ECO SECURITIES

Prototype Carbon Fund Market Intelligence Report

Prepared for PCF*Plus*

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Executive Summary

The first half of 2001 has brought the climate/GHG emission issue perhaps into its greatest prominence since the emergence of public concern in 1988. The decision of the Bush Administration to repudiate the Kyoto Protocol has resulted in very focused attention on the issue across a wide range of observers. The public opposition to President Bush's actions has been quite widespread. As of early June the world awaits the results of the policy review announced by the US, and its engagement at the continuation of COP 6 in July 2001.

While the UNFCCC process of Rio, Kyoto and The Hague remains the overarching structure around which climate policies are being developed, it is important to recognize that Kyoto is far from being the "only game in town". Indeed, Kyoto barely scratches the surface of actual policies and associated developments that are already impacting the incipient carbon market. While on the surface this seems counterintuitive - without Kyoto what can there be? - it is imperative to recognize that international agreements only create a general framework into which domestic policies are fit in accordance with local conditions. As such, there are innumerable jurisdictions which are already undertaking policies that would be sympathetic to the implemented Kyoto process and which are not waiting until finalization of those negotiations before coming into effect.

While there is often a general assumption that domestic policies on greenhouse must necessarily track the framework of Kyoto, this assumption will come under increasing challenge if the current international policy impasse continues. Furthermore, there are other emerging policy vehicles - including domestic emissions trading and tradable renewable energy credits - which can potentially encompass similar value propositions as the CDM for developing country offerings of CERs. Much of this report is centered on those initiatives.

Until the point that policy regulates carbon emissions, market activity is based upon individual corporation's subjective interpretations across various areas. These are perceived to be indicative of the direction and strength of the Kyoto Cap process. These include (but are not limited to):

· The divisions between Annex B nations over Kyoto implementation and goals

· The emergence of domestic policy vehicles that reward or penalize relative greenhouse performance or proxies of such;

· Energy utilization trends and technology shifts, particularly in Annex B countries;

Given the sheer numbers of jurisdictions (which number in the hundreds, once it is recognized that sub-national jurisdictions are among the most active areas for greenhouse policy instruments) it is impossible to comprehensively identify - let alone analyze - all of the relevant dynamics. Nonetheless, key developments do have the potential to influence the carbon market in both short- and long-term. This report represents EcoSecurities' subjective choices regarding the importance of different phenomena that are impacting - or could impact - this nascent market. We refer to these phenomena within the general rubric of "trends" though in many cases they may only be single iterations, whose subsequent uptake

and expansion would potentially impact the market.

Within this first report, the significant trends identified include:

1. The open policy divisions between Annex B nations over Kyoto implementation and its goals;
2. Market movements in the North American energy markets;
3. Market tendencies leading to the accumulation of emissions credits, leading to the perceived oversupply of emissions trading permits;
4. The evaluation of current academic models, which seek to explain potential carbon pricing under various regimes (see Annex I);
5. Actual emission policy trends in key Annex B jurisdictions (see Annex 3);
6. The emergence of renewable energy portfolio standards and green energy pricing as an alternative to carbon trading (see Annex II).

We make no claims that such a list is comprehensive at this juncture. In that vein of acknowledging its shortcomings, it is important to recognize that any report of this kind - by its very nature - is out of date almost by the time it rolls off the printer. Given the abovementioned breadth of public jurisdictions and private initiatives that are under constant evolution, this report represents a snapshot in time of some particularly salient pieces of information that may - or may not - ultimately prove to be significant pieces in the carbon market puzzle.

Section 1

The Open Division over Kyoto

Overview of the Situation

The friction between the EU and US that was a major cause for the diplomatic breakdown in The Hague, increased substantially after President Bush reversed a campaign pledge to cap American CO2 emissions from electric power plants under a proposed four pollutant regime. Tensions were further exacerbated by the US announcement that it would not ratify the Kyoto Protocol. It would be difficult to deny that these actions placed the Kyoto agenda at its highest point of public awareness ever, with a constant “full court press” from US allies, NGOs, public figures and the media pressuring the administration to modify - if not reverse - its course.

As importantly, the President’s unilateral action in denouncing Kyoto certainly increased pressure within the so-called Umbrella Group. The decision on ratification by the governments of Japan, Canada and Australia will be key with regard to the coming into force of the Kyoto Protocol. As of the first week of June, there are indications that some alternative

US proposals may be on offer, though the details are yet unknown. The degree to which such new ideas can overcome differences in positions will only be seen once negotiations again begin in earnest at the continuation of COP-6.5.

We therefore focus this first section on the relative movements within the EU and US, mainly concentrating on activities outside of President' Bush's actions in March and the subsequent debate. We conclude by considering the reactions of the other nations in the Umbrella Group.

One similarity between the US and Europe positions is that in both there are discernible differences between activity levels at the central/federal political tier versus the state/sub-national levels. While neither the EU nor the US has come forth with comprehensive emissions policies, that relative vacuum at the level of central governments has helped foster out a variety of initiatives across various sub-jurisdictions. Many of these have substantial potential for demonstration and subsequent replication at the national levels of decision-making.

European Union

Facts

Despite the collapse of negotiations in The Hague, the EU has continued its process towards Kyoto ratification. This resolve appears to have hardened with the recent US threat to withdraw from the Kyoto process. In late May, Denmark became the first European Union country to make a formal decision on ratification of the Kyoto Protocol when Denmark's parliament gave the go-ahead for the government to ratify Kyoto Protocol. Denmark's actual ratification of the treaty would take place along with that of other European Union member states at a later unspecified date. Several other European nations may make similar decisions by the end of this calendar year. The EU has continually reiterated its intention to ratify the Protocol by the Rio+10 conference in 2002.

Upon assuming leadership of the EU in January, Sweden announced tougher targets for its domestic CO2 emissions reductions. Sweden now aims to reduce its national emissions by two percent during 1990-2010, in contrast to its previous commitments, which stipulated unchanged output. Sweden also declared it was considering domestic carbon tax hikes to set an example. At 6.4 tons/C per capita, the nation already has one of the lowest levels of CO2 emissions in the EU, compared with the European average of 9.0 tons.

In this vein, Sweden is determined to push the EU towards reductions of GHG emissions. In recent months, the EU Commission has:

- Revealed an ambitious target of reducing GHG emissions by 40% by 2020;
- Announced plans to implement minimum EU-wide tax rates on energy products and new taxes on gas, electricity and coal;
- Created a European air emissions inventory system, covering all greenhouse gases. The inventory contains emissions data on the sectoral level and a draft for a more disaggregated Pollutant Emissions Registrar -- which would cover all GHGs -- is pending;
- Published national comments on its proposal for an EU-wide emissions trading

system based on the upstream approach, which would allow nation-states substantial flexibility in the creation of national inventories, emissions monitoring and the auctioning of trading permits;

- Announced plans to introduce a "league table" to publicize the results of environmental investigations and distinguish the countries with the worst green credentials, including performance on GHG measures.

Speculation

Within EU countries, policy discussions continue to split along the lines of energy-intensive groups and non-carbon-intensive service groups. Within each state there remains a number of energy-intensive producer associations, which refuse to accept not only carbon tax increases, but also limitations on emissions trading rights as well as the European rejection of sinks as a major or main emissions reductions tool. For instance, in January 2001 Sweden's timber industry insisted that using forests to reduce carbon dioxide was a valid approach that should be supported by the Swedish leadership of the European Union. Still, considering that both the volume of output and employment in carbon-intensive sectors across the EU are continuously declining, it is obvious that calls of political opposition will not shift the overall EU stand on specific policies being voiced for Kyoto implementation.

Although agreements on taxes must be unanimously approved by EU member states, the Commission might use the "enhanced co-operation" wording introduced as part of the Nice Treaty, to push these measures through. This provision allows member states to agree on implementation of new laws at different speeds, thereby preventing some countries from being held back by other countries, which oppose such measures.

We believe that the EU is likely to become more flexible on international emissions trading if and when emissions reduction difficulties start becoming apparent. Despite substantial domestic policies to curb them, European CO2 emissions are likely to show a continuing net increase. This is in large part due to the transportation sector - like the US, Europe has not yet achieved meaningful reductions of GHG emissions from that sector and transportation emissions growth has been substantial. In January 2001, the European Environmental Bureau (EEB) confirmed that voluntary agreements between the Commission and vehicle manufacturers to reduce GHG emissions have been weak and unenforceable. A new EU directive mandating that 5% of all transport fuel come from renewable sources will likely create substantial demand for biodiesel and ethanol, some percentage of which is likely to come from international sources due to agricultural constraints within Europe.

The withdrawal of the US from the Kyoto negotiating process - if this truly occurs -- will force Europe to look carefully at its negotiating position. If the EU redoubles its efforts to confirm the Kyoto process through ratification, while US emissions remain unconstrained, carbon intensive producers will promote policy tools to help them maintain competitiveness. Indeed, the arguments the US has used to defend its competitive position versus uncapped countries would likely filter into the European stance as it evaluates its own competitiveness with the United States and developing economies.

One such tool would be the increasingly aggressive use of international emissions trading, particularly via JI with Eastern countries and the CDM with developing states, to help bring down the costs of national Kyoto compliance. While it is unlikely that Europeans would

completely shift their policy positions to suit the American liberal stance on trading (which Europe has resisted since well before the Hague), the pressure to maintain national competitiveness by facilitating emissions trading is expected to be stronger than before the US declared withdrawal from the Protocol. In such a case, we would expect variants of the Dutch government-led ERUPT system to be a likely policy outcome, particularly in the more statist states within the EU.

The United States

Facts

Beyond the general outcry that has accompanied the decisions of the Bush Administration on climate, there are other historical considerations that bode more positively. First, despite his plans for expanded oil and gas drilling in the Arctic, President Bush has a record of implementing an emissions trading regime in Texas. Also, as a Governor of Texas, Bush signed an energy sector restructuring law, which induced an aggressive reduction of SO2/NOx emissions as well as major advances in the development of renewable energy via the Renewable Portfolio Standard system that is generally recognized to be among the most successful in any jurisdiction in the world.

This noted, the new Administration's Energy Policy - released in mid-May -- contained little to encourage advocates of greenhouse gas restrictions. While continuation of renewable energy and conservation tax incentives were part of the new policy package - as well as renewed emphasis on nuclear energy - the remainder of the package strongly emphasized the increased production and utilization of fossil fuels, particularly coal and petroleum for electricity generation and transportation. While this is not an appropriate venue for a full analysis of the Bush plan, it is sufficient to note that its overall tenor was again viewed as being unaccommodating to greenhouse goals. Indeed, the plan is noteworthy in one aspect - despite the clear salience and relationship between energy and environmental goals, greenhouse emissions are not mentioned more than once within the entire document.

If nothing else, the ongoing Bush policy development has brought the greenhouse issue to the forefront of political debate as it has rarely been in the US. A substantial number of Congressional Democrats and moderate Republicans continue emphasizing the importance of reducing GHG emissions. There is a growing sense that some type of political compromise may ultimately be reached. There is also increasing activity at the State level that should not be underestimated, which is elaborated on in Appendix II.

In the United States, the issue of greenhouse gases is high on the political agenda due to the California electricity crisis and the recent run-up in gasoline prices. As the year continues, it is likely that many of these issues will meld together into some type of omnibus Energy/Environment Act. There is simply no single consensus issue among the following around which majority opinions can coalesce without compromise:

- Deregulation/reregulation of the electricity industry and the gas transport industry;
- Opening up of federal lands to oil exploration, most notably in the Arctic and offshore;
- Enhanced use of nuclear power;
- Support for conservation and/or expansion of renewable energy via tax incentives.

Speculation

President Bush may ultimately be better positioned (relative to a Democratic President) to undertake the important task of getting some type of emissions deal through the more skeptical parts of Congress. Indeed, it has been informally suggested among certain sources that the Administration's surprising public support for - and then very public rejection of - Kyoto represented little more than an early positioning tactic, targeted towards moving the negotiating space at COP 6.5 towards a position that the American Congress will be able to accept. From a pure negotiating standpoint, there are few tactics that are more effective than to simply threaten to leave the negotiating space.

The main division on greenhouse limits within the US is perhaps less between business and environmentalists than between large multinationals and smaller businesses. As with other forms of regulation, large firms are generally able both to influence policy outcomes to their benefit and to amortize compliance costs over substantially large capital bases. Moreover, many multinationals possess substantial international assets with potential emission reduction capacity. It is noteworthy that large-scale firms such as Entergy, Ford, and Rio Tinto (a UK company, with large assets in the US) have all offered substantial support for pro-active greenhouse policies in the past several weeks. At the same time, General Motors invested US$10 million in a forest conservation project in Brazil in conjunction with the Nature Conservancy, and another US oil firm is reportedly poised to undertake a similar activity.

There is a possibility that the US and some of its international supporters may develop their own approach to emissions reductions. If so, we would envision such a system encapsulating some or all of the controversial issues that the US unsuccessfully advocated at earlier stages of international negotiation. If the US were to take on some type of domestic emission cap - even if applicable only to certain sectors -- we would anticipate some or all of the following controversial issues to become a part of the political compromise:

- Liberal interpretations of financial additionality,
- Forward borrowing of emission allowances,
- Expanded use of sinks, including:
  - Domestic soil conservation
  - International forest conservation.

While such activities might not comply with the perceived norms of the Kyoto Protocol, they would likely gain popularity among certain key US interest groups, bridging major environmental groups such as Nature Conservancy, Conservation International, and Environmental Defense with large emitters seeking low-cost carbon abatement options. To the public at large, such a compromise might also be appealing. As noted in April's US public opinion polls, more than 75% of Americans consider climate change to be a serious problem, but their willingness to pay to remedy the situation remains fairly low. This type of flexibility in reducing GHG emissions would therefore enable a policy compromise.

The result of this would be to drive down overall US domestic compliance costs of GHG emissions reductions. The flip side is that it might create value for certain projects that achieve real emission reductions but are not currently "Kyoto compliant." While such a path would clearly be controversial at the international level, it would have the effect of creating a multi-tiered pricing structure for international emissions reductions. At this juncture, however, it is not possible to forecast whether such developments are likely to take place before COP-6.5.

The Umbrella Group

Facts and speculation

The US is not alone in emphasizing the importance of maximum emissions trading flexibility. Despite general condemnation of the manner in which the US repudiated the Kyoto Protocol, several Umbrella Group nations - including Australia and Canada -- have indicated a degree of sympathy for the US position on the technical issues that broke up the Hague conference. It is perceived that the economic profiles and negotiating positions of Canada, Japan and Australia are closely interconnected with the American policy preferences, especially on the issue of carbon sinks and that the US may have some sympathy for its position with regards to developing country participation, especially from Australia.

The Kyoto debate has become a major component of Australian politics recently. It is considered likely that any successor party to John Howard's party - who is not likely to win according to recent Australian polls -- would be far more sympathetic to the ratification of Kyoto than has been the current regime.

Japan has actively canvassed the US administration to find ways of rescuing the political process that is named for one of its most important historical places. While Japan has not gone so far as to say that it would ratify the Protocol without US participation, there have been many indications that Japan would make all possible attempts to abide by the tenor of the Protocol. For example, Japan has continued to lobby for a more liberal interpretation of sinks. On the international front, a group of national agencies, including the Ministry of Environment, the Japan Bank for International Cooperation and the New Energy Development Organization (NEDO) have all allocated funds to support CDM and/or prototype CDM activities. Also, at the beginning of June 2001, Japan appears to have secured a concession in regards to the utilization of sinks that would apply only to Japan, meaning that there is greater possibility that Japan will ratify Kyoto. It is not clear whether this concession will be acceptable to the rest of the Umbrella Group. Finally, several dozen Japanese companies have announced their support for domestic emissions trading "pilots" that are being developed on behalf of the government by Natsource Japan and Mitsubishi.

Norway's position appeared to be changing. Even before Bush's retreat from Kyoto there were calls to join European Union and others in ratifying Kyoto at the earliest opportunity. Studies on abatement costs in Norway have consistently confirmed the advantage of launching the earliest international emissions trading regime. Thus, for Norway, it might be beneficial to agree to a sooner, relatively restricted emissions-trading regime within the European Union, perhaps integrated with the Danish and UK trading schemes, rather then pushing for a long-term unrestricted worldwide trading in alliance with the United States.

Statements out of Russia indicate that it may ratify the treaty quite soon: the Russian Duma is considering ratification at the end of June 2001 before COP-6.5. As Russia is the only Annex B nation to have the monopoly of a large-scale sale of Kyoto allowances, the loss of the US within the market would be quite damaging, but not nearly as damaging as the loss of Russia would be to the remaining Kyoto participants should it decide not to ratify Kyoto. However, it appears that Russia remains committed to the ratification of this agreement.

Section 2

Energy Sector Developments in the United States

The emergence of GHG policies worldwide is occurring within a context of rapidly evolving energy markets. We focus this section on several key energy sector developments in Annex B countries that have the potential to change projected demand profiles for GHG emission reductions. A good example of this type of phenomenon is the recent California energy crisis, which has become international news. While one result has been an unprecedented boom in renewable energy - with several thousand megawatts of wind energy resource development underway in the American West -- there is simultaneously a conflicting call to rapidly develop carbon-intensive coal resources, which would lock in a negative emissions trajectory for the lifetime of those new plants.

EcoSecurities focuses our energy sector review primarily on the United States. This is done to inform the reader about the major policy developments in this domain, which will be supplemented by the discussion of the US climate change policies, presented in Appendix II. The reader is advised that more detailed reviews of energy sector developments in Annex B at large are forthcoming in our future reports.

The Importance of the Arctic

The opening of the Arctic National Wildlife Refuge (ANWR) -- while relatively insignificant in a general equilibrium analysis of energy- is an important touchstone in the American energy debate. Within this context, bills promoting new fossil fuel exploration and production are increasingly coupled with calls for measures that would have the indirect effect of reducing GHG emissions. For example, on March 5 Sen. Frank Murkowski (R-Alaska), Chairman of the Senate Energy and Natural Resource Committee, introduced an omnibus energy bill (S 338), which offers numerous tax incentives to encourage domestic oil production in the Arctic National Wildlife Refuge alongside the calls to extend 10 year wind energy tax credits and to offer 15% tax credits for high efficiency micro-turbines. Meanwhile, the North Slope advocates have subtly redefined the value of ANWR toward its potential as a gas reserve rather than a petroleum asset, responding to natural gas shortages in the continental US.

Our sense is that expanding ANWR oil exploration remains politically unpopular within the United States, no matter how appeasing the add-on inducements to support renewables and energy conservation may be. Whether these “appeasement points” would be able to somehow survive on their own remains to be seen. Since exploration of ANWR in itself would not change the trend of US emissions, but would only partially shift their source to domestic resources, the rejection of ANWR could have a negative but only marginal impact on the short- to medium-term GHG emissions in the United States.

North American fossil fuel activities are likely to shift to Canada and perhaps Mexico, pending sufficient market liberalization. It is interesting to note that with his denunciation of Kyoto, President Bush almost simultaneously seemed to give up on the opening of the ANWR by announcing that it would probably be better for the US to open gas reserves in Canada and Mexico. Considered from a realpolitik perspective, a somewhat counterintuitive compromise could be in the works, trading access to the gas potential of the North Slope for formal regulation of greenhouse emissions and support for indirect greenhouse measures.

Gas

The electricity crisis in the US is generally referred to as a 'gas crisis'. While there has been a visible increase in gas generation, domestic exploration and gas transmission, there is a perception of increasing shortage of natural gas supplies, which has already led to market difficulties in the Western US. Indeed, President Bush cited a perceived inability to rapidly bring gas into the US marketplace as one of the key reasons of his rejection of Kyoto. While the United States is aggressively expanding its natural gas reserves, gas analysts now warn of an unforeseen pipeline shortage.

It is expected that the US will not be able to generate sufficient natural gas volume to meet an anticipated 62% demand growth over the next 20 years. In light of this, on March 21, President Bush prioritized cooperation with Mexico and Canada to boost energy supplies throughout the hemisphere. The President is encouraging Mexico to let American companies explore for Mexican natural gas. Mexican law currently bars foreigners from oil/gas drilling; at the same time, the Mexican government lacks the cash it needs to explore on its own. President Fox is discussing a set of policies to partially liberalize Mexican gas/oil market, although EcoSecurities still has to see any indication of substantial policy shifts within Mexican energy laws.

Gas, unlike oil, must be produced for the most part in North America because it cannot be shipped in large quantities. This said, there are several forward-looking energy companies including Enron, El Paso and Williams that are investing into the LNG terminals in the US. This investment will certainly help level market spikes for gas when the market becomes operational.

In is expected that gas will retain its competitive advantage over other fossil generation technologies. The most dynamic and profitable energy companies in the US - such as Calpine, Enron, Dynergy, Duke Energy and others - are all heavily expanding their gas assets. In addition, EcoSecurities received indication of the decline in energy-intensity of gas-fired power generation, which translates into the decrease of associated GHG emissions. For example, Siemens currently offers combined cycle gas turbines (CCGT) at 58% efficiency, compared to the 30-35% efficiency of many single cycle plants, at a capital cost of about US$500 per KW. Replacement of older gas facilities would further help lower emissions. A major issue, however, is the availability of the best hardware, developed chiefly by Siemens, Alsthom and General Electric. For example, Siemens has anticipated that the US energy market will add 40,000 to 50,000 MW of capacity before 2003, with 80% of that base coming from gas turbines. Put into carbon terms, for each 1000 MW of high efficiency CCGT implementation, we project an annual relative reduction of at least 1.5 million tons of CO2.

The Importance of Wind

While US wind power development has lagged behind Europe in the past decade, it is anticipated that over the coming five years the US will be among the most active wind markets globally. A chief difficulty with wind development has been the on-again-off-again status of renewable energy tax credits, which lower the price of wind power development. However, according to the current legislation pending in Congress, it is likely that the 1.5-cent per kilowatt-hour tax incentive will become permanent in 2001.

Even before the full extent of the California crisis was revealed, Dresdner Bank had projected the implementation of more than 12,000 megawatts of US wind power capacity in the 2001-2006 time period. Annual installation is predicted to grow from 1000 MW this year to 3500 MW by the end of that period. Given the very aggressive pace of installation of new wind facilities in Q1, 2001, these estimates appear to be conservative. However, we may be witnessing a period of "front-end loading" as developers seek to benefit from the crisis mentality in the western US. At the same time, in May 2001 Environmental Finance indicated that the pace of national wind installation has been slowing down since April 2001. Therefore, EcoSecurities cannot project the expected value of GHG emissions reduction associated with wind power development in the North American market.

Still, it is worthwhile considering the greenhouse implications of the reported growth, as it impacts the ultimate size and shape of the emission credit market. If we calculate just the 12,000 MW of (projected) wind power growth operating at an average capacity of 35% and an avoided carbon emission factor of 0.5 tons per MW/h, these installations would cumulatively reduce projected US emissions by more than 18 million tons of CO2 per year. Since it is expected that within the United States the largest wind power growth will be in the West - namely, in Texas, Nevada, Wyoming and California - the Dresdner Bank report estimates are likely to be conservative. Considering that the assessed growth trajectory would put an additional 12,000 MW in place by 2009, it can be seen that this aggressive implementation of wind will take some of the pressure off the US in meeting Kyoto targets or reducing national GHG emissions levels independently if the nation chooses to abandon the Protocol.

Most conservatively, we could anticipate gross reductions of the assumed US emissions trajectory by more than 100 million tons of CO2 during the first commitment period from the enhanced installation of wind power. Assuming a disproportionate displacement of higher carbon assets in the American West and a more aggressive wind technology installation curve, it is not unreasonable to expect that wind alone could, hypothetically, take 400 to 500 million tons of assumed emission credit demand off the table for the US during the first Kyoto commitment period.

Coal

The United States is debating indirect relocation of federal energy-conservation funds to substantially expand a clean coal research program. Not surprisingly, Sen. Robert Byrd (D-W.VA) is leading the effort to expand the clean coal technology program. While his Bill S.60 proposes tax credits for the installation of emissions control devices (which do not impact carbon), it still shifts national funding priorities from development of renewables to "cleaning" national coal-based power generation. In December 2000, the US Department of Energy offered as much as $95 million for coal development, which had to be matched by private-sector proposals.

At the same time, US decision-makers are trying to mix expansion of coal-based power generation with a wide range of initiatives on expansion of renewables. In mid-February (2001) a group of Congressional Republicans delivered a bill designed to help US electricity markets. While this Bill offers substantial tax credits for development of clean coal technologies, it proposes tax refunds for a large number of energy efficient appliances and boosts growth of renewables by stipulating tax credits for biomass, geothermal and incremental hydropower.

Coal has become fashionable due to rising natural gas and electricity prices combined with the increased lobbying of electric utilities and independent power producers to step up coal-fired capacity. In January 2001, inventories of US coal companies fell 20%, and the spot price of coal, particularly East of Mississippi, increased 36% from the previous year.

Section 3

Market Movements

The lack of resolution following COP 6 in The Hague has had a discernable impact on the market for immediate carbon investments. There have been only a few market transactions since The Hague. In addition, the resultant market is showing a growing imbalance: the potential supply of credits and quasi-credits is increasing rapidly, while demand is lagging, as an enormous number of firms and project developers who were prepared to enter the market after The Hague had timed their market offerings of credits/allowances accordingly. This imbalance happened because it was expected that the general tenor of the COP-6 outcome would push a large number of buyers into the incipient market, given the new context of greater international certainty. Since his expectation has not materialized, the current market remains fundamentally skewed towards buyers. The exceptions to this trends involve the more sanctioned forms of carbon investment, such as represented by the PCF and ERUPT.

Given this, we divide this section into the following categories:

- "**Buy side**" (those firms and entities that are perceived likely to require means to reduce their exposure to climate change policies); and
- "**Sell side**"(those firms who are likely to sell emission credits into the international marketplace).

The Buy Side: A Variety of Strategies

There are several ways in which firms can reduce or counter the negative impact of carbon restrictions on their bottom line. Such reduction and countering of negative Kyoto effects

entail a number of distinct strategies:

- Bilateral transactions;
- Purchase of carbon via a "buyer club" intermediary such as the Prototype Carbon Fund;
- Direct investment in external assets, which promise both emissions reductions and, generally, enhanced equity value.

Recent Bilateral Transactions

A limited number of small, but noteworthy bilateral transactions has taken place or are currently in process. Most of these have been reported in the media and are fairly well known. The most well known are:

- Petro Source Carbon Co. sold a combined 1.9 million metric tons of carbon dioxide equivalent (CO2e) emissions reduction credits in two trades to GemCo and Ontario Power Generation. These represent a novel approach to carbon offsetting, as the emissions reductions are being created by injecting CO2 underground to enhance the flow of oil from mature fields in West Texas. While not disclosed, it is believed that prices were less than US$1.00 per ton of CO2;

- Australian Macquarie Generation, which is owned by the state of New South Wales, sold carbon credits to Chubu Electric Power Company and Tomen Corpo ration created by the co-firing program pioneered in Australia at Liddell Power Sta tion in 1999. Macquarie generates credits by introducing sawdust and wood shav ings to the fuel supply of a standard coal fired power plant. The company has been selling its green energy certificates to Australian power retailers since 1999 and has now separately transacted a carbon reduction stream;

- In a somewhat different vein, we have furthermore seen a series of RFP's from vari ous entities for emission reductions, including the International Utility Efficiency Partnership, Oregon Climate Trust/Seattle City Light and BC Hydro. More detail on these projects will be given in subsequent reports.

External Investments

Among a number of energy-intensive companies, there are some indications of risk mitigation trends via equity participation in technologies, which either promise direct GHG emissions reductions or which are expected to outperform conventional market indices in a future carbon-constrained world. While this is best demonstrated by the investment positions of BP and Shell, it is certainly a noticeable trend across a variety of technologies and investors. Notable movements in January-April 2001 include:

- The investment of Australia's Woodside Energy in Ocean Power Technologies (OPT) and Ceramic Power, a fuel cell company. Woodside purchased a 5% stake in the US-based OPT, which develops wave energy systems. The agreement gives Woodside the option to purchase, by 2012, half a million tons of CO2e from OPT at a "discount" to prevailing market prices at the time. Woodside also has invested in Ceramic Power, a leading Australian fuel cell company;

- The collective US$100M investments by BP-Amoco and Nuon (the Netherlands) in Green Mountain Power, a US retailer of 100% renewable energy;

- The substantial competition for an embedded stake in micro-turbine leader, Cap stone Energy, which has been an underlying part of a bidding war for New Zea land's Fletcher Energy, eventually won by Shell;

- The January 2001 acquisition of 33% of US-based Energy Photovoltaics, Inc. by MVV Energie AG, a leading German utility; and

- The direct investment of Trans-Alta in Vision Quest, a Canadian renewable energy developer. This investment is also believed to have involved options on emission reduction credits.

Buyer Clubs

Purchasing carbon through some sort of 'buyer club' is yet another approach reducing potential GHG liabilities. As of now, the only major players in the carbon purchase market are buyer clubs -- the Prototype Carbon Fund and ERUPT in the Netherlands. A number of other "integrated" investment funds are currently under review from financial institutions including UBS, Dresdner Bank, Credit Lyonais, an Australian bank and others, but despite a fair amount of hype, no well-defined financial commitments have been secured from external investors.

The successful conclusion of the first-year Eru-PT process in the Netherlands indicates that there is a new emerging market for emissions reductions via that type of bidding process. In the recently concluded round, 5 projects promising more that 4 million tons/CO2 of reductions were funded, with a total value of just under US$ 40 million. These projects delivered ERUs from various Eastern European Annex B nationals at a price range between 5 and 9 Euros per ton of CO2, for the 2008-2012 period. Successful bidders included wind, hydro, CHP and efficiency in Poland, Romania and Czech Republic.

The Depth of the Sellers Market

As noted above, it is our opinion that emission reductions supply by far exceeds the current demand in the market. This is very logical - a forward carbon sale represents a tranche of zero-cost equity that can be valuable to the project.

To example, one fairly credible carbon bulletin board - that of CO2e.com - currently has upwards of 15 million tons of anonymous credits for sale on its board, which are offered from more than 15 projects in both CDM and Annex B nations. As noted earlier, the recent RFP that was announced by the Seattle City Light and the Oregon Climate Trust received over 120 applications from project developers seeking to access funding. While there is no objective way to assess the relative quality of this pools of projects (and the many more like them that are coming up as EcoSecurities is preparing this report), it is sufficient to note that there are innumerable convincing indicators that the market has accumulated carbon emissions reductions, which are ready for sale, with sellers eager to do so at what we consider very competitive pricing.

As interestingly, massive industrial developers (and possible sellers) of potential CDM credits are now moving into the market. Such deals represent an investment in external assets, which are frequently backed up by governmental guarantees, such as OPIC insurance or IFC funds. One such project is a recently announced methanol conversion undertaking in Equatorial Guinea by the international firm, CMS Energy, represents a single development with a claimed future stream of nearly 3 million tons of CO2e per year. Similarly, petroleum giant Chevron is actively pursuing emissions credit potential for two major gas projects in Africa and Papua New Guinea.

Still, the degree to which such projects - and the many others that are clearly in the pipeline of firms who see the strategic advantage in becoming "atmospheric mercenaries" -- will be deemed credible under a Kyoto framework is questionable. However, given the potential for policy/market fragmentation, it would be unwise to completely discount the potential of these firms to achieve value from their carbon claims. If so, these actions will again exert downward pressure on market prices over the short run.

Section 4:

Emergence of 'Sub-Markets' - National Green Certificate Trading & Emissions Trading

Renewable Portfolio Standards
Emerging Carbon Trading Systems
Denmark
United Kingdom

There are a number of policy initiatives, which - despite the uncertainty of the Kyoto process - indicate that there may be other points of value for emission reduction projects. Chief among these are:

- The partial cap and trade systems of the United Kingdom and Denmark, and
- The Renewable Portfolio Standards across other jurisdictions in Europe, Australia and a number of American states.

Were the United States to engage in a unilateral emissions reduction policy, such a scheme would likely represent an enactment of the US position on a variety of controversial emissions reduction schemes, such as forest and soil conservation, which would thereby create an immediate market for a particular type of project offerings. However, in this report we do not consider an internal emissions trading regime for the US since none has been approved (although, as we showed above, a number of four-pollutant emissions trading bills are discussed in the US Congress). Internal emissions trading regimes are also considered in Norway, France and Netherlands; EcoSecurities will review emissions trading proposals advanced within these jurisdictions in our next report.

In this section we focus only on the aforementioned emissions trading/green certificate trading regimes in Europe. Policies outlined below are elaborated in Appendix II, where we lead the reader through specifics of European/North American green certificate trading systems and elucidate the initial phases of domestic emissions trading in the UK and Denmark.

Renewable Portfolio Standards

Renewable Energy Trading began in Europe in January 2001. Companies from 6 countries are currently beginning the test phase of the Renewable Energy Certificates Program (RECS). Participating states include Denmark, Greece, Italy, Netherlands, Norway and Sweden, and may be joined by companies in Belgium and France at some point during the initial testing. In the European RECS voluntary initiative, certificates are bought and sold from the electricity produced by renewable plants, while certificate-issuing bodies in each country, acting like central banks, will oversee their transfer between countries. In the process, certificates generate extra revenue for the renewable energy companies involved, creating an additional form of renewable energy financing.

The first test phase of this program will last for 20 months, and RECS plans to be trading at a volume of 100 gigawatt hours by its end. One certificate is issued for each megawatt hour produced by a renewable plant; certificates are then purchased at a market-determined price by electric utilities and other energy-intensive companies that may need to fulfill national renewable electricity quotas or reduce GHG emissions.

The most significant development in the RECS initiative is that a number of entities within the European trading system expressed their interests in green certificates from external sources, which may or may not include sources that would otherwise be eligible for the CDM. If this proves to be the case, it indicates that there is a substantial market for green certificate trading.

The net long-term effect of green certificate trading is the reduction of carbon emissions from Europe, as the RECS system is expected to promote growth of renewable energy use. The significance of this undertaking is in standardizing European financing mechanisms pertaining to this sector, with an additional significant long-term effect being a reduction in pressure for Annex I polluters to invest in CDM carbon-offsetting projects in developing states.

There are a number of REC systems emerging in the US, most notably in Texas. In general, the Texas system is considered to be very successful, as approximately 900 MW of new renewables are to be installed this year, far ahead of the articulated goal for 2003 of 400 MW. The Renewable Energy Credits are beginning to trade, including some transactions to entities outside Texas. Again, we elaborate on various details of renewable certificate trading in Appendix II.

Emerging Carbon Trading Systems

Perhaps the most significant development in European carbon reduction policies is the development of domestic emissions trading systems in Denmark and the UK.

Denmark

Denmark's national emissions trading scheme is up and running as of January 2001. The scheme covers nine capped companies, which account for 90% of the country's electricity production. To keep the trading manageable, almost 400 companies that produce less than 100,000 tons of CO2 per year are excluded. Denmark's electricity sector was covered due

to its spiraling GHG emissions, the result of expanding exports to Norway and Sweden. In 1996 - a year of substantial electricity exports - CO2 emissions from the sector exceeded 37 million tons, around 12 tons above the expected national emissions levels. In addition, electricity generation is the only major sector in Denmark that is not covered by carbon taxes or energy efficiency measures.

The current Danish scheme is running until the end of the trial period in December 2003. Danish companies are awarded emissions permits on the basis of historical emissions ("grandfathering"), and emissions caps are going to be declining: for the first year of the trial period, permits to emit 22 million tones of CO2 will be sold; this number then falls to 21 million in 2002 and 20 million in 2003. Trading will be carried out bilaterally due to a limited number of companies participating in the emissions trading scheme. There will be a narrow band of prices (around US$0.005 per kilowatt hour) where trades will take place. However, the trading prices will fluctuate depending on the price of electricity within the Nordic market. The non-compliance penalty is set up to be very low, about Dkr 40 for each ton of CO2 they emit beyond their cap. Such a low penalty is not justified economically, but was a necessity borne out of political compromise: it ensures the Danish electricity producers will still be able to participate in the Nordic electricity market, even if prices in the electricity pool are high. However, after other countries introduce emissions trading, it is expected that trading penalties will rise.

The United Kingdom

The UK has proposed system of trading that is far more ambitious. The main goal of the system is to achieve annual CO2 reductions of 2 million tons by 2008, representing roughly 1 per cent of national GHG emissions. Like the Danish scheme, it is a 'cap and trade' arrangement. Trading was due to begin in April 2001, but due to some difficulties with the permit pricing and problems with regulatory specifics (elaborated in Appendix II), the review of the final emissions trading rules was postponed until July 2001. Originally, it will be restricted initially to 'forward' transactions for permits in later years, as the emissions limits for individual companies have not been set until 2002.

Under the British system, not all companies have equal rights to buy and sell emissions allowances. As a result of the national Climate Change Levy (CCL, operational since April 1, 2001), the British trading system expects two categories of participants: the 'core' group, and 'unit' participants. 'Core' companies agree to absolute emissions targets, while the 'unit' trading entities will have negotiated a rebate on the CCL (a tax on business energy use) in exchange for energy efficiency improvements. As these goals are generally measured as improvements in energy consumption per unit of economic output rather than absolute cuts in energy use, emissions from these companies could increase as economic growth continues.

The trading mechanism incorporates a provision, which restricts the sale of permits from the 'unit' sector to 'core' sector to ensure actual GHG emissions reduction within the nation. There will be no restrictions on trade between parties within the 'unit' sector.

The major complexity of this system is the requirement that companies in the 'unit' sector provide a verifiable conversion factor, which translates the amount of energy they use into a certain quantity of carbon emissions. Without this measure, UK permits may not be translatable for export in a future international emissions trading system.

Participation in the British trading is voluntary, open to all companies operating in the UK who commit themselves to emissions limits. Trading covers all GHG gases with crediting past actions leading to the GHG reduction.

To encourage trading, the UK government has set aside close to UK£30 million to be given to firms, which join the scheme as 'core' players. Pricing of permits will be determined through an auction process, with the government setting the target emissions reduction level and the companies bidding prices per ton of CO2 equivalent.

Some remaining issues to be resolved within the system are:

- How to facilitate the entry of electricity generators into trading;

- Double counting: how does one count emissions reduction bonuses to be awarded to companies, which implement energy efficiency measures and cut down electric ity consumption, thereby reducing the carbon emissions of electricity suppliers, while they did not take any direct actions to reduce GHG emissions. In such case it would be hard not to over-count emissions reductions on the part of electricity suppliers;

- How to reconcile the politics of job protection in the declining coal sector, where the large-scale adoption of fuel switching projects will be limited by the need to support coal production.

Again, we elucidate specifics of British emissions trading system in Appendix II and invite the reader to follow our analysis of emerging stamping blocks on the way to establishing a functional British system of carbon transaction.

In addition to the U.K. and Denmark, a number of states have been working on their own national trading schemes, and initial trading schemes are emerging in Norway and Japan, while Canada, the United States and Australia have developed embryonic/regional schemes of emissions trading within their provinces or/and volunteer industry/governmental organizations. The Norwegian scheme is the most developed of these, and bears watching over the coming months.

Section 5

International Carbon Prices

Limitations of this Price Discovery Exercise
Discoveries Resulting from Research
Table 5.1 Range of Carbon Price Forecasts

After reviewing the emerging systems of internal emissions trading, it is natural to inquire about the determinants of carbon prices. The following section leads the reader through a set of price forecasts carried out by a number of modelers in the US, Norway, and several of other countries. This section should be considered in conjunction with Appendix I, which presents several best-known models integrating economic, engineering and bio-chemical expertise to provide multi-scenario forecasts of carbon prices.

In our report, model selection is determined by the frequency of referencing models' findings in the climate change literature and by their choice made by the *Stanford's Energy Modeling Forum*, which is the focal center of model assessment in the United States. We summarize results from different models instead of presenting variations of multiple forecasts computed by the same model to explain why such a substantial differences in the price forecasts exist.

In Appendix I we review four studies scrutinized in the abovementioned Stanford's Energy Modeling Forum. Because most of the price forecasts published by the Forum underwent rigorous peer review, we consider them the most accepted by the diverse group of climate change academics.

Furthermore, since each one of these models represents a substantial simplification of empirical reality, we also reviewed several studies supplementing Energy Modeling Forum's forecasts in Appendix I. Specifically, we focus on a politico-economic modeling effort, which incorporates political probabilities of Kyoto ratification. We also touch upon an integrated representation of multi-gas price forecasts published by the MIT Joint Program on the Science and Policy of Global Change in the 1999 issue of *Nature*. Finally, we briefly review the studies by the Norwegian CICERO, the US Presidential Administration and yet another pricing forecast carried out by the abovementioned MIT group in 1998.

Limitations of the price-discovery exercise

What were the limitations of this price-discovery exercise?

- First, it is not possible to determine with any degree of precision which model should be given preference over a set of others due to substantial differences *eco nomic assumptions* about economic growth, energy-production input, rate of tech nological change, consumer reaction to carbon policies, etc.;

- Second, models vary to a great extent with respect to carbon transaction *scenarios* for which carbon prices are estimated; they also differ with respect to p*olicy assumptions* embedded in each one of these scenarios: for example, inclusion of carbon sinks can noticeably affect the price forecasts; the inclusion of soil seques tration in the sinks further affects the expected price of carbon;

- Further, model reviewers should exercise care to compare prices in currency for the *same* base-year as well as for the same unit of greenhouse gas emissions measure ment (for example, as units of carbon equivalent) because modelers use different base-years in their price calculations and express prices with respect to *both* CO2 and carbon equivalents;

- Finally, a set of the studies we intended to review, such as the 1999-2000 ABARE publications, were unavailable to EcoSecurities, which limited our ability to pro vide a comprehensive review of pricing forecasts. *Hence, we by no means assert that this analysis represents the most comprehensive outline of all models devel oped up to date.*

It should be noted, however, that despite these limitations the models represent the best and most sophisticated price estimates currently available for the non-existent market.

Discoveries Resulting from Research

Central Case: the G-Cubed model - $61/tC

The most comprehensive study in the Energy Modeling Forum, the G-Cubed Model by McKibbin et. al. (1999) , estimates the price of carbon to be equivalent to $61/ton of carbon in 2010 for the Annex I trading scenario and $32 per ton of carbon in 2010 for the "Double-Umbrella Trading Scenario", which assumes trading within the EU and trading between the remaining members of the OECD. It is interesting to note that in this "Double-Umbrella" scenario, the US becomes a net carbon permit *seller*, as it was originally modeled as the nation with the *lowest marginal* [carbon] abatement costs (MAC) relative to the rest of developed economies (namely, Japan, Australia, Other OECD). The prices of the double-Umbrella scenario are lower because the EU is excluded from buying the FSU's "hot air". For the global trading scenario, the study found the prices of carbon to drop to $23 for 2010.

Reasons for Higher Prices

Carbon prices look substantially higher in the estimates of the Oxford model for the same period in comparison to McKibbin et.al's computations: Cooper et.al. expect carbon prices to range within $215/ton of carbon for the Annex I trading scenario (for 2010) and to rest at approximately $165 in the European Double-Bubble scenario, where the EU is not entering the international emissions trading system and while the remaining members of Annex I trade between themselves. Similar to the previous model, in the double-umbrella trading scenario the price of carbon *decreases* when trade restriction is imposed, and "…non-EU countries benefit from the lower international permit price".

Why is there such a difference in the price forecasts in the Oxford Model when compared to G-Cubed (and other forecasts shown below)? Possibly because the Oxford model uses a high base level of carbon taxes for the nations that have already imposed a high tax on a particular fuel. For example, European taxes are to be raised substantially in the model (up to 50%) to stimulate any substantial reduction in emissions, while a comparable magnitude of reduction of GHG emissions could be achieved in the US and other coal-intensive companies through coal substitution. However, it is the coal-intensive companies that tend to be more energy-intensive in their structure of production (or so the model claims), which increases their internal GHG abatement costs. In addition, Oxford model provides comparatively higher price forecasts because it meticulously accounts for interactions between inflation (which for many EU countries is set to a very low level), high carbon taxes, price of energy inputs and energy intensity. Specifically, for the majority of the EU countries the domestic costs of carbon abatement appear to be high due to the pressure of keeping down the inflation (macroeconomic response), while simultaneously raising the *already* high carbon taxes and reducing industrial energy costs by switching away from coal.

Reasons for Lower Prices

Yet another price estimate provided by Nordhaus and Boyer's (1999) RICE-98 model, reveals that the $200 price will be achieved only by 2050, while in 2010 carbon prices will rest at the $66/ton of carbon mark for the Annex I trading scenario (which is close to the price calculations set up by McKibbin et.al.) and $167/ton of carbon for the OECD trading scenario. RICE-98 established the global trading price of $21/ton of carbon. RICE-98 simplified a great deal of economic components used in this computation, which are emphasized/detailed in the Oxford model. For example, RICE-98's optimal economic growth theory does not consider all pivotal macroeconomic shock factors, which may increase the price of carbon within domestic jurisdictions in the short-term. For this reason

the 2010 price of carbon may be lower relative to the Oxford model.

MERGE by Mann and Richels (1999) presented a set of international carbon prices for the international emissions trading scenario, where the authors introduced several market restriction options, among which two are of the most interest: a buyer-restricted market and a seller-restricted market. For 2010, the unrestricted price of carbon in the global trading scenario is forecast to be $65/ton C, which is more than two times higher than the price forecast by RICE-98 (for the same year); for the buyer restricted market the price is expected to drop to $30/ton C due to the constrained demand, but for the seller-restricted market, due to possible monopoly collusion on the part of permit sellers, it rockets up to $135/ton. For 2020, the unconstrained market price projection is about $82/ton C, which for the buyer-restricted market drops to $50/ton C and jumps to $164/ton in the seller-restricted market.

Global trading leads to lower prices

Ellerman and Decaux (1998), in their MIT carbon price study, give a substantial range of carbon prices. This is due to the fact that the authors researched large number of emissions trading scenarios. While for 2010 the Annex I trading price is $127/ton C --which increases to $142/ton C when the former Soviet Union exercises monopoly power by restraining quantity of permits available for sale, -- the price of carbon in the global trading scenario drops to $24/ton C (further decreasing to $6/ton C with quantitative import restrictions equivalent to 33% of any national Kyoto commitment).
Ellerman & Decaux (1998) also compute the price of carbon for the scenario, which stipulates restrictions on trading due to the supplementary requirement, with trading between the Annex B states only. Where the limit is assumed to reach 33% of any Annex B party's ability to meet its emissions reduction requirement, the price of carbon drops from $127/ton C to $144/ton C.

Considering all GHGs in the model substantially reduces prices

MIT's modeling effort was expanded in 1999 when Reilly et. al. developed a comprehensive carbon price estimate for the multi-gas Kyoto control strategy using the Integrated Global Systems Model (IGSM). The study argues that while the majority of current analysis is limited to computing market prices/national Kyoto abatement costs under various scenarios of reducing carbon emissions, national costs of GHG abatement could be substantially reduced when a multi-gas strategy is considered. This work analyzes the results of including forest sinks and the non-CO2 greenhouse gases in GHG mitigation scenarios and concludes that omitting non-CO2 gases and sinks leads to the overestimation of the annual costs of emissions abatement by 2010 in Annex B nations within the approximate magnitude of 21%. If the modeling scenario includes developing countries, the multi-gas approach would reduce the costs of meeting Kyoto commitments by as much as 60%.

The Model's computations demonstrate that the 'carbon-only' GHG reduction scenario overestimates the carbon price ranging from 8% for Eastern Europe ($11/tC) to 153% in the remainder of the OECD ($158/tC). Much of the carbon price/abatement costs difference comes from regional variation in the carbon sinks potential. The importance of this model is in providing support for the argument that multi-gas Kyoto implementation strategy is likely to substantially reduce the costs of limiting greenhouse gas emissions.

Finally, we experimented with one politico-economic price-forecast that relies heavily on political developments surrounding Kyoto negotiations in its attempt to predict the short-time price of carbon. The Carbon Price Analyst believes that if carbon transactions were car-

ried out immediately after COP-6, the price of carbon would range from $ 0.21 to $1.97 tCO2 (both in US$2000), depending on the exact scenario of trading.

We welcome the reader to explore the details pertaining to each of the aforementioned price forecasts in Appendix I . The list of additional studies and corresponding carbon price forecasts can be found in the Dutch National Research Programme of Global Air Pollution and Climate Change (DNR, 1998), which completed a study on "flexibility" instruments under the Kyoto Protocol.

In conclusion, we would like to present a summary table combining the price forecasts from analyses reviewed above. The table can be found on the next page (as well as in Appendix I.6.1.).

Model Title, Author(s), Year in which the model was published and Modeling Scenarios	**Year for Which Price Estimate is Given**	**Annex I Trading**	**"Double Bubble" or other 'intermediate' trading scenario**	**Annex I Trading Plus CDM**	**Global Trading**
Oxford, Cooper, A. *et.al.* (1999)	*2010*	$215	$165[1]	N/A	N/A
RICE-98, Nordhaus *et.al*. (1999)	*2010*	$66	$167[2]	N/A	$20
-- RICE-98	*2050*	$258	$407	N/A	$41
-- RICE-98	*2100*	$349	$472	N/A	$54
MERGE, Mann & Richels, (1999), no limits to the market	*2010*	N/A	N/A	N/A	≈$65
-- MERGE, no limits to the market	*2020*	N/A	N/A	N/A	≈$82
--MERGE, buyers restricted market	*2010*	N/A	N/A	N/A	≈$30
MERGE, buyers restricted market	*2020*	N/A	N/A	N/A	≈$50
--MERGE, sellers restricted market	*2010*	N/A	N/A	N/A	≈$136
--MERGE, sellers restricted market	*2020*	N/A	N/A	N/A	≈$164
G-Cubed, McKibben *et.al*., (1999)	*2010*	$61	$32	N/A	$23
--G-Cubed	*2020*	$109	$71	N/A	$37
Carbon Market Analyst (2000)	2000[3]	N/A	$0.21	Range from $0.86 – to $1.97[4]	$1.97
CICERO's ACT, Holtsmark, Bjart (1998)	*2010*	$33	N/A	N/A	$23.6
SGM, Clinton Administration Interagency Analytical Team (1998)	*2010*	$23	N/A	N/A	$14[5]
MIT's EPPA, Ellerman *et.al*. (1998)	*2010*	$127 or $142[1]	$114[2] or $240[3]	$ 63[4]	$24 or $6[5]

Table 5.1 (also in Appendix I.6.1.)

Range of Carbon Price Forecasts, Various International Trading Scenarios (per ton of carbon, in US$, converted to US$1995)

Section 6

Conclusion

Effects of US position on Kyoto
Future of Carbon transactions and potential prices

We began analyzing the current status of international emissions trading market by reviewing the policy positions of major Kyoto players. We also elucidated in some depth policy preferences of the EU, the United States and other pivotal players in the Umbrella group. We noted that should the U.S. not be engaged in the Kyoto Protocol following Cop-6.5, we believe that the emissions trading market may continue without the US participation, given a certain set of conditions met at COP-6.5. In addition, the position of President Bush with respect to abandoning Kyoto's commitments strengthens our arguments insisting on the likelihood of regional multi-tier markets.

Where does the US position leave the remaining adherents of Kyoto, including the Umbrella group?

We emphasized that on several occasions the EU had volunteered a unilateral GHG reduction commitment in case the required number of parties does not ratify the Kyoto Protocol. We believe that this solution to the Kyoto impasse is plausible, considering that the EU is likely to be joined by Russia/Ukraine and other Former Soviet Union countries that remain strongly interested in emissions sales. In addition, the EU has already developed a scheme of continental emissions trading, and most West European states have established domestic renewable portfolio standards and/or integrated green electricity trading. In Germany and the UK, a series of multifaceted and politically intense negotiations have been carried out to determine voluntary GHG emissions standards for energy-intensive industries; in both countries, these obligations would reduce the size of Climate Levy/carbon taxes for each firm undertaking voluntary initiatives. Such activities represent political 'sunk costs', which force political and economic actors to adhere to their previous positions.

Hence, the EU is not likely to abandon the Kyoto framework. As a result, Europeans are well-positioned to undertake the leadership in Kyoto Ratification, and it is not feasible that the EU will back out of the emissions reduction Treaty due to the substantial level of public investments in renewables as well as due to taxpayers' support for consistent anti-global warming efforts, especially in the Netherlands, Norway, Sweden, Finland, Denmark, Greece and Italy.

Furthermore, as shown in the above sections, the Umbrella group is not entirely homogenous. As was indicated in this report, Norway and New Zealand have advocated environmental integrity with the EU position, with Norway questioning the wisdom of postponing Kyoto ratification to get the US on board. It will be interesting to assess the cohesiveness of the Umbrella group following CoP6.5.

In light of the above, what can be said about the future of carbon transactions and potential prices?

First, we expect European efforts to structure a EU emissions trading regime to continue without major impediments. We also foresee selected EU states accelerating their involve-

ment in the CDM, which is likely to be actively joined by Japan, which has temporarily halted its CDM activities in the post-COP-6 period. We hope to see growth of CDM activities by France, Belgium, Spain and Italy. At COP-6.5, we expect some pressure to be placed on East European states with respect to strengthening their domestic emissions trading institutions and legislations, all of which are likely to boost the demand for carbon and increase transaction prices.

The position of the United States will remain a major issue for the international climate change regime. The United States is still considering multi-pollutant emissions reduction bills, which are paralleled by state-level initiatives in renewable portfolios, expansion of wind power capacity and the growth of technological innovation, the pace of which can nevertheless be slowed down by the forthcoming economic recession. We do not foresee sustainable growth of US government-lead activity in either CDM or JI, which sends a signal that the country is halting its previously active efforts to develop CDM and pilot JI initiatives. At this juncture, it remains impossible to forecast the exact effect that US policy-making will have on North American carbon prices in the post COP-6.5 period, but the immediate US position has a clear price-dampening effect on continental GHG transactions.

Finally, we have sketched analyses of forces driving formation of carbon prices in 2000-2010. In our price forecasts we had to rely on formal modeling techniques, which were used by various experts to predict movement of carbon prices under various emissions trading/non-trading scenarios for the first Kyoto commitment period. In reviewing multiple sources of carbon price forecasts, we discovered that under the Annex I emissions trading scenario, 2010 carbon price range from $61/ton of carbon equivalent on the lower end (G-Cubed Model) to $215/ton of carbon equivalent on the high end (Oxford Model). For the global emissions trading scenario the price ranges from $20 (RICE-98)-$23(G-Cubed)-$24(EPPA)/ton of carbon to the high of $63/ton of carbon (EPPA) if developing countries exercise monopoly restrictions on the quantity of emissions permits sold. *Interestingly, for the global trading scenario most models reviewed in this analysis converge on the price close to $23+-/ton of carbon for the year 2010.*

For 2020 prices are forecast to be $109/ton of carbon for Annex I trading (G-Cubed), which drop to $37/ton under the global emissions trading scenario (same G-Cubed). For 2050 RICE-98 predicts the price increase to $258/ton for Annex I trading and $41/ton under global trading.

Among the models reviewed in this Appendix, the most interesting experimentation is done with the 2010 price forecasting, where MIT's EPPA projected carbon prices for a number of restricted emissions trading scenarios, Oxford model tested double-Bubble European trading situation and MERGE experimented with the restricted global emissions trading projection (with restrictions on permit sellers and permit buyers). EPPA found that for 2010 the price of carbon would drop to $6/ton should there be quantitative restrictions equivalent to 33% of national Kyoto commitments. The same model showed that for Annex I trading scenario carbon prices drop from $127/ton to $114 when quantitative restrictions associated with Kyoto's supplementary requirement (the model sets quantitative restrictions on demand at 33%). Oxford model shows that under the so-called "European Double-Bubble" scenario carbon prices decrease to $165/ton C from $215/ton C due to the decreased demand for emissions trading permits. Finally, MERGE forecasts that -- under the global permit-trading setting -- permit purchasing restrictions lead to the price decline from $65/ton C (in 2010) to

$30/ton of carbon, while permit selling restrictions lead to price increases from $65/ton C to $136/ton C (for 2010). The same model demonstrates that in 2020 the price of carbon would be affected by the seller/buyer restrictions in the following way: with purchasing restrictions the price declines from $82/ton C (the global trading price in the no-restrictions scenario) to $50/ton C, while with selling restrictions it will climb from the aforementioned $82/ton C to $164/ton C.

EcoSecurities by no means claim that our price analysis represents the most comprehensive review of all price forecasts developed up to date. Our report is to be interpreted as a subjective review of the most multi-faceted studies, where EcoSecurities is solely responsible for the model choice and price representation shown in Appendix I.

Footnotes

[1] For all appropriate references see Appendix I. All prices hereafter are expressed in US$1995 per ton of carbon.

2 Cooper et. al., *the Energy Journal*, p. 357

3 For all appropriate references see Appendix I. All prices hereafter are expressed in US$1995 per ton of carbon.

4 Cooper et. al., *the Energy Journal*, p. 357

5 Costs throughout the estimates are in the US$1985.

6 This estimate is for the current price of carbon in 2000 given a non-operational market. The previous models, however, estimate the price of carbon for the year 2010 with the assumption that there will be a functional market by that point in time.

7 A detailed table summarizing price forecasts for all studies mentioned above is presented in Appendix I.

8 Note: prices in US dollars reported in this table are slightly different from the ones reported in the main body of the text since they are converted to the same base year of 1995.

9 In the Oxford-modeled European Double-Bubble the EU is not entering international emissions trading system, but enacts internal trading between members of the Unions, while trading occurs in a parallel regime between the remaining members of the OECD

10 In RICE-98 model special scenario represents OECD trade (emissions trading only between members of OECD)

11 Carbon Market Analyst provides price analysis for the short-time horizon: pre-Bush election estimates, considering the failure of Cop-6 in the Hague. Therefore, all prices

are given in US$**2000**.

12 Scenarios for this price range include: a) Free trade, terrestrial uptake included, inefficient CDM, b) Free trade, terrestrial uptake excluded, efficient CDM; c)Removed restrictions on hot air (50%), terrestrial uptake included, efficient CDM; d)Free trade, terrestrial uptake included, efficient CDM.

13 Presumes active participation of East European countries.

14 The price of carbon would increase from $127 to $142 in the case when the FSU from exercising monopoly power.

15 $114 is the price of carbon with restrictions on trading due to the supplementarity requirement, with trading exercised within Annex B circle. The limit is assumed to reach 33% on any Annex B party's ability to meet its emissions reduction requirement.

16 The price of carbon reaches $240/ton in the case of OECD trading only.

17 The non-Annex B cartel (the case of collusion among the non-Annex B countries) leads to the price increase to $63/ton; this scenario is considered as a plausible CDM.

18 With the 33% limit on permit imports, the global price of carbon would slide down to $6.

19 Details on German climate change policies are forthcoming in our next report.

20 Hereafter, the names of models generating price forecasts are given in brackets since all forecasts are strictly 'proprietary' to the models computing these estimates.