PRICE OF KYOTO COMPLIANT EMISSION UNITS

Report for the New Zealand Treasury

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Executive Summary

This report estimates a carbon price for the purposes of calculating the Kyoto Protocol related liability for New Zealand on the Crown Balance Sheet.

Such an exercise is fraught with difficulty and uncertainty given the nature of the market: primary, bilateral, non-transparent, and with prices heavily influenced by project-specific factors. Further to this, recent volatility in the European Union Emissions Trading Scheme has complicated the valuation exercise.

Trades in Kyoto-compliant units have been heavily dominated by trades in Certified Emission Reduction (CERs). CERs are the Kyoto units that relate to the Clean Development Mechanism (under the Kyoto Protocol, the Clean Development Mechanism allows Annex 1 countries such as New Zealand to claim credit for projects that reduce emissions in non-Annex 1 countries). The price estimated is that of a Certified Emission Reduction price (the unit involved is a United States dollar price per tonne of carbon dioxide equivalent – USD per tonne CO_2-e).

There is no single, authoritative way to estimate the Certified Emission Reduction price. Broadly speaking, the methodology chosen is to calculate a mid-point between three different pricing approaches, and then to build in an explicit recognition of risk. The pricing approaches identified are:

- Using World Bank published data on prices;
- Using an average historical Certified Emission Reduction / European Union Allowance price discount multiplied by the December 2008 contract European Union Allowance price;
- Observing reported deals from Point Carbon.

All three methods come with a significant health warning. Certified Emission Reduction prices reported in the World Bank's report fall in a very wide range – from just over USD 3 to USD 24 – and the ratio-based approach relies on this data (as well as exhibiting considerable volatility in the ratio itself). Given these provisos, best estimates of the CER price are as follows:

World Bank data: USD 7.20 per tonne CO_2-e

Discounted EUA Dec 2008 contract (28/4/06 – 6/6/06): USD 8.40 per tonne CO_2-e

Discounted EUA Dec 2008 contract (16/6/06): USD 7.62 per tonne CO_2-e

Point Carbon data USD 7.25 – USD 12.00 per tonne CO_2-e

The choice of range depends on the risk preferences of the Crown versus the risk characteristics of the World Bank portfolio versus the Point Carbon information. The World Bank data is extensive and has a mix of projects, in many cases contracted by the World Bank at early (and therefore risky) stages in the project. The Point Carbon data is also extensive, but also has prices divided by category of delivery risk in the project.

The delivery risk inherent in a CER purchase contract is currently a major determinant of the price. Because Point Carbon provides the only data series that divides transactions into delivery risk categories, considerable attention is given to this data.

Because the Crown has ways to mitigate the compliance problems that can be caused by project non-delivery (including buying project credits early), it is appropriate to take a relatively low price/high risk category – which also has the greatest amount, and therefore reliability, of data. Using the Point Carbon data would give us a range of USD 7.60 – 12.50 per tonne of CO_2-equivalent (and a midpoint of around USD 12). However, it is also appropriate to take into account the World Bank data.

As a result, an estimate of the cost of carbon credits is determined by a simple average of the World Bank midpoint point of USD 7.20 and the Point Carbon midpoint of USD 12.07 per tonne of CO2-equivalent. It is therefore an implicit assumption of this estimate that the Crown will purchase a portfolio of carbon credits, some cheap with high delivery risk and some expensive with low delivery risk. The averaging assumes that, overall, the Crown's portfolio will be made of about half of the higher risk portfolio of World Bank projects, and half of the portfolio of projects reported by Point Carbon.

It is therefore recommended that a price of **USD 9.65 per tonne of carbon dioxide equivalent** be used for the purposes of calculating carbon liabilities on the Crown's Balance Sheet. This is based on current market conditions and practices, but should not be seen as any guarantee of the price obtainable if/when the Crown enters the market to purchase credits.

Contents

Purpose of this Report

The purpose of this report is to provide a range and a point estimate of the price of Kyoto-compliant emissions units for the purpose of recognising the Kyoto liability on the Crown's Balance Sheet. The report assumes some prior knowledge of carbon instruments, markets and pricing.

Background

New Zealand currently has an estimated emissions level some 40-60 million tonnes of carbon dioxide equivalent (CO_2-e) above its Kyoto Protocol cap for the Commitment Period 1 (CP1) of 2008-2012. The purpose of the balance sheet valuation exercise is to recognise the Crown's resulting liabilities on Her Balance Sheet. This treatment of the liability is consistent with Generally Acceptable Accounting Principles on contingent liabilities.

Last year (2005) was the first year in which the Crown recognised a Kyoto related liability on its balance sheet. The estimation of the price of carbon for this was a technical exercise conducted by the Treasury, after receiving advice from the Allen Consulting Group (discussed below). The valuation has since been updated to allow for foreign exchange movements but this is the first time that the assumed carbon price will be updated for valuation purposes.

This report discusses last year's methodology, outlines possible approaches to this year's valuation, works through these approaches with available data, and concludes on an appropriate price range (and point estimate) for the purposes of this year's valuation.

Last Year's Methodology – the Allen Consulting Group Report

Last year's valuation was determined following a report by the Allen Consulting Group. This report discussed the various carbon instruments and market conditions, and concluded that the price as reported in the World Bank's *State of the Carbon Market* report (driven largely through the price of Certified Emission Reduction or CERs) was the most appropriate and reliable price indicator to use.

This conclusion was based on the assumption that New Zealand would be meeting its Kyoto liability through either purchasing carbon credits from the international market or undertaking domestic action, whichever proves to be the least cost option. In addition it was assumed that domestic abatement will be achieved at some cost to the Crown and could be substantially more expensive than international purchase (in the author's view this is more likely).

Discussion of Appropriate Instruments to Consider for Valuation Purposes

(a) Why Use International Prices?

It is reasonable to assume that the cost to the Crown of meeting its carbon liability is equivalent to the cost of purchasing on the international markets. This is for two key reasons.

Firstly, it is quite possible that the domestic economic cost of emission reductions could exceed the cost of international purchasing. Given the nature of New Zealand's emissions (about 50% agriculture-based) and the fact that New Zealand's agri-businesses compete on world markets (and therefore would likely be unable to pass on the cost of emission reductions to consumers), the economic impact of domestic emission reductions on a major scale may well be substantial.

Secondly, even if the domestic cost of emission reductions were competitive with the international purchase costs, this would likely come at some cost to the Crown. The cost to the Crown may be in the form of lost credits (through a mechanism like the Projects to Reduce Emissions programme) or actual cash payments for reductions.

(b) What are appropriate Instruments to Benchmark Against?

In theory, for valuation purposes the Crown should use whatever mix of carbon instruments (Assigned Amount Units or AAUs, CERs, Emission Reduction Units or ERUs[1] or Removal Units or RMUs) that it chooses to purchase and their weighting in the Crown's purchase portfolio[2]. However, in the absence of a Government decision on how to comply with New Zealand's Kyoto obligations, this approach poses difficulty – precisely because there is no information on which to base any sort of portfolio weighting.

As a result, it is appropriate to use benchmark prices for instruments that could reasonably be used for compliance, and for which there is sufficient reliable price data with which to make a pricing assessment. At this point in time, neither AAUs nor RMUs have been substantially traded.

The market for ERUs is only just beginning to develop because ERUs are only valid from 2008. But the market for CERs is relatively active given the level of activity in the European Union's Emissions Trading Scheme (EU ETS).

Although the EU ETS has its own targets and carbon instruments (European Union Allowances or EUAs, which trade at a considerable premium to project credits), it allows (at least some) importing of project credits. Because the EU ETS is currently the largest and most robust carbon trading scheme in the world (and also has the highest carbon prices), it is largely driving the price of project credits.

[1] Of these types of units, ERUs and CERs are attached to specific emission reducing projects. These are known as project based units. Credits from these projects are known as project credits.

[2] An optimal approach to international purchase, and management of associated Kyoto risks, would most likely be to build a portfolio of different emission reduction credit types and project types, locations and maturities.

The EU ETS is divided into two phases. Phase 1 (2005-2007) is a trial phase and has seen prices over EUR 30 prior to the price crash in late April. Prices for the first phase are now hovering around EUR 15-17, depending on maturity of the contract. Because ERUs are not able to be created until 2008, only CERs can be imported into phase one of the EU ETS. For this reason, and because the Joint Implementation (JI) administrative arrangements have been established more slowly than the Clean Development Mechanism (CDM) arrangements, much of the short term project activity has been in CERs rather than ERUs.

Phase 2 of the EU ETS (2008-2012) will allow imports of ERUs. To date however there has been limited activity in the ERU market (as reported in the World Bank *State and Trends in the Carbon Market Report 2006)*. As a result the main non-EUA instrument that has reliable trading data is Certified Emission Reductions from CDM projects. Phase 2 EUAs are trading around the 17-20 euro range with CERs trading at varying discounts to the EUA price.

Because New Zealand is not bound by the EU emissions caps (EU countries have their own emissions caps but are dealing with them in a single EU-wide 'bubble'), the EU price is not appropriate for New Zealand – particularly because the EUA price is considerably more than what other Kyoto-compliant credits can be bought for. Simply using the EUA price as a proxy for the assumed price in the Crown's carbon liability would therefore significantly over-estimate the cost of Kyoto compliance to New Zealand.

As a result, CERs are the main instrument which both apply to New Zealand and for which there is a reasonable amount of data. Although the Crown may well in reality purchase a portfolio of instruments, at this stage and with the information available, the CER price seems the best benchmark for a carbon price to assume in estimation of the Crown's carbon liability.

Discussion of Possible Valuation Approaches

Given this conclusion that CERs seem to be the most appropriate benchmark at this stage, estimation of a price for liability calculation purposes would initially appear to be relatively simple. However, this is complicated by two factors.

Firstly, the CER market is heavily bilateral and there is relatively little public information as to prices. The main reliable sources of information are the World Bank's *State and Trends of the Carbon Market* report, which aggregates trading date from World Bank activities and broker reporting, and Point Carbon's reporting. However, this is complicated by the fact that each project has different sets and levels of project and Kyoto registration risk – and therefore has different pricing and contractual terms. Project developers who provide delivery-guaranteed credits, for example, are receiving EUR 13-15 per tonne at the moment whereas non-guaranteed credits are fetching EUR 6-13 (source: Point Carbon).

Secondly, the EUA price crash of 25-26 April 2006 has introduced an element of volatility and uncertainty into the short-duration market that did not appear to exist previously.

The price crash occurred over a short (1-2 day) time period when various EU countries released actual emissions data for 2005. This indicated that actual emissions were considerably below forecast levels, implying that there may be an excess of EUAs as already allocated for the first phase (2005-2007). With an excess of emission allowances, the theoretical EUA price should be zero – although it has not dropped to that level, reportedly because there are fears that emissions may increase in 2006 and 2007.[3]

It should be noted that the initial allocations made in the EU ETS were made without access to verified historical emissions data as it is now compiled. The over-allocation can therefore (hopefully) be seen as a teething issue in the setup of the scheme, rather than a systematic fault in carbon trading per se.

Prices did, however, drop from over EUR 30 to (at one stage) less than EUR 10 for contracts in the first phase. They have now stabilised (at least temporarily) around EUR 15.

This has injected a significant level of uncertainty into the CER market. If the EU ETS is net long allowances, there is little value to be gained from importing more emission allowances from developing countries. As a result, following the price crash, CER trades were scarce but since then trading volumes have largely recovered.

However, a key differentiator between CERs and phase 1 EUAs is that CERs can be used for compliance in either phase 1 (2005-07) or phase 2 (2008-12), whereas phase 1 EUAs can only be used in phase 1. As a result, CERs are now being viewed as phase 2 compliance instruments. The question that results is "what is a phase 2 compliance instrument worth".

The answer is highly uncertain at this stage. National Allocation Plans (the documents that determine the overall level and distribution of emission permit allocations in EU countries) have not been finalised for phase 2 and, despite being due to the European Commission by 30 June this year, are quite widely expected to be delayed. The general expectation, however, is that governments will substantially tighten the allocations so as to encourage emission reductions – and that they would be justified in doing this after observing the actual out-turn versus forecast for 2005. This is reflected in current trading prices for EUA contracts for December 2008 delivery, of around EUR 17-20 (source: Point Carbon). CERs are now trading at a discount to the EUA 2008 price, but the precise discount is difficult to determine and affected by a large number of project-specific risks as outlined above.

That said, three key valuation approaches appear available:

1. *World Bank Data*: Simply use the World Bank data as provided for the past year. This has an advantage of simplicity and being based on observed data, but may not fully incorporate the effects of the April price crash and may have some (positive) risk bias, causing a negative average price bias (discussed below)

[3] A further reason why the EUA price has not dropped to zero is that some European nations are allowing their firms to carry-over unneeded EUAs from phase one to phase two of the EU ETS.

2. *Discount from December 2008 EUA price*: Because many market participants are now pricing CERs at a discount to EUAs (as they can use them as EU ETS compliance instruments), it may be useful to consider the typical discount to the EUA price that CERs have been trading at and to apply that to recent Dec 2008 EUA price data.

3. *Use of Point Carbon reported data*, to the extent that this reflects the market and is within narrow enough ranges to be meaningful.

These approaches are enumerated below.

Valuations

World Bank Data

The World Bank comments:

> *As of the end of March 2006, contracts for over 79 million tons of emission reductions, largely for CERs, had been signed in the first three months of the year, continuing the blistering pace struck in 2005. The EU ETS market influenced price expectations in the CDM market and helped stimulate the supply of carbon in the market. Prices for CERs in primary market transactions appreciated considerably from an average of US$5.15 in 2004 to US$7.04 in 2005 and US$11.56 in the first three months of 2006 as EU ETS Phase I approached its first "true-up" period. Since the sharp declines in EUA price starting in late April 2006, both buyers and sellers have substantially slowed down the pace of transactions as they try and make sense of the impact on demand for CERs and ERUs.*

From their commentary it is difficult to ascertain the precise CER price that is relevant for the purposes of this valuation. However, the average volume-weighted price was around USD 7.20 per tonne through the year, with prices increasing to USD 11.56 in the first three months of this year (before the price crash). From these numbers, and the fact that the EUA market now seems to have stabilised at lower levels, the USD 7.20 number seems reasonable (although this may be an underestimate – see below).

Discount from EUA Dec 08 Prices

To estimate prices using this methodology, the following approach was taken:

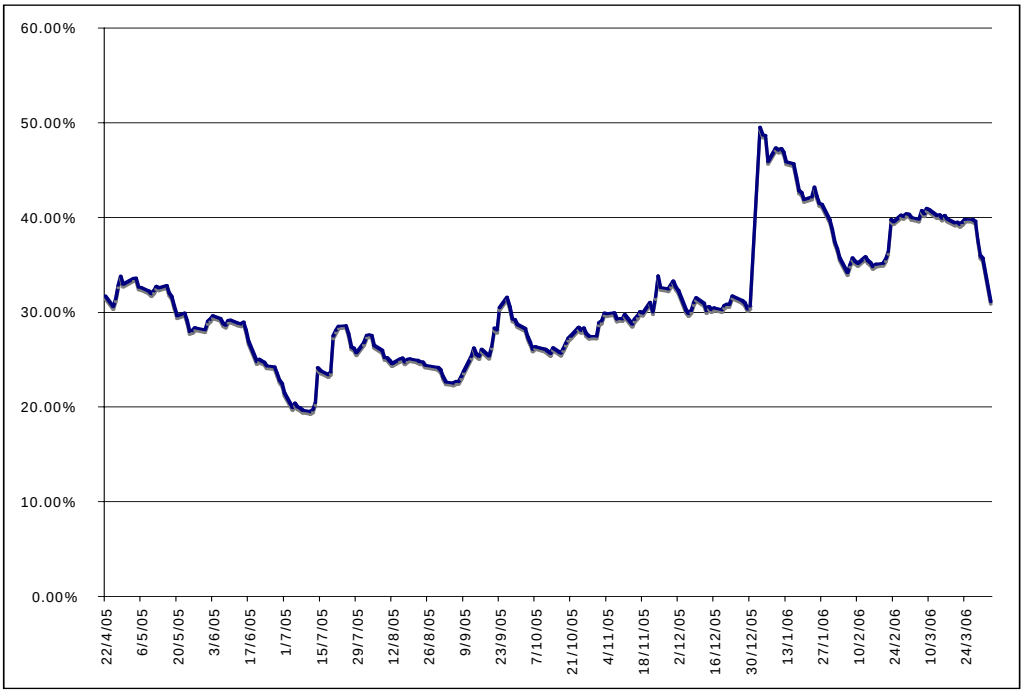
1. *Collect EUA Dec 08 data*. Daily prices from the European Climate Exchange (ECX)-traded EUA December 2008 contract were collected for the past year (from the start of trading to 6 June 2006). The ECX is the most liquid exchange for EUAs, particularly forward vintages, accounting for approximately 35-40% of trading.

2. *Collect CER price data*. World Bank CER price data was used. Unfortunately, it was not possible to gain more disaggregated data than the information reproduced above. Because EUA prices are in euros but World Bank-reported CER prices are in USD, the conversion of the CER prices to euros was

undertaken using the average day interbank exchange rate from oanda.com (i.e. the average for the period of the data in question).

3. *Calculate CER price as a percentage of EUA price*. The CER price was calculated as a percentage of the EUA price (illustrated below). On average, CERs were 31% the price of December 2008 EUA contracts. However, there is considerable variation in this ratio.

   CER price as % EUA Dec 08 price



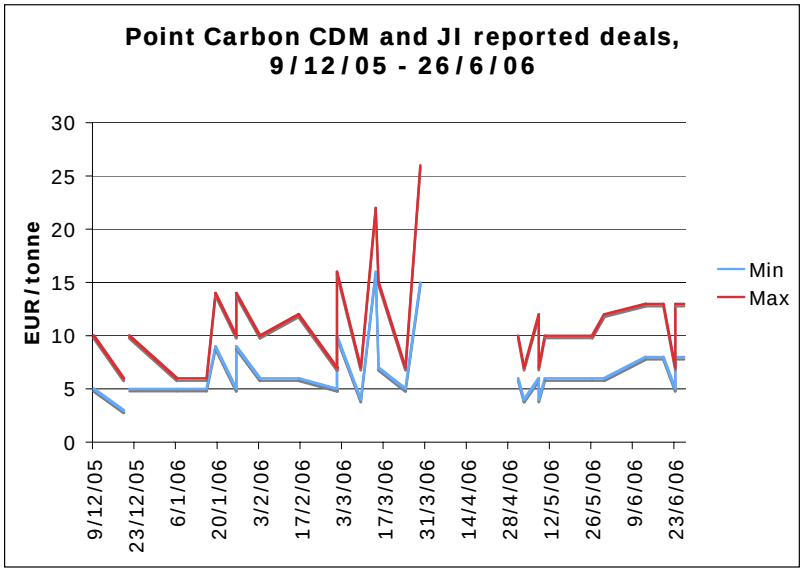
4. *Apply to recent December 2008 contract prices*: Using the average December 2008 contract price on ECX for the period 28 April 2006 (shortly after the price crash) to 6 June 2006, a 31% CER:EUA price ratio implies a CER price of EUR 6.58 or USD 8.40 (using the average interbank rate for this period). Using the December 2008 contract price for Friday 16/6/06 only, it implies a CER price of **EUR 6.04 or USD 7.62**.

One problem with this approach is that it produces numbers substantially lower than the Point Carbon data (below). In addition, it appears to be generally accepted in the market that most CERs are worth considerably more than 30% of the December 2008 EUA price.

Point Carbon Data

In this approach, all project transaction data as reported by Point Carbon in the "recent transactions" part of their *CDM & JI Monitor* reports since December 2005 (which is when Point Carbon started reporting price ranges) has been collected.

The reported prices are shown graphically below. Excluding the period of high volatility leading up to the end of April, the range has tended to average between EUR 5.90 and 9.85. The wide range can be explained by different project risks and projects being at different stages of the registration process.



Issues of Project Delivery Risk

It is important to note that all of the methods above effectively assume that projects have an average risk of non-delivery. In the case of most projects this is a significant (although very seldom robustly quantified) risk.

If the Crown were to buy a portfolio of projects to meet some or all of its Kyoto liability, the existence of delivery risk may require some apparent over-purchasing. The reasoning for this is that if some projects do not deliver, the Crown will need to make up those lost volumes with other projects.

At this stage of development of the projects markets, some buyers insist that sellers (ie project developers) not sell all of the credits that they are forecast to generate (as per their Project Description Document or PDD). Generally they are requiring the seller only to sell up to 70%-80% of the PDD volumes. In this way a delivery error buffer is built into each contract and, when taken from the point of view of a portfolio that the Crown may purchase, an overall delivery buffer of 20%-30%.

An alternative approach would be to buy entire PDD volumes and reduce the price accordingly, but to effectively over-purchase by 20%-30% (or whatever margin is considered reasonable). Either of these approaches may over-compensate for delivery risk if there is any negative correlation between delivery risks of different projects in the portfolio.

The question then is whether and how to factor this into cost projections for the Crown. At the moment there is no standard contracting practice in the market, and it is unlikely for primary transactions (ie the initial purchase of credits from the project

developer as opposed to a secondary market in credits) that practices will standardise in the near future.

However, in addition to having some delivery buffer, it is also likely that contracts to buy project credits have some under-delivery factored into the price. This may be part of the explanation as to why CERs and ERUs trade at a discount to the EUA price.

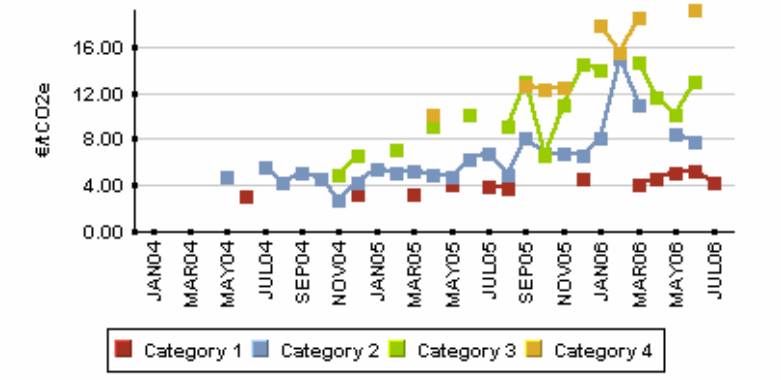
Indeed, this can be seen in the differential pricing of project credit purchase contracts (ERPAs or Emission Reduction Purchase Agreements) according to the extent to which the seller guarantees delivery of the credits. Guaranteed delivery credits trade at a 10-15% discount to the EUA price. This discount largely seems to account for risk that the EU will not allow some of these credits to be used against European emissions targets – there is currently at least a theoretical cap of 8% of emission targets in the EU ETS that can be offset by buying project credits[4]. These credits are also referred to as 'secondary CERs'.

Point Carbon, which collects information including the extent to which ERPAs guarantee delivery, divides these guarantees into a number of categories:

Category[5]	**Price range**[6] **(EUR)**
1. Seller endeavours to deliver flexible volume and buyer commits to buy what is delivered, even if it is not Kyoto compliant: Highest risk to buyer	CER: 5-7 ERU: 5-6
2. Seller endeavours to deliver flexible volume, buyer commits to buy if seller delivers	CER: 6-13 ERU: 6-9
3. Seller commits to deliver firm volume, buyer commits to buy if seller delivers. Valid only if certain preconditions met	CER: 13-15 ERU: 6-12
4. Seller guaranteed to deliver firm volume, buyer guaranteed to buy if seller delivers	CER: 15-19 ERU: N/A

At the same time, prices have been trending up as illustrated by the charts below.

Point Carbon reported CER prices by risk-distribution category

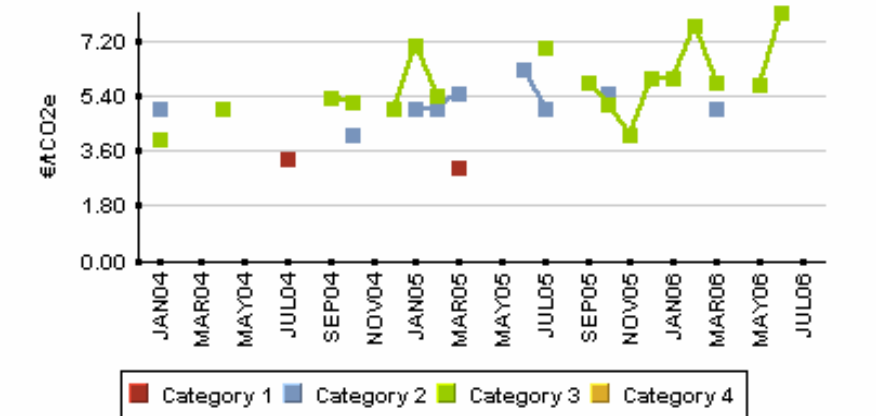


[4] Although in practice this appears at this stage to be a relatively soft cap

[5] Source: Point Carbon

[6] Average past 6 months

Point Carbon reported ERU prices by risk-distribution category



From the Crown's point of view, this means that there is a choice: buy low risk credits for a higher price OR buy cheap credits and bear a likely higher cost of failure to deliver. Of course in reality some mix of the two would make sense but, without a detailed design of a carbon credit purchase programme, it is difficult to predict what that mix may be.

However, if we were to consider a 'normal' portfolio, we could expect some 'average' or 'medium' delivery risk to eventuate from the entire portfolio. Whether this is acceptable from the Crown's point of view, however, depends on how it goes about managing its Kyoto compliance. If it were to contract, for example, sufficient project credits to be delivered by 2010, it would have time to make-up any delivery shortfalls by buying further projects before the end of 2012 (the end of Commitment Period 1). In this case most ERPAs that the Crown may enter are unlikely to be paid for unless the credits are delivered, so the Crown would primarily be exposed to the risk of the project credit price changing (increasing) during the period 2010-2012 when it is trying to make good delivery shortages.

From the point of view of this estimate, however, exactly how the delivery risk is managed is less important than the fact that it would be possible to manage it with sensible and pro-active policy settings. It would therefore appear appropriate to take prices in the mid-range of delivery risk – where the Crown accepts some delivery risk. Given that the only (and perhaps most comprehensive) data available with the risk break-down is provided by Point Carbon, it seems appropriate to use Point Carbon data for CERs, which is that prices range between 6 and 13 euros per tonne in risk category 2[7]. It is also helpful to use this data because it has the greatest volume of trade and is therefore most likely to produce reliable pricing information.

The problem in using this Point Carbon data is that it differs significantly from the World Bank data. This is not surprising as World Bank deals tend to occur quite early in the life cycle of a project and therefore have significantly higher levels of risk priced into them (thereby trading at a substantial discount). On the basis that CERs

[7] Price category 1 is not used because contracts of this type have a high risk of yielding carbon credits that are not Kyoto compliant (VERs vs CERs), and are not therefore useful to the Crown for compliance purposes

contracted by the World Bank are fungible with CERs contracted by anyone else (which they should be), it seems reasonable to rely on the Point Carbon data.

Price Trends

It is also important to note that, despite the April EUA correction, CER prices have been trending upwards over the past months. This has a number of important implications for the Crown.

Firstly, prices at which the Crown is able to buy CERs may rise compared to historical data. This, however, is far from certain because of uncertainty over the extent to which CER imports will be capped in the EU ETS under the Linking Directive.

The current EU target is that project credits should not be used for more than 8% of the total emissions cap in the EU ETS. Implementation of this for the second phase varies widely between countries, and may be difficult to enforce in practice. However, Deutsche Bank has recently estimated that there will be a 320 million tonne import limit of project credits into the EU ETS. If compliance buyers in the EU near this limit, there could be significant price volatility and the CER price may fall. That said, given current information it is equally possible that the Crown may face rising project credit prices. If the Crown were to buy higher risk credits, it would face a greater level of uncertainty as to the cost of adjustments and making good on failed deliveries in future years.

Secondly, this volatility has implications for the Crown's price risk if it looks to make up any under-delivery in later years. Price rises would make this more expensive, whereas price falls would make it less. This simply underlines the need for a well planned portfolio approach.

Conclusions and Recommendation

Any estimate of a carbon price for the purposes of recording the Kyoto related liability on the Crown Balance Sheet is fraught with difficulty and uncertainty given the nature of the market: primary, bilateral, non-transparent, and with prices heavily influenced by project-specific factors.

Given the need to make an estimate, this report confirms the validity of last year's approach of using World Bank published data. It also adds two other approaches; that of using an average historical CER/EUA price discount multiplied by the December 2008 contract EUA price, and that of observing reported deals from Point Carbon. These methods both reflect common practice in the market and provide additional useful points of data with which to come to an overall estimate.

That said, all three methods come with a significant health warning. CER prices reported in the World Bank's report fall in a very wide range – from just over USD 3 to USD 24 – and the ratio-based approach relies on this data (as well as exhibiting considerable volatility in the ratio itself). Given these provisos, best estimates of the CER price are as follows:

World Bank data: USD 7.20 per tonne CO_2-e

Discounted EUA Dec 2008 contract (28/4/06 – 6/6/06): USD 8.40 per tonne CO_2-e

Discounted EUA Dec 2008 contract (16/6/06): USD 7.62 per tonne CO_2-e

Point Carbon data[8] USD 7.62 – USD 16.51 per tonne CO_2-e

The first three of these estimates all use World Bank data in one form or another, and are therefore unsurprisingly similar. The Point Carbon data, however, is substantially higher unless we take the lower end of the range. Noting that it is unrealistic to expect that the Crown (or anyone for that matter) can consistently get bargain basement prices with a given risk level, it seems appropriate that we take a midpoint of the Point Carbon range, which is USD 12.07. The question then becomes which estimate to use. In determining this, the following points – some of which are discussed above - are taken into account:

- The World Bank data may have a negative bias due to the likelihood that many World Bank contracts are entered at very early stages of development
- Point Carbon is the only data source to divide prices in accordance with a categorisation of who bears delivery risk
- Prices have trended upwards of late, even despite a reaction to the EUA price 'correction' in April 2006

In reality, the Crown is likely to need to take a portfolio approach to buying, suggesting that some credits may come at the lower end of the price range through the World Bank or other service providers, and some may fit more squarely within the Point Carbon price range.

It should also be noted that prices are volatile. This may have implications for the Crown's choice of project riskiness: lower price, higher risk projects now may mean greater volatility in the cost of meeting Kyoto targets through purchasing project credits in future. However, it is likely to make sense to buy at least some cheaper credits if delivery risk can be adequately managed.

It would therefore appear that the CER price at which we can currently assume the Crown would have to buy is between the World Bank number of USD 7.20 and the Point Carbon midpoint of USD 12.07. In the absence of more information on Crown policy about which instruments should be bought, what technologies should be utilised, and at what stage of the project cycle, it would seem reasonable to take a point estimate half-way between them at USD 9.65.

[8] This is converted from Euros using the average interbank day-close EUR/USD exchange rate for July of 1.27027. Using category 2 prices

Recommendation

It is therefore recommended that The Treasury assume a price of **USD 9.65 per tonne of carbon dioxide equivalent** for the purposes of calculating carbon liabilities on the Crown's Balance Sheet. This is based on current market conditions and practices, but should not be seen as any guarantee of the prices obtainable if/when the Crown enters the market to purchase credits.

Glossary of Terms

Kyoto Protocol	The international treaty under which New Zealand has an obligation to reduce emissions to 1990 levels (see http://www.climatechange.govt.nz/about/kyoto.html)
CER	Certified Emission Reduction. An emission reduction credit generated under the Clean Development Mechanism
Clean Development Mechanism (CDM)	One of the mechanisms under the Kyoto Protocol under which carbon credits (CERs) can be generated in developing economies by investing in projects that reduce emissions compared to what they would be without the emissions-based investment
ERPA	Emission Reductions Purchase Agreement. This is common terminology for the sale/purchase agreement for project credits (CERs or ERUs) between a project owner and the buyer of the credits
EU ETS	EU Emissions Trading Scheme. An EU-wide emissions cap and trade scheme for greenhouse gas emissions. Major industrial and energy installations through the EU are set emissions caps through National Allocation Plans (NAPs) and can trade allowances (EUAs) as part of their compliance strategy
EUA	European Allowance. A tradable carbon instrument under the EU ETS. Denominated in 1 tonne of CO2-e
Point Carbon	A leading carbon information and analysis service – see www.pointcarbon.com
Kyoto-compliant emission units	Tradable emission units that are eligible for use against a country's Kyoto obligation. These include AAUs, ERUs, CERs and RMUs (see definitions in this glossary).
Kyoto Protocol cap	Countries' emissions targets under the Kyoto Protocol (New Zealand's is to reduce emissions to 1990 levels over 2008-2012)
Commitment Period 1	The first period of time when countries have an emissions target under the Kyoto Protocol – 2008 to 2012
AAUs	Assigned Amount Units. Each country with a Kyoto emissions target has that target denominated in tradable tonnes of CO2-e. Each of these tonnes is one AAU
ERUs	Emission Reduction Units. Greenhouse gas credits generated from Joint Implementation projects

Joint Implementation (JI)	One of the mechanisms under the Kyoto Protocol under which carbon credits (ERUs) can be generated in countries that have an emissions target by investing in projects that reduce emissions compared to what they would be without the emissions-based investment. Similar to the CDM but for a different set of countries. ERUs can only be created from 2008, but CERs can be created from 2005
RMUs	Removal Units. Carbon credits generated through carbon sequestration from land use, land use change and forestry
Project credits	Carbon credits generated through projects under the CDM or JI
Short duration market	The market for short-dated contracts (i.e. carbon contracts for delivery of the credits immediately or in the near future)
Net long	A situation where, overall, there is more supply than demand in a market (in this case, of carbon credits). An individual or organisation can also be said to be long when they own more credits than they require
Net short	A situation where, overall, there is more demand than supply in a market. An individual or organisation can also be said to be short when they have sold, or have an obligation for, more credits than they own
National Allocation Plan (NAP)	Under the EU Emission Trading Scheme, the allocation of carbon obligations to industrial installations is made through a series of National Allocation Plans. Each national government completes a NAP prior to the beginning of each phase of the EU ETS. Phase 1 of the EU ETS is 2005-07 and phase 2 is 2008-12
Delivery risk (of projects)	The risk that the emission reductions forecast to occur as a result of a project do not eventuate or are only partially realised.
Project Description Document (PDD)	A document outlining the key features of a project. PDDs are submitted to the CDM Executive Board (in the case of the CDM) or the JI Supervisory Committee) for JI) for registration of projects. Registration is the process by which projects are able to issue Kyoto compliant credits
PDD volumes	Projected volumes of emission reductions as stated in a project's PDD