) that is the nexus for information on RE in China. Information transparency on CDM projects has furthermore increased by the publication of the several CDM newsletters.

CONCLUSION

The article sets out to access the contribution of the CDM to the deployment of RE in China. Based on analysis on the contribution in terms of CDM project number and CDM project revenues an ambiguous picture emerged: while RE energy projects have the majority in China’s CDM project portfolio, the bulk of revenues from CERs are generated from a dozen HFC projects. Two main barriers hampering the full usage of the potential RE projects for the CDM have been identified: the cost-benefit ratio and the dilemma for CDM projects to proof their additionality. Because the CDM so far was not able to fully tap the potential of RE projects in China despite the positive political support towards RE as expressed in various Chinese targets for the future usage of RE, the article raised the question what policy measures the Chinese government might take to make more usage of the CDM. Drawing on innovation theory's life-cycle model of the deployment of RE, the hypothesis was drawn that in order to make RE projects not yet fully considered by the CDM more attractive, the task of the government would be to push RE technologies towards a stage of commercialisation where they almost – but not fully – become financially viable.

The second part of the article examines the Chinese national regulation and Chinese specific CDM rules in order to investigate what impact the current two-level governance has on the deployment of RE in China.

Results show that governance for the deployment of RE at the national and at the CDM project level is not always in harmony, but can produce contradicting results: while the managerial capacity and the political risk of RE CDM projects is clearly strengthened by the two-level regulation, the financial project viability and the technical performance of projects is influenced by incentives that – in parts – contradict each other. One very successful policy measure has been the invention of the “royalty fees” on CDM projects which helps RE projects to reduce their comparative disadvantage to non-RE projects. A policy measure that has rather negative consequences for the tapping the full potential of the CDM is the local content requirement of 70% for RE equipment which – in conjunction with the allegedly poor intellectual property rights situation in China – hampers the technology transfer the CDM was supposed to deliver.

One explanation to these findings is that the Chinese government takes a dual approach of attracting foreign investment and technology transfer while at the same time strengthening the local renewable energy industry. While both targets have their merits, their simultaneous pursuit has shown to cause some contradictions. A source for inspiration of how to combine both targets is China’s experiences with attracting foreign direct investment (FDI) in other sectors while fostering its own industry (Zhao/Michaelowa 2006:1881). Successful practices from other sectors might then be taken as samples of how to design a multi-level governance framework for RE that is attractive for foreign CDM investment as well as for domestic industry development.

While the article’s qualitative comparison of the two-level regulation leads to the conclusion that Chinese governance for the deployment of RE has contributed to push RE technologies towards commercialisation and thus making them more attractive for the CDM, further quantitative research examining details of the impact of these policies on the economic, technological and political project risk would shed more light on concrete causal connections between these policies and the deployment of RE in China.

Ultimately, the deployment of RE in China and in other countries will not depend to a great extend on the usage of the CDM because it is financially contributing only little in comparison to investments needs for the energy infrastructure. Instead, the deployment of RE depends on an effective long-term governance for renewable energy exercised by an interplay of national governments and private actors. Thinking about options of who to make RE projects more preferential under the international CDM rules of the Kyoto Protocol is nevertheless a worthwhile task in order to come up with a comprehensive mechanism that is not only cost-effective, but also contributes to the transformation towards low carbon economies in developing countries.
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