

**VERONIQUE BISHOP, from the World Bank Carbon Finance Business, provides some innovative structured finance mechanisms that could improve revenues and access to project finance in carbon markets**

# Catalysing climate-friendly investment

Carbon finance is emerging as a powerful tool to improve the viability of clean technology investments. The sale of greenhouse gas (GHG) emission reductions (ERs) can generate sufficient cash flow to render certain classes of projects financially viable, notably in the biomass energy and solid waste management sectors. For these technologies as well as most other classes of projects eligible under the Kyoto Protocol's Clean Development Mechanism (CDM) and Joint Implementation (JI) financial engineering of carbon contracts can help projects reach financial closure.

The World Bank's Carbon Finance Business is using structured finance in a number of ways to enable the enhanced revenues from carbon sales to improve projects' access to financing. This article outlines some of this structured finance and describes the impact of carbon finance on cash flow for a range of technologies.

Revenues from the sale of ERs can boost cash flows and rates of return. The increase in a project's financial internal rates of return (IRR) depends on the technology, the resource, and the carbon intensity of the baseline. For example, the impact on project financial internal rates of return for a range of CDM and JI projects undertaken by the World Bank at a price of \$4/tonne CO<sub>2</sub> equivalent is 0.5–2.5% for Hydro, wind and geothermal; 3.0–7.0% for forest and crop residues; and 5.0–15.0% for municipal solid waste.<sup>1</sup>

In general, our experience indicates that carbon revenues can boost IRRs of renewable energy<sup>2</sup> projects by about 0.5% to 2.5% – at \$4/t CO<sub>2</sub>e – depending on the baseline fuel and the cost and revenue structure of the project. In unit terms, carbon can contribute about \$2.00–3.40 per MWh delivered (see Table 1).

Clearly, revenues of this order of magnitude will not render renewable energy projects viable unless they are already at the margin of profitability – and therefore possibly prone to criticisms that they are not 'additional.' For projects that mitigate more potent GHGs, however, ER revenues can be sizeable. For example, capturing and destroying fugitive methane emissions – from coal mines, landfills or other waste sources – can generate ERs in excess of 14t CO<sub>2</sub>e, and revenues of over \$56 per 1,000 cubic metres of methane.

Landfill gas-to-energy projects, for example, destroy methane that would otherwise have vented to the atmosphere. They may also displace fossil fuel-based power generation in the same way as renewables. Under typical conditions, flaring of landfill gas alone delivers some 38tCO<sub>2</sub>e/1,000 tonnes of waste per year. Adding power generation contributes an additional 4–10tCO<sub>2</sub>e/1,000t waste per year, for a total of about \$17–19/MWh (at \$4/t CO<sub>2</sub>e) for landfill gas to energy projects. Other methane-based projects such as coal bed methane capture and organic waste-to-energy projects

provide similarly high revenue streams which, on their own, can be sufficient to support project financing.

In general, CDM and JI projects face structural difficulties in obtaining financing. Climate-friendly technologies such as renewables tend to be highly capital-intensive, so even if they are competitive with fossil fuel technologies in economic terms,<sup>3</sup> they are not financially viable at the rates of return required by emerging-market investors. In other words, studies that show renewables competitive with fossil fuel-based generation tend to make unrealistic assumptions about cost of capital and risk aversion in the emerging-market setting. The trend toward substituting spot-price power pools for long-term power purchase contracts accentuates the disadvantage of renewables relative to plants that can dispatch on demand. Further, financing generally is not available at low enough interest rates or for sufficient tenors to permit adequate debt service coverage. Moreover, many banks require additional coverage, such as personal guarantees, country risk insurance, or deposits of 50% of the loan proceeds, which increase the effective cost of financing.

## Credit risks

Lenders may have good reason to be wary. Local currency-denominated revenues may be exposed to currency controls and depreciation. Local power off-takers typically have poor payment records, and in some cases pay uneconomic tariffs, making the renewable generators that sell to them poor credit risks. Revenues from reforestation and similar CDM-eligible projects generally begin to flow many years after the initial investment, so little cash is available to service debt in early years. Moreover, projects typically must demonstrate that they are not least-cost, or are constrained by other barriers, in order to show additionality under CDM and JI.

The experience of the World Bank is that the sale of emission reductions can help secure financing for CDM and JI projects not only based on the additional revenues they can generate, but also due to the high quality of these cash flows. Carbon contracts are denominated in hard currency – usually US dollars or euros – as the known carbon buyers to date are in OECD countries. Contracts are typically multi-year; for example, the Prototype Carbon Fund's (PCF) typical ER contracts are for deliveries expected over a 10-year period or longer. The counterparties are highly-rated: AAA-rated governments accounted for about half of known CDM and JI carbon purchases in 2002–03, with investment-grade multinationals, largely banks and power companies, accounting for most of the rest.<sup>4</sup>

To enable project sponsors to borrow against these revenue streams, the Emission Reduction Purchase Agreement (ERPA) developed by the World Bank's Carbon Finance Business has the facility to enable ER payments to be placed in escrow. This has permitted project sponsors to use the ERPA proceeds to service debt, and could also be used to support repayment of export credit loans (see Figure 1). Moreover, placing the escrow account outside the host country mitigates currency convertibility and transfer risk.

Structuring loan amortisation to match the expected ER payment schedule can further reduce country risk. The PCF–Brazil Plantar transaction was structured in this way, enabling the lender, Rabobank, to extend its loan tenor from two years without carbon finance to five years with carbon finance.

<sup>1</sup> It is recognised that IRR has substantial limitations but it permits comparisons across sectors.  
<sup>2</sup> Hydro, wind, geothermal and biomass. The impact on IRR for solar PV is much smaller, given the higher investment cost.  
<sup>3</sup> Note that numerous studies show the cost of renewables as competitive with fossil fuel-based sources do so using economic analysis at discount rates of 6–10%. At discount rates that reflect risk, renewables are generally not competitive.

**Table 1: Carbon revenues per MWh renewable energy generation**

Fuel displaced	Generic emissions factor (tCO <sub>2</sub> e/MWh)	Carbon revenue at \$4/t CO <sub>2</sub> e (\$/MWh)
Gas	0.50	2.00
Coal	0.85	3.40
Diesel	1.00	4.00

The PCF–Plantar–Rabobank transaction structure is, unfortunately, exceptional. Due in part to the novelty and complexity of the carbon business, few banks will consider ERPA cash flows when evaluating debt capacity. According to numerous banks, the cost of developing the institutional capacity required to lend against carbon – especially in the absence of clarity about Kyoto Protocol rules, entry into force, perfection of legal title to ERs – is not worth the investment. This is particularly true given the small size of the market and the other risks inherent in investing in emerging-market climate-friendly projects.<sup>5</sup>

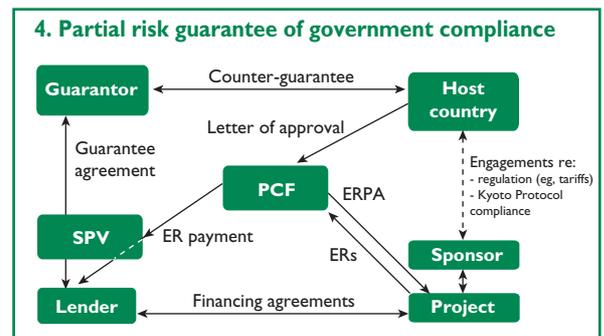
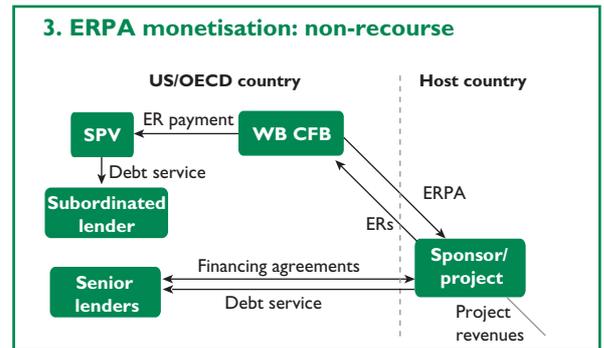
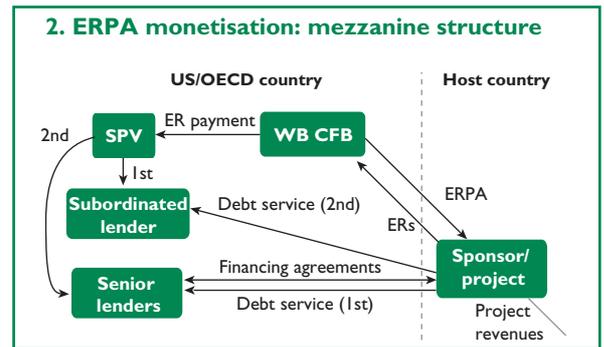
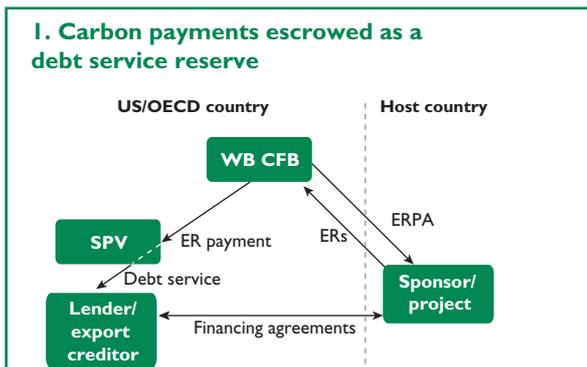
### Mezzanine finance

To help enable project sponsors to borrow against the future carbon revenues, the World Bank issued a note on its website identifying the opportunity to fill this gap and inviting mezzanine financiers to express interest in monetising ERPA. Two such investor groups, led by EcoSecurities and the Merzbach Group, responded, and the CFB has introduced them to project sponsors that might benefit from such financial structures. Although mezzanine finance is a highly negotiated hybrid between senior debt and pure equity, in general the structures under discussion involve the mezzanine investors taking a senior interest in ER payments and a kicker, which can be in the form additional ERs and/or a subordinated interest in a share of the project's general cash flows (see Figure 2). An alternative non-recourse or securitised structure could be possible in limited cases or for bundled transactions with sufficient size and financial depth (see Figure 3). The key limit to non-recourse lending in this setting is, self-evidently, that it is high-risk in an environment where lenders are already scarce.

The World Bank is also developing a credit-enhanced non-recourse financing structure along the lines described above to help address market failure in financing "small-scale" projects – as defined under the CDM. These projects face acute difficulties in finding financing due to their size and due to the fact that many proposed small-scale projects are intended to serve the rural poor in some of the poorest countries. Recognising these constraints, the World Bank established the Community Development Carbon Fund (CDCF) to support small-scale projects in rural or remote areas of developing countries, where the project sponsors can demonstrate that the project will generate benefits for the local community. In general, the CDCF will not assume the full risk of non-delivery by project sponsors as it would risk substantial cost overruns.

The CFB is therefore working with private insurers to identify ways to provide credit enhancement in the form of second-loss protection to a non-recourse monetisation product which would facilitate financing for a sub-portfolio of CDCF projects. In this way, credit enhancement would counterbalance the high risk and non-recourse feature of the advance payment.

Other forms of credit enhancement are being developed to enhance the bankability of CFB projects, notably, to insure against host country non-compliance. Financing projects in emerging markets can hinge on the host country's commitment to engagements related to the project or to the sector in which it operates. For example, financing of independent power producers often requires a government's commitment to tariff indexation. In the CDM and JI context, financing approvals also may require that the host country demonstrate its commitment to complying with the provisions of the Kyoto Protocol as well as project-specific letters of



approval, and, in the case of some JI countries, host country agreements with the International Bank for Reconstruction and Development<sup>6</sup>. The World Bank is considering partial risk guarantee structures to provide the assurances required by lenders (see Figure 4). Where such guarantees are not available from bilateral, private or official insurers, renewable-energy-specific contingent finance instruments could be developed with donor support.

For methane mitigation, and other gases with high global warming potential, in projects such as landfill methane collection, ER sales proceeds at current prices can render projects viable, boosting IRRs in some cases by more than 15%. For renewable energy technologies, the impact on IRR is not as great – carbon may contribute some \$2.00–3.40/MWh for power projects – but carbon finance can be used to secure commercial financing and, combined with other instruments in a financing package can together bring projects to closure.

Carbon finance for any of these technologies, and for sinks, provides a revenue stream that, if well structured, can reduce the need for subsidies and potentially improve a project's access to capital markets by enabling the sponsor to borrow against the ERPA contract. To date, the general unwillingness of commercial banks to lend against carbon revenues has led the World Bank to work with other financial intermediaries who recognise the value in these cash flows and are prepared to lend on a subordinated basis. These efforts are giving rise to a number of innovative structures which, when combined with other sources of financing, have the potential to encourage new CDM and JI projects. There are implications not only for catalysing projects that reduce GHG emissions, but also for extending modern energy services to the world's rural poor. Veronique Bishop is lead financial specialist in the World Bank Carbon Finance Business in Washington, DC. E-mail: [Vbishop@worldbank.org](mailto:Vbishop@worldbank.org)

4 Franck Lecocq and Karan Capoor, State and Trends of the Carbon Market 2003, PCF plus Research, World Bank. <http://carbonfinance.org/>  
5 Foreign direct investment has declined dramatically in recent years: power sector FDI in developing countries overall has declined sharply, from [~\$50 billion] in 1997 to [~\$15 billion] in 2002; renewables have borne the brunt of this decline [cite PPI Database]  
6 IBRD acting both in its own capacity and its capacity as Trustee for the relevant Carbon Funds (for example, the PCF, BioCarbon Fund, Italian Carbon Fund, as well as other funds currently under discussion and development).