WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption.

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# THE VALUE OF CARBON IN CHINA

## Carbon Finance and China's Sustainable Energy Transition

## EXECUTIVE SUMMARY

A WWF report prepared by ECOFYS azure international

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## EXECUTIVE SUMMARY

# FOREWORD

WWF commissioned the 'Value of Carbon' report in late 2007. The motivation from our Hong Kong and Beijing offices was to analyse the market from the perspective of the Chinese energy system rather than the carbon trading desk. Unconvinced by the traders' 'tonne is a tonne' logic and the determination to use volume-of-carbon-traded as a proxy for environmental performance, we felt that a more detailed picture of how carbon was affecting China's nascent sustainable energy market would give us insights into the real significance of carbon finance as a tool for driving the sustainable energy transition.

This report by Ecofys-Azure, a company based for some time in Beijing, goes some way to answering these questions, and we hope provides an analysis that can be built upon and deepened to ensure the world's perspective on the Chinese market is not restricted to the number of tonnes it sells each year.

From an energy sector perspective the scale of carbon capital flows remains insignificant when compared to cost of China's appetite for energy infrastructure. This is unsurprising but emphasizes that the CDM-led project based phase can only be a beginning if emissions trading is to be a tool of choice for bringing a carbon price more deeply to China's energy markets.

More encouraging is the increasing diversity of the Chinese project pipeline. No longer confined to sustainability-free HFC23, the market is innovating and bringing carbon finance to new technology sectors and in particular to renewables.

In this context the visible hand of the Chinese government has played a key role, by evolving the CDM as a tool of conscious policy choice, alongside other incentives for renewable energy. Making renewable energy a policy priority has cleared the way for the CDM to engage.

In theory the CDM then provides additional value by driving marginal projects, that other regulation and incentives can not move forwards by themselves. For methane based projects, where carbon returns are substantial as a fraction of project costs, this impact seems obvious. For grid based $CO_2$ technologies such as wind and small hydro, where the carbon kick is much smaller, the financial benefits of the CDM are less clear cut. It is with these projects that the risk of non-additionality is at its highest.

As the report emphasizes, however, analysts must take care not to oversimplify the Chinese additionality issue as more subtle forms of additionality are at play beyond the pure financial impact. However in WWF's view regulatory intervention is required either from the Executive Board or at the national level to improve the implementation of additionality at the project level to maintain the credibility of the CDM.

Assuming that the implementation of additionality can be improved, along with other more temporary problems such as the dreaded 2012 cut-off which already appears to be impacting projects, then the report envisages plenty of future opportunity. Most encouraging is the potential for energy efficiency – again driven by government policy, but supported by the CDM – to flourish. Perhaps even more than renewables, energy efficiency will benefit from a fresh look and entrepreneurial spirit of the carbon market in the future.

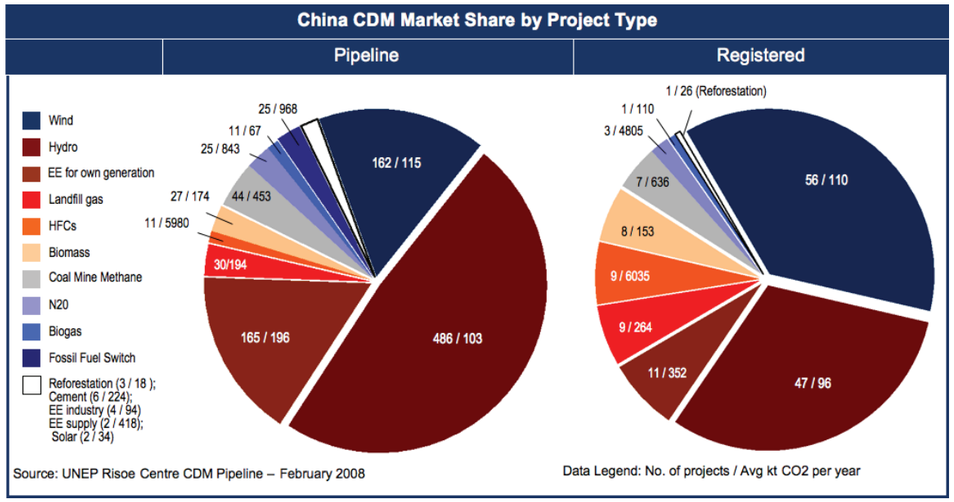
Liam Salter
*Head, Climate Programme*
*WWF Hong Kong*
*17 July 2008*

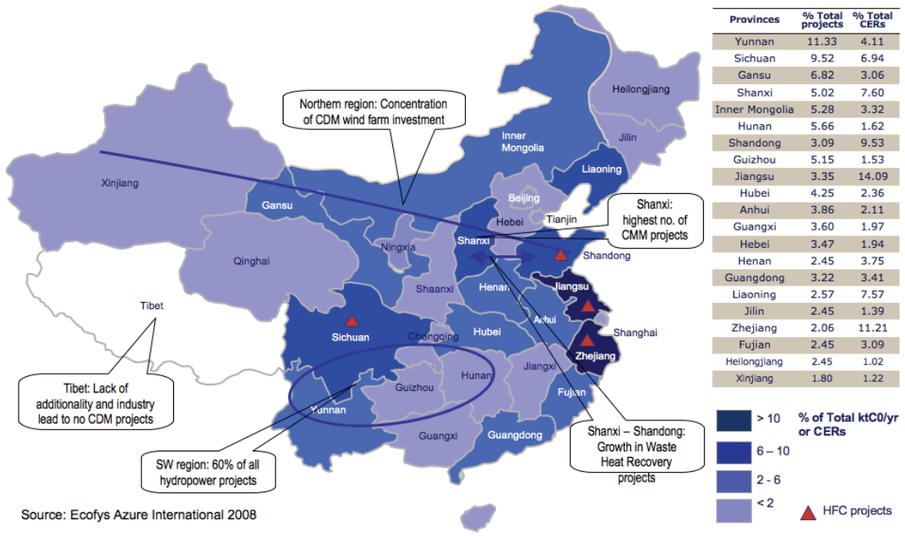
# INTRODUCTION

Rapid rates of economic development have resulted in significant challenges in the generation and use of energy across the world. Soaring fuel prices and concerns over future energy security and climate change have compelled nations to initiate transitions to more sustainable energy sources. China is no different. The Chinese government has targeted significant increases in the use of renewable energy and efficient energy consumption with some success. However, in order to balance climbing energy demand and continue economic development in the present, China's policy-makers will continue to rely on coal for up to 60-70% of the energy demand mix for the foreseeable future. It is clear a significant amount of work remains in order to achieve a sustainable energy transition.

Although the CDM market in China has only recently been established, its effect within the evolving sustainable energy market provides important lessons and insights into how a wider roll-out of clean energy technologies can be facilitated. A booming market has seen a rising number of projects and emission reductions, thereby confirming China as a key player in the global carbon market. An introduction into current market trends in the China carbon market is presented in this section, while the key findings of the report 'The Value of Carbon in China: Carbon Finance and China's Sustainable Energy Transistion' are provided in the following sections.

Analysis of the development of the CDM market in China reveals important trends in the growth of different project types and their locations. The share of hydropower projects has increased dramatically since the end of 2006 to dominate the entire pipeline (including projects at the validation stage). Another important trend is the strong growth in projects under energy efficiency through own generation or waste heat/gas recovery to equal the share of wind projects in the pipeline. In terms of projected generation of CERs, renewable energy projects have seen notable increases in tandem with the roll-out of larger wind and hydro projects.




| Provinces | % Total projects | % Total CERs |
|---|---|---|
| Yunnan | 11.33 | 4.11 |
| Sichuan | 9.52 | 6.94 |
| Gansu | 6.82 | 3.06 |
| Shanxi | 5.02 | 7.60 |
| Inner Mongolia | 5.28 | 3.32 |
| Hunan | 5.66 | 1.62 |
| Shandong | 3.09 | 9.53 |
| Guizhou | 5.15 | 1.53 |
| Jiangsu | 3.35 | 14.09 |
| Hubei | 4.25 | 2.36 |
| Anhui | 3.86 | 2.11 |
| Guangxi | 3.60 | 1.97 |
| Hebei | 3.47 | 1.94 |
| Henan | 2.45 | 3.75 |
| Guangdong | 3.22 | 3.41 |
| Liaoning | 2.57 | 7.57 |
| Jilin | 2.45 | 1.39 |
| Zhejiang | 2.06 | 11.21 |
| Fujian | 2.45 | 3.09 |
| Heilongjiang | 2.45 | 1.02 |
| Xinjiang | 1.80 | 1.22 |

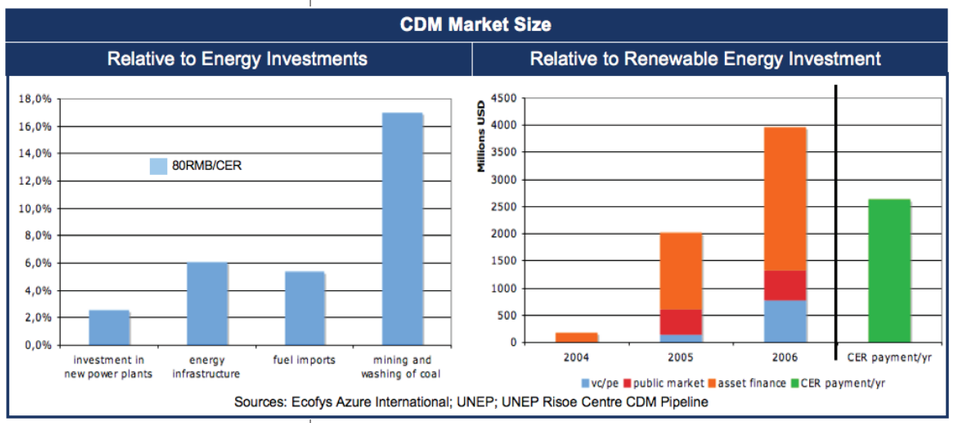
While significantly, energy efficiency projects have decreased their average CER size, denoting the scarcity of "low-hanging fruit" projects. This also signals a shift to an area with significant emission reduction potential but as yet, little representation in CDM project portfolio – that of small-scale energy efficiency activities. The regional distribution of CDM projects reveals significant concentration of emission reductions in the industrial centres of the east while the greatest number of projects are in the south-west, central and northern provinces.

# The Value of CDM in China

KEY FINDING

## Rapid rise of China's economic development and energy demand has overwhelmed renewable energy and CDM growth

Renewable energy has achieved spectacular growth in recent years, making significant progress toward achieving policy targets for 2010, which were published last year. However, given the dramatic increases of total domestic energy consumption, which increased four times faster than predicted in 2006, as well as government policies focused on controlling inflation by subsidising the price of electricity, it is clear the contribution of renewable energy as a meaningful player in the Chinese energy portfolio faces significant challenges. As long as production costs for renewable solutions remain higher than coal, it will be difficult to make an impact on an energy mix which currently relies on meeting 70% of its demand through the use of coal.



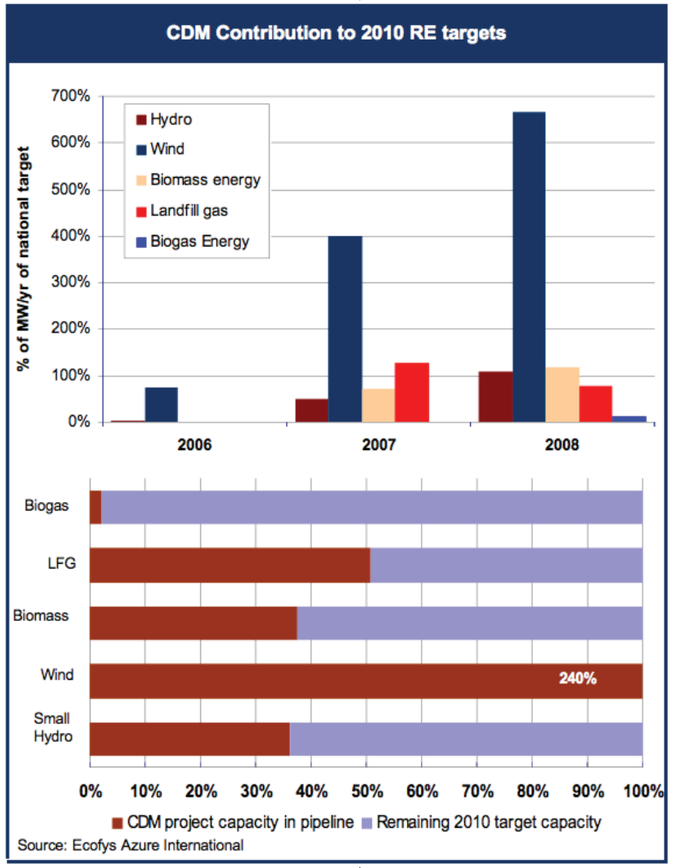

For CDM, a booming market has seen a rising number of projects, confirming China's role as the key player in the global carbon market. However, viewed in the context of overall energy related investments, the size of the market in terms of CER revenue is relatively minute (approx. 5%) compared with investment in new power plants, energy infrastructure and fuel imports. Project-based mechanisms have little capacity to make wide-ranging impacts on the structural issues of the Chinese energy market.

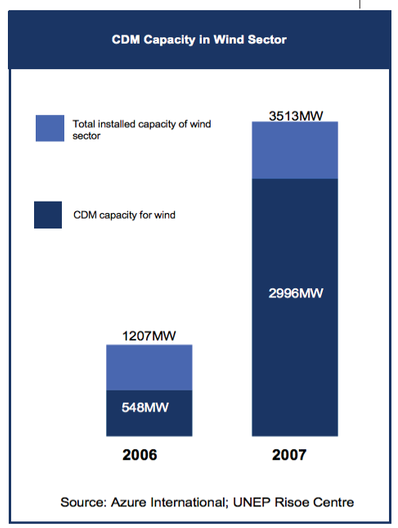
KEY FINDING

## CDM can be useful tool for policy makers in steering the market towards achieving national policy objectives

By analysing the growth of the CDM market in China and the diversity of project types, the role of policy makers in steering project activities toward fulfilling national policy is evident. In this case, the renewable energy law was the primary vehicle to roll-out project activities. CDM played a significant role in supporting the growth of renewable energy sector, for example in the wind sector, where the capacity of all projects in the pipeline was twice that of the original 5GW target and matches the revised target of 10GW.

The Big Five state-owned power utilities and other SOEs were leveraged by policy makers to couple their renewable energy projects with CDM, even with significantly low IRR values. This also had a spill-over effect on other market players, such as in the small hydro power sector, where initial uptake of CDM was low in comparison. Policy makers also leveraged fiscal policy measures, in the form of the national CDM fund, to ensure that project activities focused on achieving sustainable benefits.



KEY FINDING

## CDM contributed to improving market transparency and efficiency in renewable energy and industry sectors

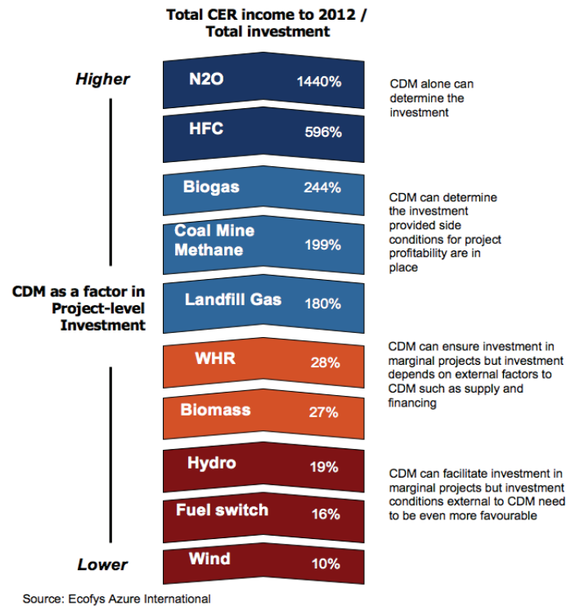
Sourcing accurate and reliable data in the China market can be challenging. Through formalizing project development actions both at the local level, with clear rules and procedures to receive DNA approval; and at the international level, through DOE and UNFCCC quality assurance, CDM has improved market transparency and the provision of reliable data in relevant sectors. This has contributed to both industry stakeholders and policy-makers making policy and investment decisions in greater confidence and a more efficient functioning of the market. In fact, the availability of experiences and business plans to draw information from is an essential tool to minimize the investment risk and mobilize resources in new areas. CDM is creating a large scale database for this kind of information. It has also continued to update the database every year, through verification processes.

The additional revenue provided by CDM has also enabled project owners to finance more efficient and higher quality projects in the renewable energy sector. With CER revenue contingent on efficient technologies displacing more coal-fired electricity from the grid, project owners are more inclined to invest in the most rewarding technologies as opposed to only considering the capital cost.

KEY FINDING

## Additionality factors in some wind and hydropower projects can be more subtle than a strict demonstration of financial additionality

Recent research has reported weaknesses in the overall CDM rules for accurately defining additionality at the project level and has issued recommendations to improve the additionality test for CDM. [1]In China this analysis is complicated by the fact that a range of new policy support has been brought into precisely the sectors where the financial signal from CERs is weakest, such as wind and small hydropower. The fact that the CDM has become the norm for wind and hydro projects in China suggests that whilst the financial impetus of CDM is likely to be a factor in improving the viability of marginal projects, in some cases it may not be the decisive factor in the investment decision.



Source: Ecofys Azure International

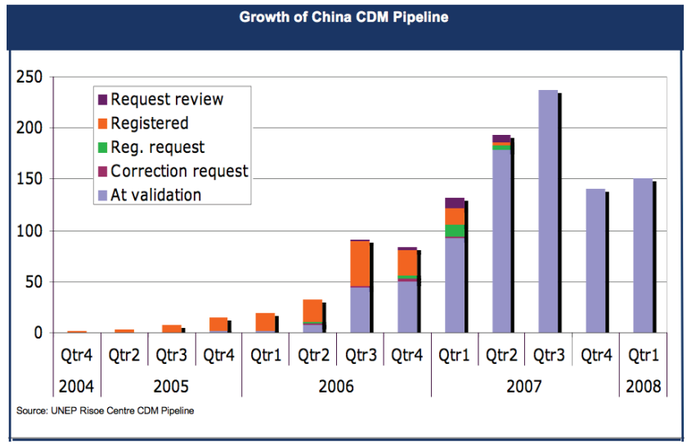
While an in-depth assessment of additionality issues is beyond the scope of this analysis, it is important to bear in mind that in a proactive policy environment, such as in China, legitimate forms of additionality can come in many forms, and is not solely a function of IRR. Issues such as access to finance, additional revenue streams, and improved market transparency are all real market barriers that carbon finance can remove and which an IRR analysis may not capture.

[1] *See for example Schneider, L. 'Is the CDM fulfilling environmental and sustainable development objectives?' (Oeko Institute for WWF, November 2007).*

KEY FINDING

## Scope of market hampered by 2012 horizon

There has been a marked slowdown in the growth of projects joining the China CDM pipeline since the 3rd quarter of 2007 from a high of 237 to approximately 150. This may be attributed to a combination of various factors, the most prominent being the approaching 2012 horizon. Indeed, one may assume that the rapid boom in 2007 may have been a result of project developers rushing through development stages in order to maximize the window of opportunity in eligibility of CER issuances.




This will have ominous consequences for CDM playing a part in the required shift to energy conservation practices within China. First, energy efficient projects with large potential will continue to be actively pursued, like waste heat recovery. However, more wide-ranging efforts, which may significantly reduce energy demand but individually contain less carbon reduction potential, may not be economically feasible given the time and financial resources contained within the project development costs. Maximising CER revenue before 2012 is significant determinant in whether to pursue a given project.

However the voluntary emission reduction market, despite its minor role thus far, could exhibit strong growth and absorb a great deal of carbon reduction credit demand moving forward.

KEY FINDING

## Market Actors regard the CDM market at working at limited effectiveness in China

Although China represents the major player in the global CDM market, significant issues remain which continue to reduce its overall efficiency. The two most pressing issues in the run-up to the 2012 deadline are financing and institutional capacities. The local investment environment and financing sector remains a significant barrier for pursuing project opportunities. Although local commercial institutions are open to financing renewable energy projects, the carbon value of these projects cannot be taken into account. This impacts greatly on those technologies which rely heavily on CDM investment, particularly biomass, biogas and coal mine methane.

In addition, a lack of institutional capacity at all levels of project approval stage (DNA, DOE and UNFCCC) impacts on market efficiency, leading to long delays in the registration process and the economic benefit endowed on project owners.

KEY FINDING

## Efficient energy conservation holds future opportunities for unlocking carbon value

Until renewable energies attain efficiency levels suitable to substitute larges share of the generation capacity without increasing prices, policy makers will have to stimulate end-use energy conservation to reduce the rate of energy consumption. A rapid scale-up in these activities is required to make the necessary impact. Successfully improving the energy system efficiency might in turn make inflation less sensitive to power price, and allow small increases to help both renewable energy and system efficiency to progress faster.

For the CDM and carbon market, opportunities will be presented to replicate its alignment with a new renewable energy policy, highlighted through the implementation of the energy conservation law. Focusing on particular sub-sectors and key areas for efficiency will most likely be rewarded, as the wind and hydro sectors can testify. On a smaller-scale, Programmatic CDM (P-CDM), while with significant potential of its own, may turn out to be a missed opportunity due to the lack of policy support and an enabling framework. Project developers will be unwilling to take significant transaction cost risks without clear signals of profitability, including CER pricing and ownership difficulties.

KEY FINDING

## Going beyond project level will be important to scale up impact of carbon finance

The future of CDM and carbon markets in China will have to examine country-specific policy approaches and ultimately create compatible frameworks that can successfully integrate China into a global climate change regime. The challenges of the Chinese energy system cannot be solved by a single-project approach. In particular post-project frameworks can build upon lessons under P-CDM to support their development. Post project systems that have been proposed may be useful to overcome some of the barriers and transaction costs associated with the present CDM in China and could also potentially overcome difficulties associated with defining project level additionality. An overview is provided below of the potential roles CDM may play in a post-2012 regime.

**Policy-CDM:** Crediting is applied through the quantification of reductions associated with sustainable development policies and measures adopted by a developing country. This approach recognises that economic development often has a higher priority than climate change for many developing countries. However, other approaches in this area call on a simple registry of sustainable development policies and measures to account for actions developing countries will take. This would consist of no need for quantification and thus no role for CDM.

**Sectoral-CDM:** This option entails developing an emissions baseline across an entire sector, either globally or nationally. Benchmarking standards may be applied across emission-intensive sectors such as electricity or cement. An alternative option, the sectoral no-lose targets, consists of crediting emission reductions below a targeted baseline, as opposed to the actual measured baseline. This allows domestic policies and measures for emission reduction in a given sector to be considered as the targeted baseline and crediting to apply once the emissions are below this. No penalty is stipulated in case of higher emissions but benefits in terms of carbon trade are possible with lower emissions.

### Ecofys and Azure International

Ecofys is a global sustainable energy consultancy and innovation company. With more than 400 employees and 19 offices in 14 countries, Ecofys is one of the largest consultancy firms providing sustainable energy and climate solutions worldwide. Ecofys' areas of expertise are:

- Renewable energy policy
- Energy efficiency policy
- Climate policy
- Renewable energy and energy efficiency in buildings
- Renewable energy project consulting
- Corporate renewable energy, energy efficiency and climate strategies

In China Ecofys has been active through its subsidiary Azure International. At the time of its establishment in 2003 Azure International was one of the earliest dedicated sustainable energy consultancy and project development companies in China, and provides the following services:

- Wind power project development consultancy: wind measurement, permitting, feasibility assessment, due diligence, park layout, power price negotiations, project financing;
- Biogas project development consultancy: feasibility assessment, design, engineering, contracting, operating, project financing;
- Wind power market analysis: Turbine and component manufacturing industry, wind project development and policy analysis;
- CDM project development
- Corporate renewable energy strategy development.

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"The Value of Carbon in China: Carbon Finance and China's Sustainable Energy Transition" is a report prepared for WWF by Ecofys Azure International and combines the knowledge and experience of operating in the China carbon market with in-depth research and analysis in the role of carbon finance in China. Stakeholder interviews, an up-to-date literature review and an analysis of the full range of projects in the CDM pipeline in China as of February 2008, contributed to the development of the report. This document is a synopsis of the key findings of the full report available online at WEBSITE. The authors would like to thank all those who contributed to the report, in particular Professor Pan Jiahua (Chinese Academy of Social Sciences), Christian Ellermann (Ecofys), Dongmei Chen (WWF), Liam Salter (WWF-Hong Kong) and Chris Raczkowski (Ecofys Azure International.