The Role of Emissions Trading in Asian Clean Energy Finance

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Introduction

The development of certain energy projects as assets able to claim and transact emission reduction credits for the betterment of their balance sheets is an emerging market fraught with process requirements and complexities. A comparative minority of energy developers understands these processes and complexities. Moreover, the pricing, depth, liquidity and long term relevance of these emergent markets is a subject of considerable debate, as the Kyoto Protocol moves toward implementation throughout most of the world. While these questions are in their own right worthy topic(s) for discussion in a forum such as PowerGenAsia, we by and large assume the existence of this market and of the processes required to create Certified Emission Reductions (CERs) under Kyoto. We feel that this assumption can be justified – in late 2003 we can point to dozens of instances of clean energy projects tapping this market and there are numerous firms – ours among them – that assist firms in identifying, packaging and transacting these kinds of emissions assets using increasingly standardized processes.

Rather, this paper focuses on the relative project finance impacts of this nascent commodity currently and presents analytic mechanisms to gauge that impact in project *pro formas*. We place particular emphasis on a case study in an industrial scale renewable energy project. The paper then concludes with some general observations concerning the range of projects that can be positively impacted by the Kyoto markets and therefore the analytics presented within. We also discuss some of the key challenges of making Asian assets more competitive in this emergent market, which is global, not local or regional, in nature.

Renewable energy project financing can be an expensive undertaking. Project risk, inflexible tariff structures, higher obscelence cycles and regulatory uncertainty all conspire to keep borrowing costs for renewable energy projects relatively high. When these projects are planned in developing economies (DCs) higher levels of political risk and economic uncertainty, as well as higher transaction costs only add to the cost of capital. Moreover, debt for renewable energy projects is typically non-recourse to the equity sponsors of the project, thus making it commensurately more risky and more expensive.

With revenue streams essentially fixed, higher borrowing costs could mean these projects will have greater challenges meeting debt service coverage ratios (DSCR) and therefore have difficulty securing debt financing. This leads to more equity-weighted capital structures that decrease the overall rate of return for equity investors. Obviously, lower expected equity returns resulting from low debt leverage will dissuade some investors from renewable projects making it hard to raise equity capital.

This problem is exacerbated since renewable energy generators characteristically have a higher proportion of capital expenditures to operating expenditures (owing to the lack of fuel procurement needs). This only intensifies the effect that increased debt leverage has on higher returns on equity (ROE), which makes the capacity to carry more debt very desirable for renewable energy developers.

Yet this challenge need not restrict renewable energy development if the resultant environmental benefits can be monetized, as is the case with projects eligible under the Kyoto Protocol's Clean Development Mechanism (CDM). Higher borrowing costs can be mitigated by additional cash flow streams stemming from the sale of Certified Emission Reductions (CERs). While the monetizing of carbon reductions to generate additional cash flow is a well known concept, discussions on linking these cash flows to debt obligations has been subordinated to the general 'revenue enhancement' argument, which is often less compelling on its face. Operating costs associated with carbon cash flows, i.e. verification and monitoring costs, are generally minimal. Therefore, carbon sales can generate free cash flow that can be readily applied to debt service obligations. This article reviews how carbon cash flow streams can mitigate project risk accruing to lenders by increasing project DSCRs, thus making debt financing more viable for this challenging asset class.

What are the Stakes – A Wind Project Example

While our analysis can theoretically apply to any renewable energy project, we believe that the most representative application can be generated for a wind energy asset. This is primarily due to wind's attractive economics at an industrial scale. However, the argument posited also applies to other project types – geothermal, low head hydro and sustainable biomass for example that are located in countries with relatively high carbon coefficients[1] which result in displacement of more emission-intensive energy sources. Therefore, while we use a wind example herein, it should be recognized that the arguments made generally have applicability to a far wider range of project types

The capital structure of most wind projects in industrial countries fall along traditional project financing lines, i.e. higher debt than equity. Wind projects in DCs however tend to be more equity intensive. This is in large part due to systematic risks outlined above. Debt to Equity ratios (D/E) of wind projects in DCs typically range from 40/60 to 70/30. While borrowing costs can differ dramatically depending geographic location, they usually fall in the range of LIBOR plus 500 to 1000 basis points with terms to maturity generally in the range of 10 to 20 years. Consequently, for projects ranging in size from $50 million to $150 million, representative annual

[1] The carbon coefficient refers to the basic ratio of carbon dioxide emission per megawatt hour that a energy source is responsible for. A renewable energy project is assumed to have a carbon coefficient of zero, in that it has no emissions. When discussing the carbon coefficient of a country – a key parameter within this paper -, this represents an analytic undertaking that assesses what the average emissions are per megawatt hour based on overall matrix of electricity provisions within the national or regional grid into which the new asset is being placed.

debt service costs can be between $2.7 million and $8.2 million, respectively (assuming a D/E leverage of 50%, 7.0% interest rate, 15 year term and "mortgage style" amortization schedule). Of course, each project will have its own intricacies and thus its own capital structure. For the purposes of this article, a generalization of the capital and operating structures for wind projects is appropriate. For the sake of simplicity, our analysis will focus on a hypothetical wind project with the following characteristics.

Our hypothetical 100 MW wind facility has an initial capital outlay of $82 million, with borrowing costs of 7 per cent compounded annually over 15 years. Annual generation is roughly 300 GWh and EBITDA margins are set at 75 per cent. The ratio of CO_2 emissions to electricity generation (carbon coefficient) is set at 0.7 tonnes of CO2e per MWh, which is represents an approximate average for countries with significant reliance on coal and bunker fuel for generation needs.. Monitoring and verification costs for the CER commodity are negligible at $10,000 per annum. We have intentionally left out the country of domicile because our analysis isolates electricity rates as the independent variable. As such, depending on the regional location of the project, electricity revenues from our example can range from $10.5 million to $22.5 million (assuming electricity rates between US$35 and US$75 per MWh, respectively).

Figure 1: Debt Service Coverage Matrix

Figure 1: Debt Coverage Ratio Matrix - BLUE indicates points at which carbon revenue boosts ratio over threshold!

Project Cost	$82,000,000
Interest Rate	7.00%
Debt Term	15.0
EBITDA Margin	75%
CO2 Costs	$10,000
Target DSCR	2.0
Carbon Price	$4.00
MWh	300,000
Carbon Coeff.	0.70

D/E Ratio \ Price per MWh	$35.0	$37.7	$40.3	$43.0	$45.7	$48.3	$51.0	$53.7	$56.3	$59.0	$61.7	$64.3	$67.0	$69.7	$72.3	$75.0
5.0%	19.34	20.67	22.00	23.34	24.67	26.00	27.34	28.67	30.00	31.33	32.67	34.00	35.33	36.67	38.00	39.33
7.5%	12.89	13.78	14.67	15.56	16.45	17.34	18.22	19.11	20.00	20.89	21.78	22.67	23.56	24.44	25.33	26.22
10.0%	9.67	10.34	11.00	11.67	12.33	13.00	13.67	14.33	15.00	15.67	16.33	17.00	17.67	18.33	19.00	19.67
12.5%	7.74	8.27	8.80	9.33	9.87	10.40	10.93	11.47	12.00	12.53	13.07	13.60	14.13	14.67	15.20	15.73
15.0%	6.45	6.89	7.33	7.78	8.22	8.67	9.11	9.56	10.00	10.44	10.89	11.33	11.78	12.22	12.67	13.11
17.5%	5.53	5.91	6.29	6.67	7.05	7.43	7.81	8.19	8.57	8.95	9.33	9.71	10.10	10.48	10.86	11.24
20.0%	4.83	5.17	5.50	5.83	6.17	6.50	6.83	7.17	7.50	7.83	8.17	8.50	8.83	9.17	9.50	9.83
22.5%	4.30	4.59	4.89	5.19	5.48	5.78	6.07	6.37	6.67	6.96	7.26	7.56	7.85	8.15	8.44	8.74
25.0%	3.87	4.13	4.40	4.67	4.93	5.20	5.47	5.73	6.00	6.27	6.53	6.80	7.07	7.33	7.60	7.87
27.5%	3.52	3.76	4.00	4.24	4.49	4.73	4.97	5.21	5.45	5.70	5.94	6.18	6.42	6.67	6.91	7.15
30.0%	3.22	3.45	3.67	3.89	4.11	4.33	4.56	4.78	5.00	5.22	5.44	5.67	5.89	6.11	6.33	6.56
32.5%	2.98	3.18	3.39	3.59	3.80	4.00	4.21	4.41	4.62	4.82	5.03	5.23	5.44	5.64	5.85	6.05
35.0%	2.76	2.95	3.14	3.33	3.52	3.71	3.91	4.10	4.29	4.48	4.67	4.86	5.05	5.24	5.43	5.62
37.5%	2.58	2.76	2.93	3.11	3.29	3.47	3.64	3.82	4.00	4.18	4.36	4.53	4.71	4.89	5.07	5.24
40.0%	2.42	2.58	2.75	2.92	3.08	3.25	3.42	3.58	3.75	3.92	4.08	4.25	4.42	4.58	4.75	4.92
42.5%	2.28	2.43	2.59	2.75	2.90	3.06	3.22	3.37	3.53	3.69	3.84	4.00	4.16	4.31	4.47	4.63
45.0%	**2.15**	2.30	2.44	2.59	2.74	2.89	3.04	3.19	3.33	3.48	3.63	3.78	3.93	4.07	4.22	4.37
47.5%	**2.04**	**2.18**	2.32	2.46	2.60	2.74	2.88	3.02	3.16	3.30	3.44	3.58	3.72	3.86	4.00	4.14
50.0%	1.93	**2.07**	2.20	2.33	2.47	2.60	2.73	2.87	3.00	3.13	3.27	3.40	3.53	3.67	3.80	3.93
52.5%	1.84	1.97	**2.10**	2.22	2.35	2.48	2.60	2.73	2.86	2.98	3.11	3.24	3.37	3.49	3.62	3.75
55.0%	1.76	1.88	**2.00**	**2.12**	2.24	2.36	2.49	2.61	2.73	2.85	2.97	3.09	3.21	3.33	3.45	3.58
57.5%	1.68	1.80	1.91	**2.03**	**2.15**	2.26	2.38	2.49	2.61	2.72	2.84	2.96	3.07	3.19	3.30	3.42
60.0%	1.61	1.72	1.83	1.94	**2.06**	2.17	2.28	2.39	2.50	2.61	2.72	2.83	2.94	3.06	3.17	3.28
62.5%	1.55	1.65	1.76	1.87	1.97	**2.08**	2.19	2.29	2.40	2.51	2.61	2.72	2.83	2.93	3.04	3.15
65.0%	1.49	1.59	1.69	1.80	1.90	**2.00**	**2.10**	2.21	2.31	2.41	2.51	2.62	2.72	2.82	2.92	3.03
67.5%	1.43	1.53	1.63	1.73	1.83	1.93	**2.02**	**2.12**	2.22	2.32	2.42	2.52	2.62	2.72	2.81	2.91
70.0%	1.38	1.48	1.57	1.67	1.76	1.86	1.95	**2.05**	2.14	2.24	2.33	2.43	2.52	2.62	2.71	2.81
72.5%	1.33	1.43	1.52	1.61	1.70	1.79	1.89	1.98	**2.07**	2.16	2.25	2.34	2.44	2.53	2.62	2.71
75.0%	1.29	1.38	1.47	1.56	1.64	1.73	1.82	1.91	**2.00**	**2.09**	2.18	2.27	2.36	2.44	2.53	2.62
77.5%	1.25	1.33	1.42	1.51	1.59	1.68	1.76	1.85	1.94	**2.02**	**2.11**	2.19	2.28	2.37	2.45	2.54
80.0%	1.21	1.29	1.38	1.46	1.54	1.63	1.71	1.79	1.88	1.96	**2.04**	2.13	2.21	2.29	2.38	2.46
82.5%	1.17	1.25	1.33	1.41	1.50	1.58	1.66	1.74	1.82	1.90	1.98	**2.06**	2.14	2.22	2.30	2.38
85.0%	1.14	1.22	1.29	1.37	1.45	1.53	1.61	1.69	1.76	1.84	1.92	**2.00**	**2.08**	2.16	2.24	2.31
87.5%	1.11	1.18	1.26	1.33	1.41	1.49	1.56	1.64	1.71	1.79	1.87	1.94	**2.02**	**2.10**	2.17	2.25
90.0%	1.07	1.15	1.22	1.30	1.37	1.44	1.52	1.59	1.67	1.74	1.81	1.89	1.96	**2.04**	2.11	2.19
92.5%	1.05	1.12	1.19	1.26	1.33	1.41	1.48	1.55	1.62	1.69	1.77	1.84	1.91	1.98	**2.05**	2.13
95.0%	1.02	1.09	1.16	1.23	1.30	1.37	1.44	1.51	1.58	1.65	1.72	1.79	1.86	1.93	**2.00**	**2.07**
97.5%	0.99	1.06	1.13	1.20	1.27	1.33	1.40	1.47	1.54	1.61	1.68	1.74	1.81	1.88	1.95	**2.02**
100.0%	0.97	1.03	1.10	1.17	1.23	1.30	1.37	1.43	1.50	1.57	1.63	1.70	1.77	1.83	1.90	1.97

Based on these assumptions, Figure 1 shows the various DSCRs for the first year's debt obligation relative to various D/E ratios and electricity rates. We define DSCR as cash flow available before taxes (EBITDA) divided by equal annual repayment of principal and interest, i.e. "mortgage style" amortization. The figures in blue show where the additional cash flow from the sale of carbon credits increases the DSCR past the threshold ratio of 2.0 – which is a common lending requirement for these projects. Thus, with projects located in areas where electricity rates range from $35 to $75 per MWh and conservatively assuming prices per CER are $4.00, we observe that the supplementary cash flow from the sale of carbon credits can boost DSCRs between 5.0 and 10.5 per cent. Assuming minimum DSCR requirements of 2.0, and 50% debt leverage, this translates into roughly $4 million of additional debt carrying capacity, or approximately 10 per cent (given the aforementioned range of electricity tariffs). In other words, by monetizing emission reductions, our hypothetical project requires up to $4 million *less* equity investment – thereby increasing ROE. If the price per CER is increased to $8.00 (current estimates project the price of carbon to be between $8 to $12 in 5 years), this figure could rise to as high as $8 million in additional debt capacity which translates to a full 20 per cent reduction of the required equity financing.

Carbon Cash Flow Can Support Debt Service in Other Innovative Ways

Once the intent to apply carbon cash flow to debt service has been established, there are a myriad of techniques that can be employed to achieve the same result – i.e. mitigating lending risk. These include, but are not limited to following;

- Establishing a cash reserve account to be applied to debt service in the event of liquidity problems
- Funding a cash reserve account that can hedge against variability of revenue streams
- Prepaying debt based on forward Emission Reduction Purchase Agreements (ERPAs)
- Depositing carbon cash flow directly with banks for credit against debt service thereby lowering liability on electricity cash flow
- Using ERPAs and/or forward carbon sales as collateral for loans

Most assuredly, the above suggestions involve all sorts of complexities. Yet this does not negate their utility as techniques to lower project debt service.

A key – yet often under-recognized point – is that carbon transactions are denominated in hard currency – generally dollars or euros. For projects in which portions of the lending are in hard currency whereas receivables are in softer currencies, this also helps hedge debt service risk issues that many bankers are likely to bring up in lending discussions.

Types of Projects Appropriate for the Carbon Finance Tool

The variety of energy projects that are potentially appropriate for using the emissions trading tool is nearly endless. While this paper focuses on specific issues around renewable energy projects that have specific financial profiles, emission mitigation assets can also be uncovered in fuel switching (coal to gas or coal to partial biomass, being the most popular) and energy efficiency projects, both at the production point (converting single cycle to combined cycle or CHP, for example) or at the end use upgrades (process efficiency on major energy consumption industries, such as aluminium and steel smelting). It is even theoretically possible that certain basic operational efficiency upgrades in carbon intensive jurisdictions such as China and Vietnam will be able to gain value from the carbon trading tool.

In renewable energy, transacted carbon projects have been undertaken in wind energy, low head hydropower (high head hydro with accompanying large reservoirs often produce significant fugitive methane from degrading biomass, limiting their effectiveness as emission reduction assets) waste biomass, dedicated biomass, solar power and fugitive methane projects. Fugitive methane encompasses a certain subset of project types, including landfill gas, anaerobic digestion of agricultural and/or municipal wastes and the use of methane vented from either active or retired subterranean coal mines.

Fugitive methane projects achieve the greatest so called “carbon efficiency. This is because these projects generate significantly more ERs in proportion to installed assets. . For example, whereas in conventional energy projects (such as discussed above) the percentage of debt service provided by carbon can be up to 20% and current market levels (US$4 per tonne of CO2e), which in itself is certainly significant. In methane projects, we have observed instances in which carbon values cover *greater than 100% of debt service requirements* and/or debt service capacity is demonstrably increased. Thus by monetizing emission reductions, ROE on methane projects improves explosively.

The reason for this is fairly simple, but worthy of brief explanation. Due to the Global Warming Potential (GWP) of methane being 21 (meaning that 1 tonne of methane released into the atmosphere has the warming effect on the atmosphere as 21 tonnes of carbon dioxide) the capture and destruction of vented methane to the atmosphere is a high policy priority and represents the “low hanging fruit” of the carbon trading market. The simple act of capturing and combusting that methane (thereby creating one a little less than 1 tonne of CO2 and some water) earns the developer some 20 tonnes of CO2 reduced. On a power plant basis, it can be expected that 1 MW of baseload power (8000 hours/year) fired by fugitive methane can earn some 25,000 to 40,000 CERs per year. This means a net bottom line benefit of *approximately US$100,000 to $200,000 per MW capacity* using recently reported emission trades as a benchmark for pricing.

While fugitive methane projects demonstrate tremendous carbon economics, they are hampered by size issues – globally there appear to be only several handfuls of projects with greater than 20 MW potential and the vast majority of projects appear to be at the sub 5MW range. Financing, offtake agreements and EPC contracting are challenging at even larger levels and become extremely difficult as scale diminishes. Moreover, as with any part of project finance, the embedded costs of developing the carbon trading component of projects becomes more significant, as scale decreases. Lastly, landfill gas projects – which are receiving a great deal of attention around the world due to some early, high-profile transactions— often involve engaging multiple levels of local bureaucracies and stakeholders in both the waste management and energy sectors. These contending interests mean that project developments can be enormously time consuming and risky, made doubly so by the limited sale of the ultimate asset. Without the CDM, few - if any - of these projects are worth the development risks involved. In short, despite the incredibly favourable economics that these projects represent on the surface, they are neither for the faint of heart, nor for those to whom aggressive and innovative financial structuring is a foreign concept.

Key Issues Around Developing CER Projects in Asia

Relative to Latin America and South Africa (rapidly becoming a major CDM player), Asia is relatively behind in the development of CDM projects and the required governmental infrastructure to support them. Whereas Latin America pioneered the concepts that eventually became the CDM during the Climate Convention negotiation process leading up the Kyoto Protocol, there has consistently been more reticence among most Asian governments in engaging the CDM as a tool and as a domestic policy process. This said, many conventional Asian energy developers remain unaware of the CDM tool and the financial impact it can have on a variety of project types that are being pursued in the region. While the reasons for the gap are speculative and not appropriate for discussion in this forum, it can be said that there is an emerging CDM interest in the region and it can be expected that the gap will close. Given the population dynamics, projected energy demand and significant pressures in the region for better waste and air quality management, it would be surprising not to see the CDM ultimately be adopted with enthusiasm - at least among certain governments.

The engagement of governments must be considered a vital prerequisite for the CDM to flourish. Without defined and transparent process of how governments will approve projects for CDM trading, developers cannot know if they are able to financially assume any value from the CDM on their *pro-formas* and therefore move the commodity from the speculative to the bankable. While India has already approved several projects for trading, in the rest of the region only Malaysia has moved forward with any certitude while Thailand is only slowly reversing itself from some very strongly negative comments that it made on the mechanism late in 2002.

It is expected that a significant market for Asia credits will emerge from Japan, which will potentially seek co-investment equity and debt deals to accompany carbon transactions. However, it is telling that, to date, of the millions of dollars that Japanese firms have put into emissions transactions, the highest profile direct transactions have been with Brazil, Slovakia and Kazakhstan. The transaction portfolio of the World Bank's Prototype Carbon Fund - in which Japanese investors represent some 50% of the private capital - is almost entirely in Latin America with a small amount in Africa.

Conclusion – CER Cash Flow can Help Finance Renewable Energy Projects

This article does not suggest that CDM generated carbon credits are by any means the "silver bullet" of renewable energy finance in Asia or elsewhere. While carbon credits can help mitigate debt service burdens, the above analysis might only apply to projects in countries where borrowing costs are reasonable, electricity tariffs are high enough to support operating cost structures, and the carbon credits being generated are of high enough quality to be bought by international entities. Moreover, in most Asian countries where these qualifiers are met, local CDM boards (which are required by the Kyoto Protocol) are certainly in an embryonic stage of development. The degree to which represents a "chicken and egg" scenario – that is, if more projects come forth seeking sanction, will government agencies accelerate their latent abilities to comment and approve projects

This analysis merely proposes that in CDM-related renewable energy projects, additional cash flow from the sale of CERs might be best applied to reducing the burden of servicing project debt. By linking carbon cash flow to debt payments, the project developer can increase net margins on electricity revenue, and enhance the average DSCR for the project. This can result in one of two things. It either allows the project to be financed because it increases the required DSCR past the predetermined threshold set by the lender, or it decreases the amount of equity investment required for the project – thereby increasing ROE. Either way, both the project developer and the project lender are significantly better off.

Marc Stuart is co-founder and director of EcoSecurities, which has been named the leading GHG advisory firm in the world in 2001 and 2002 by the readers of Environmental Finance. Justin Guest is a Senior Analyst at EcoSecurities and has led development of multiple emission reduction projects in Asia. Fred Wellington is a former investment banker and currently is a consultant to EcoSecurities. He is pursuing a dual M.S./MBA in Environmental Management at the University of San Francisco.