Global Emissions Trading:
Prospects and Pitfalls

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Paper to Kyoto the Impact on Australia Conference
Organised by the Australian APEC Study Centre

Hotel Sofitel
Melbourne
12-13 February 1998

*Paper prepared for the APEC Studies Centre conference on "Kyoto - The Impact on Australia" to be held in Melbourne February 12 and 13, 1998. This paper draws significantly on ideas and papers developed jointly with Professor Peter Wilcoxen from the University of Texas, Austin. I have also benefitted from discussions with David Pearce at the Centre for International Economics in Canberra. The views expressed are those of the author and do not in any way reflect the views of the above mentioned individuals or institutions nor the staff or trustees of the Brookings Institution or the Australian National University.

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1. Introduction

At a conference in Kyoto, Japan during December 1-11, 1997, the Parties to the UN Framework Convention on Climate Change agreed to a Protocol to reduce global greenhouse emissions. Although heralded by many as a breakthrough in climate change policy, this protocol is fundamentally flawed. There is some chance it may succeed in its goals but it is more likely to collapse within the next few years. Even if the Kyoto Protocol is ratified by the US Congress (with very low probability), failure is likely because the negotiations have continued to focus on achieving rigid "targets and timetables" for emissions reductions at any cost rather than substantial reductions at reasonable cost, in spite of the enormous uncertainties surrounding climate change. Even at this stage the move away from uniform targets for every country was forced at Kyoto because this was seen to be very inefficient and politically infeasible. The point that seems to be lost on those participating in the negotiations is that any fixed targets, **even differentiated targets,** are likely to be inefficient because we really don't know what these will cost over the long period of time being discussed[1]. More problematic for achieving the beginning of a reduction in greenhouse emissions, the Kyoto Protocol pushes any accountability for reaching the agreed targets into a window between 2008 and 2012. The Kyoto meeting has generated another classic term in environmental policy. We have gone from NIMBY (Not In My Back Yard) to NIMTOO (Not In My Term Of Office)!

The game plan now is to attempt to make a targets based approach work by using economic instruments to minimize the efficiency losses. In principle these instruments look like the way forward and indeed the Kyoto meeting incorporates explicitly the idea of using global permits or umbrella groupings of permit traders as a way to implement the Kyoto protocol. Unfortunately while the advantages of a permit trading system at the domestic level is well established (through other emissions trading schemes such as the US sulphur dioxide scheme) and the global schemes look good in theory, few researchers have understood the adjustment problems in implementing such a proposal[2]. Many of the models that have been used to evaluate global permit systems such as the Megabare model don't have the key issues of dynamics and wealth effects from permits systems incorporated and therefore miss the point completely. In this type of model, a permit is a uniform tax pure and simple. A model such as the G-Cubed model that also allows for the wealth effects of permits and the associated adjustments in international financial markets and changes in trade balances that are required to match the resource transfers

[1]See McKibbin and Wilcoxen (1997a) and Kopp et al (1997) for arguments about the difference between price and quantity caps under uncertainty.

[2]See Hartley (1997) for an overview of permit trading and its desirable properties. As with most studies that paper ignores the international economic adjustment problems

implicit in the permits has demonstrated the potential instability that may occur during the adjustment to equilibrium. In the long run (i.e. in equilibrium) a permit scheme works well but this equilibrium may never be reached if the induced volatility for other markets is too great during the adjustment phase. We have argued elsewhere of the classical "Transfer Problem"inherent in a global permit system and of the dangers of a "Dutch Disease" or "Gregory Thesis" associated with the actual operation of a global permit trading system. Indeed there are many examples of the size of problems generated by transfers of resources across national boundaries (e.g. OPEC oil price shocks of the 1970s, US fiscal policy in 1980s, German Unification in 1990 etc). Each of these cases involved massive movements in real exchange rates for a magnitude of transfers that may be significantly less than those involved in a permit trading system.

In a series of papers McKibbin and Wilcoxen (1997a.1997b) we have pointed out that global permit systems with caps on the number of permits are a dangerous way to move forward and have proposed an alternative policy that would achieve real greenhouse gas reductions without the potentially disruptive problems of a global permit trading scheme built around fixed targets and timetable. This proposal is an approach that Richard Cooper (1996) called "agreed actions" rather than an agreed targets approach.

In this paper I will give an overview of how permit systems work in theory (section 2), why there are serious problems once you move outside a domestic system (section 3), what a better alternative would be (section 4), and finally address the issue of how Australia should move from having negotiated a bad agreement to the next stage of dealing with the transition from where we now stand to a fully fledged system of international greenhouse abatement policy (section 5), whatever its ultimate form. A summary is contained in section 6.

2. How Do Permit Systems Work?

The basic idea behind a tradable permit system is simple: any firm emitting carbon dioxide (or for a broader range of gases any carbon dioxide equivalent) would be required to own permits equal to the amount of carbon it produces. For example, a firm emitting one hundred tons of carbon would have to own one hundred permits. The permits would be allocated among countries by treaty, and it would be up to each government to decide how to distribute its permits domestically. Once distributed, the permits could be bought and sold without restriction on a world market. It would be illegal to burn fossil fuels without having purchased a permit, and it would be up to each government to enforce the treaty within its own borders.

Permit systems have three key features as a method of pollution control. First, they provide a firm upper bound on emissions. This feature of permits makes them attractive to those who believe that decisive action needs to be taken on climate change.

Second, because the permits can be traded, pollution abatement will be done at the minimum possible cost to the economy. Firms that can clean up cheaply will end up doing the abatement: they will be able to make a profit by cutting their emissions and selling their extra

permits. Firms that find it very expensive to reduce emissions will buy permits instead.

To make this concrete, consider the following example. Imagine two companies, L and H, are each emitting fifty tons of carbon annually for a total of one hundred tons. Suppose the government wants to reduce total emissions to eighty tons. One approach would be to require each firm to reduce its emissions by ten tons. That would achieve the eighty-ton target, and at first glance it seems like a reasonable policy: both firms contribute equally to the problem so both contribute equally to the solution.

At a closer look, however, it is clear that the policy could end up wasting a lot of money. It fails to take into account that it might be much more difficult for one firm to reduce emissions than for the other. Suppose firm L has low abatement costs and can reduce its emissions at a cost of $100 a ton while firm H has higher costs of $200 a ton. If each firm eliminates ten tons of carbon, the total cost will be $3,000. However, it is possible to get the same amount of abatement at far less cost: if firm L cleans up all twenty tons, the cost would only be $2,000. The equal reduction policy, in other words, costs 50 percent more than necessary and would waste $1,000.

To avoid this problem, one might imagine a different policy in which firm H was not required to do anything and firm L was required to reduce its emissions by twenty tons. This would get the cleanup at minimum cost, but it would clearly not be regarded as fair by firm L. Firm L would have to pay $2,000--the total cost of the cleanup--while firm H paid nothing even though both firms were responsible for the problem.

An ideal policy would have firm L do all the abatement but have firm H pay some of the cost. The third key feature of tradable permit systems is that they allow the costs of cleanup to be shared among firms even when the firms do very different amounts of abatement. The reason is that the government can exercise a great deal of control over the equity of the policy by the way it distributes the permits.

In fact, a permit system allows the government to spread the cost of the policy across firms any way it wants. To see how this works, suppose the government decides to solve the example problem by setting up a tradable permit system with a total of eighty permits. One way it could distribute the permits would be to give forty to each firm. If no trading occurred, each firm would have to eliminate ten tons of pollution and the costs would be the same as under direct regulation: $2,000 for firm H and $1,000 for firm L. However, both firms would have an incentive to trade in the permit market. Firm H would be willing to buy up to ten permits at any price up to $200 (the abatement cost avoided for each permit), while firm L would be willing to sell permits for any price above $100 (the extra abatement cost incurred in order to be able to sell a permit). If the market price turned out to be $150, the total cost would drop to $1,500 for firm H (ten permits at $150 each) and $500 for firm L ($2,000 of abatement costs less $1,500 from selling permits to firm H).

This solution minimizes abatement costs but would probably not be regarded as fair by

firm H. However, the government could easily even out the burden by giving H a larger share of the permits. Suppose it gave forty-three permits to H and thirty-seven to L (rather than forty each). Firm H would end up buying seven permits from firm L. At a price of $150, the total cost to H would be $1,050 (7 x $150) and the total cost to L would be $950 ($2,000 - $1,050). The abatement would end up being done entirely by firm L, and at minimum cost, but the overall burden would be shared between the firms. In general, permit systems give the government great flexibility in distributing the burden of abatement. The flexibility could be used to grandfather existing firms or to shift the burden of the policy in other ways that might make it more politically viable.

Presumably if a global permit system was implemented, countries would be allocated an initial stock of permits equal to their targets. For example Australia would get 108% of 1990 emissions whereas the United States would get 93% of 1990 emissions. These would be allocated within countries and then firms could trade with each other in a global market.

3. What Could Go Wrong in Practice?

Permit systems have worked well when used to control domestic environmental problems. The best-known example is the sulfur emissions trading scheme introduced by the 1990 amendments to the Clean Air Act. It has been a tremendous success: electric utilities, the principal industry affected by the program, have been able to reduce the cost of controlling sulfur emissions to one-tenth of the minimum cost projected when the act was adopted. For controlling carbon dioxide emissions in an international context, however, several practical problems arise that ensure that a treaty based on an international permit trading scheme would never be ratified and implemented in the United States.

The first problem is that the Kyoto Protocol would force emissions back below 1990 levels and hold them there without regard to the costs and benefits of doing so. However, studies to date suggest that the global costs exceed the benefits, perhaps substantially. Estimates of the cost of holding emissions constant range from -0.5 percent (an increase in GDP) to 2 percent of GDP annually; most fall in the 1 to 2 percent range. Considerably less is known about the benefit of stabilizing emissions. In principle, the benefit of stabilization is simply the sum of the avoided costs of damages that higher temperatures would cause. In practice, these damages are fiendishly difficult to estimate. The link between carbon dioxide emissions and global temperature is slow and indirect, and is not very well understood by climatologists. Moreover, little is known about the damages higher temperatures would cause.

Together these problems have proven so daunting that only a handful of studies have been attempted and most have focused on a single scenario: estimating the damages caused by a 2.5 to 3 degree Celsius increase in global temperatures. The results vary but at the upper end of the range the cost of damages could be as much as 1.3 percent of annual GDP for the United States by the middle of the next century. The benefit of stabilizing global *temperatures* would be that these damages would be avoided. The benefit of stabilizing global *emissions* is considerably less.

Even at 1990 emissions rates, global concentrations of carbon dioxide, and hence global temperatures, will continue to rise for many years (although at a slower rate than if there were no restrictions on emissions). In fact, stabilizing temperatures would require cutting emissions to about half of 1990 levels. This means that the 1.3 percent of GDP estimate is not the benefit of stabilizing emissions but rather it is (implicitly) the benefit of cutting them to 50 percent below the 1990 level. Holding emissions at 1990 levels would only reduce the rate of warming rather than prevent it entirely, and the damages avoided would be less than 1.3 percent of GDP.

In a nutshell, current evidence is does not give clear support to a policy of holding emissions constant. The costs and benefits of stabilizing emissions are not known with much precision but most studies of costs arrive at estimates that are higher than the highest estimates of benefits. Moreover, these costs would have to begin to be paid now in order to avert damages far in the future. Given these considerations, it is difficult to imagine that the U.S. Congress would ratify a treaty based on reducing below 1990 levels. There is, however, enough evidence to make a clear case for taking steps to slow the growth of emissions. A better policy would focus on this more modest goal.

A second problem with a global permit system is that it would generate large transfers of wealth between countries. Supporters of a permit system regard this as an advantage because it would allow developed countries to compensate developing countries for reducing their emissions. This would be a significant political problem for the US Congress. But more importantly this could put enormous stress on the world trade system. The balance of trade for a developed country importing permits would deteriorate substantially. This would lead to substantial volatility in exchange rates and distortions in the world trade system. Equally serious problems would be created for developing countries. Massive exports of permits would lead to exchange rate appreciation and a decline or collapse in exports other than permits. Also, the permit revenue comes with strings attached: much of it would have to be invested in improved energy technology in order to reduce emissions and free up the permits in the first place. This is unlikely to be an ideal strategy for long-term economic development and would make the policy unattractive to developing countries.

In fact, developing countries have been so unenthusiastic about the policy that the Kyoto meeting produced support for an umbrella group to trade emission permits (including Australia, New Zealand, Canada, Japan, Russia, Ukraine and the United States). However, this is a compromise that essentially eliminates the main reason for having internationally tradable permits in the first place: the potential gain from trade in emissions rights between industrialized and developing countries. Permit trading would do little to lower abatement costs when the participating countries have fairly similar technology. Moreover, this umbrella system may not even reduce emissions because Russia and the Ukraine are well below their 1990 emission levels and would be able to sell their unused permits within the umbrella group. In that case the permit system would really amount to nothing more than an elaborate accounting mechanism for counting increases in emissions in countries like the United States against the 1990 allocation for Russia. There would be little or no overall reduction. But under a plausible alternative scenario in

which Russia grows strongly between now and 2008, the demand for permits within Russia would increase, sharply driving up the umbrella price of permits. This could add an ironic twist to an international permit policy: if Russia were to grow quickly, the United States could soon become the developed world's low-cost emissions abater. In that case the United States would be a net seller of permits, and the rest of the industrial world would end up paying it to reduce its emissions.

Finally, one further problem with the Kyoto Protocol and any permit trading system that follows, is that no individual government would have any incentive to police the agreement. It is easy to see why this is so: monitoring polluters is expensive, and punishing violators imposes costs on domestic residents in exchange for benefits that will accrue largely to foreigners. There would be a strong temptation for governments to look the other way when firms were exceeding their emissions permits. For the treaty to be viable, however, each participating country would need to be confident that all of the other participants were enforcing it. This would require an elaborate and expensive international mechanism for monitoring and enforcement.

All in all, an international permit system aimed at stabilizing emissions would not be politically viable in developed countries, could distort or compromise the world trade system, would be unattractive to developing countries, and would be difficult to monitor and enforce. It is an *impractical policy focused on achieving an unrealistic goal.*

4. A Better Alternative to a Global Emission Permit Scheme

Elsewhere[3] we have advocated a policy that gets around the potential problems of a global permit trading scheme discussed above . In many ways our approach is a small movement away from the global permit scheme retaining many of the advantages but removing crucial problems. Although philosophically our approach is a long way from the degree of centralization implicit in a global permit scheme which has very different political implications. Our proposal has become known as the McKibbin-Wilcoxen Proposal in the international debate but for whatever reason has been called the McKibbin Tax in the Australian debate (inappropriately in my view because we are not advocating a standard carbon tax). Our proposal, as originally designed, is an internationally coordinated system of national permits and emissions fees for carbon dioxide although it could easily be extended for carbon dioxide forcing equivalence so as to incorporate the 6 greenhouse gases identified in the Kyoto Protocol (carbon dioxide (CO2), methane (CH4), nitrous oxide (N20), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6)) . Under this system, all emitters of these greenhouse gases would be required to own permits equal to their total emissions of these gases. Countries would be allowed to distribute a specified number of permits to their domestic users in any way they like, including handing them out for free. Additional permits could be purchased from each government at a stipulated international price, say $US 10 per ton. Because the total number of permits can rise if abatement turns out to be expensive, the policy has a built in safety valve that would limit the

[3] McKibbin and Wilcoxen (1997a,1997b).

economic damage that the policy could inflict. Since the policy does not focus on achieving a specified target at any cost, it would be far more likely than a more rigid approach to be ratified by more countries. The key point is that the price is internationally negotiated and held fixed between negotiations.

Once an industry receives its initial allocation of permits it would have to decide whether to buy additional permits, sell some of its allocation, or stay with exactly the number it was given. If it does not buy or sell permits, it can continue with its existing practices at no additional cost (although there is a significant opportunity cost from not selling permits). If it needs to increase its carbon-emitting activities, however, it would have to buy additional permits at a price of $10 per ton, giving it a clear incentive to avoid increases in emissions. At the same time, if the firm could reduce its emissions, the permit system would give it a strong incentive to do so: avoided emissions could be sold on the permit market at a price of $10 per ton. For example, if an electric utility could shift some of its load from coal to natural gas for a cost of $6 per ton of carbon, it could emit less carbon and make a profit of $4 per ton by selling its excess permits. Indeed, many firms have claimed they are willing to undertake low-cost carbon abatement. The permit system we propose will reward firms for these endeavors. The more effort a firm puts into reducing carbon emitting activities at low cost, the higher its profits will be.

This policy is not simply a carbon tax as it is often portrayed. Only marginal emissions above the target are subject to a direct charge (the price of permits) but most of this is a transfer within industry rather than between industry and government. Indeed existing emitters are implicitly given subsidies to change their behavior because of the opportunity cost of continuing with their activities is the permit price. If firms do nothing they are not subject to any direct cost increase but are awarded profit in proportion to their success at reducing emissions. New industry is not unfairly treated because the marginal costs for both old and new activities will be the same. Existing emitters receive lump sum compensation for the change in the system where this compensation is proportional to how much abatement they achieve.

The issue of sinks of greenhouse gases could also be dealt with in this system by allowing producers of sinks (land use changes, tree planting etc) to be awarded permits for their activities that they can then sell into the permit market. There are serious issues of measurement that need to be overcome to make sure the system is not debased but in principal a generalized McKibbin-Wilcoxen system would be possible. One key problem with the Kyoto Protocol is that emissions and sinks are added together whereas the two are very different. Once a power station burns coal carbon dioxide is emitted and stays in the atmosphere for a very long time. If a farmer plants a tree then while the tree grows it absorbs carbon dioxide. Once finished growing there is not a permanent reduction in emissions rates. If the tree is harvested or burns then the emissions sink is lost. To make the system workable there would need to be a monitoring program that ensures that sinks are maintained and appropriate charges imposed for sink destruction.

The McKibbin-Wilcoxen proposal as extended here has a number of advantages:

· The same price will be charged for each new permit in each country as well as for any permits that are traded in domestic permit markets. Thus, the marginal cost of reducing carbon emissions will be equalized within and across all countries that participate. This makes the system efficient because the cheapest emissions reductions will be undertaken first. Environmentalists and engineers often argue that many low-cost options are available for reducing energy demand. If so, these low-cost options will be exploited under this policy, and without needing to be specifically identified in advance by the government. On the household side, for example, the increase in energy prices will encourage households to demand more energy-efficient vehicles and appliances.

· The policy contains built-in mechanisms to encourage enforcement. Governments will have an incentive to monitor the system because they will be able to collect revenue from selling permits. Firms will have an incentive to monitor each other because any cheating by one firm would put its competitors at a disadvantage and would also affect the value of permits held by other firms.

· The system is flexible and decentralized. New countries can join by setting up their own permit system and agreeing to charge the stipulated world price for additional permits..

· Transfers associated with the permit system are largely between firms or between firms and households, rather than between the private sector and the government. It also minimizes transfers across borders, avoiding serious economic and political problems. Unlike the experience of the 1970s, increases in energy prices under this policy would not lead to massive transfers of wealth between countries.

· The policy also could be revised easily as more information becomes available. After setting up the system and agreeing on the price of permits, participating countries could meet every five years to evaluate the extent to which carbon emissions have been abated as well as to re-evaluate the extent of climate change and its consequences. If it becomes clear that more action is required, the permit price could be raised. If climate change turns out to be less serious than it appears today, the permit price could be lowered. To minimize the costs of these price changes, future markets could be developed in permits so that risks are effectively shared.

Overall, the advantage of the permit and fee system over targets and timetables is simply that it is far more practical. It is ratifiable because it limits the cost of compliance and does not require governments to commit themselves to achieving a given target at any cost. It is transparent to households and firms because it spells out exactly how the policy will work, rather than specifying the target and leaving the policy undefined. It is more credible than a targets and timetables policy because it is not so draconian that countries will be tempted to renege, and because the revenue from selling permits will give governments an incentive to enforce it.

Moreover, because it contains a built-in mechanism for limiting economic costs, the risk of setting ambitious emissions targets—which could significantly reduce economic growth if abatement proves to be expensive—is eliminated. This would remove the single most important obstacle to reaching a realistic international climate policy.

5. What Should Australia do Now?

I suspect that Australian policymakers now face a dilemma. They have signed up to a protocol which is subject to a great deal of uncertainty about ratification by key countries (e.g. United States). It all hinges on how developing countries are included and this will become clearer in Brazil in November. If in fact the protocol does proceed then action will need to be commenced because, despite perceptions to the contrary, Australia has a lot of abatement to be implemented by 2008. Estimates from the G-cubed Model of carbon dioxide emissions from fossil fuel use by 2010 are 150% of 1990 levels under plausible assumptions (with a great deal of uncertainty around this number in both directions). Adding other sources of emissions complicates the actual emission calculation and incorporating sinks further complicates the extent of adjustment required. Nonetheless Australia's target of 108% of 1990 levels by between 2008 and 2012 will potentially require significant policy changes.

One option is to start a domestic permit trading system in the near future so that Australia would be in a good position if and when an umbrella, or more wide ranging system, was implemented. There is however a serious problem to consider before rushing into this. For carbon emissions alone we estimate that marginal abatement costs for Australia are high and certainly higher than for the United States[4]. Thus the price of permits in an Australian domestic system would be expected to be much higher than the price in a system that included the United States, who has low marginal abatement costs, or even one that included Russia who would bring a significant volume of essentially "free" permits to the system. After all if the price of an Australian only system and a wider group of countries was the same then there is no need to have a permit trading system because there would be no gains from trade! Thus a permit system with a cap on permit quantities within Australia (based on Kyoto) could be a very bad idea in the near term because any participation in a multi-country system would most likely lead to a large fall in the permit price in the future. Why pay a high price today in terms of economic costs? A better idea would be to introduce a McKibbin-Wilcoxen system in Australia with a low initial price. This could be a permit trading system with a fixed price (of say $US10 per ton of carbon equivalent emissions). Thus the cost of abatement would be known and fixed for a period of several years. The international community might yet adopt the global system consistent with our proposal (it has certainly not been ruled out). Even if the international community continue to move towards a multi-country system with a quantity cap rather than a price cap, at least the transition from a domestic to global system would be less disruptive under our system than under a domestic system with a quantity cap.

[4] See Bagnoli, McKibbin and Wilcoxen (1996) for a range of estimates.

6. Summary

The Kyoto Protocol is a bad outcome for global environmental policy. It has created a great deal of uncertainty about how and whether countries are going to achieve the strict quantity targets that have been set by 2008 to 2012. The international community had an opportunity to put in place a credible instruments based approach that would begin to reduce emissions at low cost wherever possible, in addition to giving flexibility to the time frame and burden sharing arrangements. Policy makers now have to turn to economic instruments within a target regime that has many potential risks. For a researcher in climate change research and for negotiators and bureaucrats, Kyoto was a full employment contract for many years to come. For the world economy it has presented many crucial challenges. Our goal from here should be to make the system that develops as de-centralized as possible and to ensure that Australia doesn't commit to a significant loss in economic well-being while we tread water and wait for the United States to dive in. The best way forward is a domestic version of the McKibbin-Wilcoxen proposal with allowance for sinks in which the permit price is fixed (and modest) and the market is used to determine the extent of abatement at a known cost.

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