The Allen Consulting Group

The cost of tradable emissions units under the Kyoto Protocol

Pricing a potential future greenhouse liability

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Report to the New Zealand Treasury

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Executive summary

A number of markets are being developed in anticipation of demand driven by commitments under the Kyoto Protocol. The private sector has been active in its preparations for this emerging emissions market, and a number of countries and jurisdictions have taken steps toward developing emissions trading systems in support of greenhouse objectives and obligations .

These developments generally represent a 'foundation building' exercise and a vehicle for business familiarisation, economic adjustment and price discovery in the context of mandated emission constraints. These activities are generating information on emission reduction costs under current regulatory settings and also providing information on future prices, reflecting expectations about demand and supply conditions within the 2008-12 Kyoto commitment period.

The European Union Emissions Trading Scheme (EU ETS) is an important policy mechanism in this regard and it's evolution, along with other greenhouse measures adopted by EU member countries, can have significant ramifications for the level of future trade activity in the Kyoto market. But spot prices being generated under the EU ETS are unlikely to be a reliable indicator of future Kyoto prices. The EU ETS is still undergoing a bedding down process, large Annex B countries such as Russia, Japan and Canada are not part of this market and arrangements that will provide greater access to abatement certificates from projects in developing countries are still being strengthened. Information on forward trades suggests that emission prices in the EU ETS for 2008-12 are likely to be significantly lower than those prevailing today. Much will depend on the extent to which participants in the EU system are allowed to utilise the full range of emission allowances and credits created under the Kyoto system in order to satisfy their obligations under EU trading rules.

Forward markets are currently developing for Kyoto-compliant emission certificates in parallel with developments in the EU ETS. Project based abatement certificates from Joint Implementation (JI) and Clean Development Mechanism (CDM) activities are fully recognised under the Kyoto trading system as offsets to Annex B emission liabilities and, once approved under the assessment and certification guidelines, are fully substitutable for the Assigned Amount Units (AAUs) that represent the principle emissions 'currency' of Annex B countries.

Prices for 2008-12 vintage Certified Emission Reductions (CERs – generated by CDM projects) and Emission Reduction Units (ERUs — produced through JI activities) provide the best current indicator of market expectations with regard to the cost, and current risk adjusted value, of Kyoto emission permits. Of these ERUs appear to attract greater market confidence and are most directly linked to expected demand conditions in the 2008-12 Kyoto commitment period.

Price expectations vary and will be influenced by a range of factors that will become more certain as the commitment period approaches. However, analysis of CER and ERU prices suggests that US$6.00 per tonne CO_2e would be an appropriate indicative estimate of the price of a Kyoto permit, as reflected in today's marketplace.

Section 1

Development of a Kyoto emissions market

The Kyoto Protocol to the United Nations Framework Convention on Climate Change entered into force on 16 February 2005. This agreement binds a number of developed nations and those with 'economies in transition' to achieve defined emission outcomes for the period 2008 to 2012. These agreements will see net emissions across the group constrained to an annual level for that 5 year period which is, on average, less than the emissions output generated in 1990. Countries that agreed emission targets under the Kyoto Protocol (Annex B countries) are listed in Table 1.1. Since agreeing these targets, both the United States and Australia have announced that they are currently not prepared to ratify the Protocol, and be legally bound by its provisions. Nevertheless, Australia has stated that it still intends to achieve its Kyoto emissions target for 2008-12.

Table 1.1

ANNEX B COUNTRIES AND TARGETS UNDER THE KYOTO PROTOCOL

Country	Average annual 2008-12 emissions target relative to 1990*
EU-15*, Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland	-8%
USA	-7%
Canada, Hungary, Japan, Poland	-6%
Croatia	-5%
New Zealand, Russian Federation, Ukraine	0%
Norway	+1%
Australia	+8%
Iceland	+10%

* Some IET nations have a baseline other than 1990.

Source: UNFCCC website (www. unfccc.int/essential_background/kyoto_protocol/items/3145.php)

Importantly, the Kyoto Protocol allows for a range of 'flexibility mechanisms' to be utilised by nations in achievement of their emission targets (see Box 1.1). These allow for trade in the emissions quota assigned to each ratifying Annex B country, and supplementation of that 'quota' amount with Certified Emission Reductions (CERs) generated though abatement projects in non-Annex B (ie. developing) countries, and also through eligible carbon sink activities (eg. establishment of new forest areas) that result in the absorption of atmospheric carbon dioxide.

Box 1.2

KYOTO PROTOCOL ACCOUNTING AND THE FLEXIBILITY MECHANISMS

The 'flexibility' mechanisms are based on the Kyoto Protocol's system for the accounting of emission targets. Under this system, the amount to which an Annex I Party must reduce its emissions over the five year commitment period (known as its "assigned amount") is divided into units each equal to one tonne of carbon dioxide equivalent. These assigned amount units (AAUs), and other units defined by the Protocol, contribute the basis for the Kyoto mechanisms by providing for a Party to gain credit from action taken in other Parties that may be counted towards it own emissions target.

The three mechanisms are:

Joint implementation (JI) under Article 6 provides for Annex I Parties to implement projects that reduce emissions, or remove carbon from the atmosphere, in other Annex I Parties, in return for emission reduction units (ERUs).

The Clean Development Mechanism (CDM) defined in Article 12 provides for Annex I Parties to implement projects that reduce emissions in non-Annex I Parties, or absorb carbon through afforestation or reforestation activities, in return for certified emission reductions (CERs) and assist the host Parties in achieving sustainable development and contributing to the ultimate objective of the Convention.

Emissions trading, as set out in Article 17, provides for Annex I Parties to acquire units from other Annex I Parties. These units may be in the form of AAUs, removal units (RMUs), ERUs and CERs.

AAUs, RMUs, ERUs and CERs are the basic accounting units of the "assigned amount" of each Annex I Party referred to in the provisions of Article 3 of the Protocol. Each unit is equal to one metric tonne of emissions (in CO2-equivalent terms). AAUs are issued on the basis of the assigned amount pursuant to Article 3.7 and 3.8 while RMUs are issued on the basis of land use, land-use change and forestry (LULUCF) activities (often referred to as "sinks") under Articles 3.3 and 3.4. In accordance with Article 3.10 and 3.11, the issuance of ERUs results in the cancellation of either AAUs or RMUs, in order that no overall impact on a Party's assigned amount is felt. Finally, CERs are the additions to assigned amount referred to in Article 3.12.

Source: Based on UNFCCC text (unfccc.int/kyoto_mechanisms/items/2998.php)

Mechanisms that allow the transfer of emission 'units' between countries lay the foundation for an international emissions market, and the emergence of an emissions price. This price will reflect the demand and supply conditions that prevail within that market — fundamentally determined by the:

- degree of emission constraint imposed by the targets adopted by Annex B countries for the 2008-12 period;
- scope for developing countries to generate CERs and sell these to countries whose emission are constrained; and
- cost and extent of emission reduction and sink enhancement opportunities across these countries.

However, a range of other factors can also come into play including:

- expectations about post-2012 greenhouse constraints;
- demand for Kyoto emission units by Parties other than ratifying Annex B countries (eg. environment groups or other countries that may wish to retire emission units, or use them for domestic compliance purposes); and/or
- robustness of the trading regime that is established.

Transitional markets

A number of markets are being developed in anticipation of demand driven by commitments under the Kyoto Protocol. The private sector has been active in its preparations for this emerging emissions market, and a number of countries and jurisdictions have taken steps toward developing emissions trading systems in support of greenhouse objectives and obligations (eg. UK, Canada, Norway, the Chicago Climate Exchange, New South Wales Greenhouse Gas Abatement Scheme, etc).

These developments generally represent a 'foundation building' exercise and a vehicle for business familiarisation, economic adjustment and price discovery in the context of mandated emission constraints.

The European Union emissions trading scheme (EU ETS), which came into force earlier this year, is a significant instalment in the package of measures that EU countries are putting in place to comply with Kyoto Protocol commitments for the 2008-12 period. Mechanisms are also been grafted on to the EU ETS that will allow those subject to acquittal obligations under the scheme to draw on sources of emission allowances that lie beyond the EU member countries. The use of these mechanisms will ultimately see the EU ETS become part of a broader international emissions trading system, as envisaged in the Kyoto Protocol.

A brief overview of the EU ETS is provided in Box 1.2.

Box 1.3

THE EUROPEAN UNION EMISSIONS TRADING SCHEME (EU ETS)

The EU emission trading scheme began on January 1, 2005, and applies to 25 countries, including the 10 Accession Countries that joined the EU in May 2004. The program is to be implemented in multiyear phases. The first phase will run from 2005 until 2007 and is sometimes referred to by EU officials as a "warm-up" phase. The second phase will begin in 2008 and continue through 2012, coinciding with the five-year Kyoto compliance period. The program continues in five-year phases thereafter.

Initially, the EU ETS will cover only CO2 emissions from four broad sectors:

- production and processing of iron and steel;
- minerals (such as cement, glass, or ceramic production);
- energy (such as, electric power, direct emissions from oil refineries); and
- pulp and paper.

Installations are included in the program if they exceed industry-specific production or capacity thresholds specified in the EU Directive.

More than 12,000 installations are included in the program, covering 46% of EU CO2 emissions. The EU may subsequently add additional emissions, sectors, and installations in the second phase of the program.

The EU Directive provides penalties for emissions in excess of surrendered allowances of €40/ton CO2 in the first period, and €100/ton CO2 in the second period. Excess emissions must also be offset in the following compliance period.

The EU also approved the 'Linking Directive' in late 2004 which allows member countries to approve the use of Certified Emission Reductions from Clean Development Projects as emission offsets under the EU ETS from 2005, and the recognition of Emission Reduction Units from 2008.

Source: EU Linking Directive (2004/101/EC), Joseph Kruger and William A. Pizer, (2004), The EU Emissions Trading Directive: Opportunities and Potential Pitfalls, Resources for the Future, Discussion Paper 04–24, Washington DC.

Importantly, the interaction of supply and demand conditions within the EU ETS at this point in time are not a reliable indicator of future Kyoto emission permit prices — that is, the value of AAUs, CERs, RMUs and ERUs in the period 2008-12. This is because;

1. the EU ETS currently focuses on a subset of the gases and sectors spanned by the Kyoto Protocol;

2. large Annex B countries with commitments under the Protocol (eg. Russia, Japan, Canada) are yet to be linked into the EU ETS, and two-way trade in emissions between the EU and other countries has not been established;

3. the supplementary supply opportunities created by the EU Linking Directive have not yet been fully reflected in the operation of member country trading systems (eg. the UK is not expected to transpose this into law until November 2005)[1]; and

4. project development and certification processes under the Clean Development Mechanism are bedding down, and there is considerable potential for growth in supply in this area.

Nevertheless, the EU ETS is an explicit pathway between current emission practices and policies in EU member countries and the emission constraints (and abatement opportunities) that will be in place during the Kyoto commitment period. It is a significant building block in the development of an international emissions trading system and the formation of a market for Kyoto-consistent emission permits. As participants in the EU ETS look forward to future obligations under the ETS and the assumption of full Kyoto obligations in the 2008-12 period, a market will be created for emission allowances and agreements that reflect best judgements about future scarcity conditions and the prevailing price of an emission permit. These markets are growing rapidly in the EU ETS context.

Investment and trade in CDM and JI sourced Kyoto – consistent emission allowances have also been gaining momentum. While a large share of CDM and JI derived allowances (CERs and ERUs) change hands on a bilateral basis for undisclosed prices, markets are also forming to facilitate efficient trade in these Kyoto units. Once certified, these allowances are fully fungible with Assigned Amount Units allocated under the Kyoto Protocol, and can each be used to offset emission liabilities incurred by Annex B countries under the Kyoto Protocol.

[1] See http://www.defra.gov.uk/environment/climatechange/trading/eu/info/directive.htm

Section 2

Relevant outcomes from price discovery

Forward prices under the European ETS

The EU ETS has been in the pipeline for some time. While it did not formally come into force until 1 January 2005, the first exploratory forward trade of EU consistent emission allowances was made between Shell Trading and NUON on 27 February 2003. Since that time trade volume has risen. The Pew Centre (2005) reports forward trading levels of around 50,000 tonnes of CO_2 allowances a month from February 2003 onward, but a jump to about 1 million tonnes per month after Russian ratification of the Protocol in September 2004. This volume then increased to around 5 million tonnes per month from January 2005. Over this period the price of EU ETS allowances varied from a high of 13.50 Euro per tonne CO_2 in 2003 to around 9.50 Euro per tonne CO_2 for most of 2004.[2] Earlier this year, Andrei Marcu — President of the International Emissions Trading Association, reported bid and offer prices for 2006 and 2007 vintage EU ETS allowances (as at 11 February 2005) of around 7.30 Euro.[3]

Current market conditions under the EU ETS are generating prices of around 23 Euro per tonne in the spot market, largely as a result of recent strong emissions growth among the EU group of nations, and limited capacity to draw on lower cost abatement opportunities beyond the EU borders. The EU ETS is a sovereign system whose design, and regulations governing access to external abatement sources, will have a significant influence on the emission prices generated within it. A review of the system is scheduled for 2006.

The Pew Centre (2005) has highlighted the range of expectations among traders and modellers about the long term price of allowances within the EU ETS. The authors point to the range of uncertainties that impact on this predictive exercise including the overall cap applied, availability of project credits and potential for strategic behaviour by sellers. They note that '… these modelling assumptions can easily entail uncertainty of a factor of two or more', but point to a price of around 14 Euro per tonne CO_2 (2005 prices) for allowances in 2010 derived from the Primes model.[4]

However, they also point to lower price expectations (at the time of writing) within the EU ETS forward market. Table 2.1 below is reproduced from the Pew Centre white paper.

[2] see Pew Centre (2005), The European Union Emissions Trading Scheme (EU-ETS): Insights and Opportunities, Pew Centre, Washington DC.

[3] Andrei Marcu (2005), 'Global Overview, presentation to Sustainable Market Solutions for Global Environmental Problems conference, Berkeley April 2005.

[4] Pew Centre (2005), op cit. p.18

Table 2.1

MARKET PRICE FORECASTS FOR THE EU ETS (EURO PER TONNE CO_2)

	Expected price in Dec. 2003	Expected price in Apr. 2005	Expected price in Apr. 2008	Forward Market (June 2003 - Jan 2005)
Low	2.50	1.50	2.00	6.80
Median	5.50	5.00	7.00	9.00
High	10.00	40.00	45.00	13.00

Source: Pew Centre (2005), The European Union Emissions Trading Scheme (EU-ETS): Insights and Opportunities, Pew Centre, Washington DC, page 18.

The absence of additional background information makes these results a little difficult to interpret. However, the authors advise that:

> These results suggest a lower median price than the economic modeling results in the emerging market, with considerable uncertainty attached to these predictions. Such caution in market forecasts is reflective of the huge uncertainties firms face, including final allocation decisions, linkages with non-EU systems and project mechanisms, and future expectations of emission targets.
>
> Pew Centre (2005), The European Union Emissions Trading Scheme (EU-ETS): Insights and Opportunities, Pew Centre, Washington DC, page 18

Forward prices in the JI/ CDM market

The Joint Implementation (JI) and Clean Development Mechanism (CDM) markets also offer information on the price of tradable emission units under the Kyoto Protocol.

These project based abatement certificates are fully recognised under the Kyoto trading system as offsets to Annex B emission liabilities and, once approved under the assessment and certification guidelines, are fully substitutable for the Assigned Amount Units (AAUs) that represent the principle emissions 'currency' of Annex B countries.

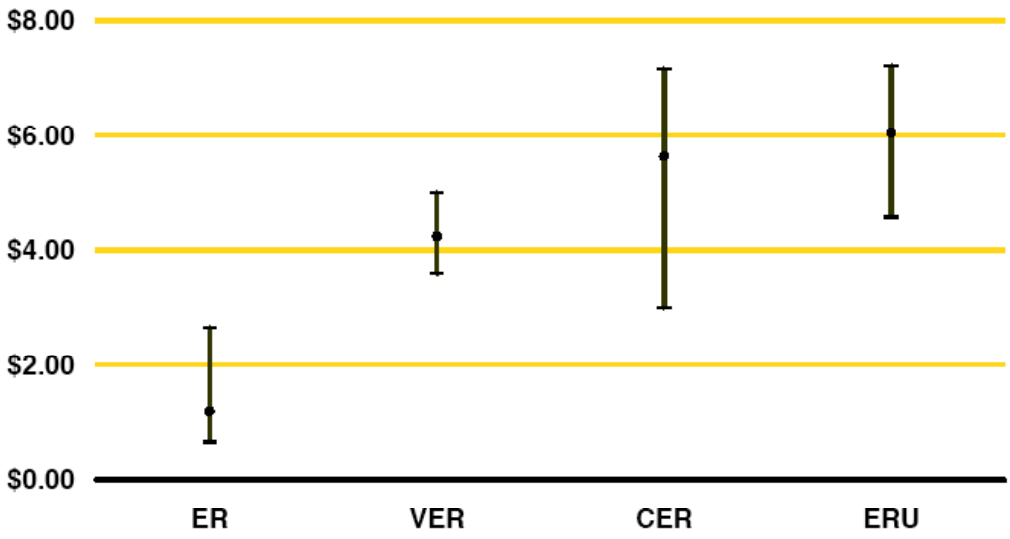
Certified Emission Reductions (CERs) from CDM are generated through abatement activities in developing countries and hence are supplementary to global emission quota defined by Annex B targets. The Emission Reduction Units (ERUs) from JI projects are generated in Annex B countries and hence represent a transfer of emission allowances within the Annex B quota amount defined in the Kyoto Protocol.

The World Bank closely monitors developments in these markets and reports growing trade volumes. Around 78 million tonnes (Mt) of CO_2e was traded in 2003, 107 Mt CO_2e in 2004 and 43 Mt CO_2e for the January – April period of 2005.

Analysis by World Bank staff highlights the recent range of prices paid for project-based emission reductions (in $US per tonne CO_2e). The range and weighted average price observed for these units is illustrated in Figure 2.1.

Figure 2.2

PRICES FOR PROJECT BASED EMISSION REDUCTIONS - JAN 2004 TO APR 2005 (USD PER TONNE)



Source: Franck Lecocq and Karan Capoor (2005), State and Trends in the Carbon Market 2005, published by International Emissions Trading Association and World Bank Carbon Finance Business, May, Washington DC.

Various classes of emission reduction unit are identified in the figure. The certificates denoted VER, CER and ERU are those that are Kyoto compliant — with VERs representing project based emission reductions that have been generated by CDM projects but which involve a risk to the buyer that the project might not be subsequently registered (approved) by the CDM Board. CERs and ERUs, as discussed, are fungible with AAUs and are sold on the basis that the seller assumes the non-compliance risk (and for earlier trades, the risk of the Kyoto Protocol not entering into force).[5]

Recent trading history of higher quality Kyoto-compliant certificates suggests a range of between US$3 and US$7 per tonne, with a weighted average value of around US$6 per tonne. Certainly, this is the value recorded for recent ERU trades, which are likely to most closely reflect the market valuation of a low risk tradable emission unit under the Kyoto Protocol.

This analysis bears comparison with CER and ERU values reported by Marcu (2005, op cit). These are reproduced in Table 2.2, and show offer prices for CERs ranging up to 5.50 Euro, and 6.00 Euro for ERUs. These equate to US dollar prices (in February 2005) of around US$7.15 to US$7.80 per tonne. Information on bid and clearing prices is not provided, but these presumably span a range of lower prices.

[5] The ERs depicted in the figure represent emission reduction projects not linked to the Kyoto Protocol, such those supplying voluntary and pre-2008 offset arrangements.

Table 2.2

CER AND ERU PRICES AT 11 FEB. 2005

Commodity type	Vintage year	Price range (offer) per tonne CO2e
CDM - CERs	2000 - 2012	EUR 1.50 – 5.50
JI - ERUs	2008 - 2012	EUR 4.00 – 6.00

Source: Andrei Marcu (2005), 'Global Overview', presentation to Sustainable Market Solutions for Global Environmental Problems conference, Berkeley April 2005.

Most recent reports from Point Carbon (a major international carbon broker) point to recent upward movement in the CER price — driven increasingly by demand for them within the EU trading system. The June issue of the CDM & JI Monitor reports CER offer prices in the 5 to 7 Euro range (for abatement certificates from yet-to-be-registered CDM projects), and trades for registered CERs occurring at above the 10 Euro mark.[6]

[6] Point Carbon (2005), CDM Market Comment, CDM & JI Monitor, 14 June 2005. (p.2).

Section 3

Best estimate of the Kyoto emissions price

It is inherently difficult to predict the price of emissions that will characterise the 2008-12 Kyoto commitment period. This will depend on a range of policy factors such as the cost and mix of measures that are adopted by Annex B nations to constrain their emissions, conditions within the global economy and the impact of exogenous factors such as climate or developments in world affairs.

Nevertheless, those facing the prospect of future emission constraints have strong incentives to focus on opportunities for accessing low cost abatement. This can entail a combination of in-house emission reduction effort and, under emission trading arrangements, paying others to undertake abatement on their behalf. Opportunities for trading under the Kyoto Protocol, have led to development of forward markets that reflect the expectations of buyers and sellers about the costs and need for abatement in the future.

There is an array of modelling results available that provide predictions of a Kyoto emissions price — driven by a range of assumptions about patterns of growth, policy settings and relative abatement costs. These are tools available to those actually involved in abatement efforts — many of whom have a substantial economic incentive to think pragmatically about the future, and the actual conditions and opportunities that are most likely to prevail during the commitment period. Self interest, commercial experience and expert judgment are inherent in the trading dynamics of forward markets.

The Kyoto Protocol sanctions a range of emission units and offsets that can be used for compliance purposes. CERs and ERUs are currently attracting considerable interest because they can be registered and transferred prior to commencement of the 2008 commitment period. Importantly, demand for CERs is also being driven by the operation of the European Union Emissions Trading Scheme (EU ETS) which has been designed to facilitate economic adjustment and learning in anticipation of future emission constraints. Though the EU ETS has been designed to integrate with the Kyoto trading system from 2008 it has not progressed far down that transition path, and is unlikely to be a good indicator of the conditions likely to prevail under full Kyoto trading. High current prices under the EU ETS are not matched in the forward market. Moreover, policy decisions within the EU that restrict future access to tradable emissions from outside the EU could result in a differential emissions price — with EU ETS prices rising above the Kyoto price in the 2008-12 period.

Prices for 2008-12 vintage CERs and ERUs provide the best current indicator of market expectations with regard to the cost, and current risk adjusted value, of Kyoto emission permits. Of these ERUs appear to attract greater market confidence and are most directly linked to expected demand conditions in the Kyoto commitment period.

Analysis of CER and ERU prices suggests that US$ 6.00 per tonne CO_2e would be an appropriate indicative estimate of the price of a Kyoto permit, as reflected in today's marketplace.