REPORT

CENTRE FOR INTERNATIONAL ECONOMICS

Early greenhouse action

Prepared for

Australian Greenhouse Office

FINAL REPORT

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Foreword

The Australian Greenhouse Office has commissioned this report from the Centre for International Economics. It is released in the interests of promoting public discussion of possible policy approaches to encourage early greenhouse gas abatement action.

This report is being published at the same time as the Australian Greenhouse Office second discussion paper on emissions trading, *issuing the permits*. The first discussion paper on emissions trading, *establishing the boundaries* was released in March 1999. Two further papers will be published over the next four months.

The views canvassed in this report do not represent the views of the Australian Greenhouse Office or the policy positions of the Commonwealth Government. This report and the emissions trading discussion papers are being widely circulated for comment to allow the Australian Greenhouse Office to develop advice for the Government on the feasibility of an emissions trading system for Australia.

Gwen Andrews
Chief Executive
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June 1999

Comment on the issues raised in this report should be made by 31 August 1999 and addressed to:

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This report is available online at the Australian Greenhouse Office Internet web site
http://www.greenhouse.gov.au/emissionstrading

Submissions provided in electronic form will be published on the web site.

Contents

Charts and tables

Summary

The question

This report considers whether the Australian government should take particular greenhouse policy actions in the lead-up to the Kyoto Protocol in order to target abatement before Australia's international obligations commence.

We examine this question given that first, it is unclear whether the Kyoto Protocol will be ratified and hence enter into force and second, that if it is ratified, it is currently unclear what ultimate form the Kyoto Protocol will take.

The early action policy problem

The nature of the Kyoto Protocol itself, combined with uncertainty about the Australian policies that could be used to achieve the Kyoto Protocol target, has created an early action policy problem.

- By mandating a quantity target for emissions in 2008-12, the Kyoto Protocol creates uncertainty about the future price of carbon (and equivalents). Uncertainty about the future price today makes it difficult for firms to evaluate abatement actions in the lead-up to the potential implementation of the Kyoto Protocol.
- The Kyoto Protocol target is ambitious, leading to concerns that if abatement does not start early, the target will not be met, or that it will be met at unnecessarily high cost.

- Firms are concerned that domestic Australian policy responses could indirectly penalise them for early action – either that they have already taken or are planning to take in the near future.

These early action uncertainties can create disincentives for early voluntary abatement. Yet, many firms are currently undertaking voluntary abatement actions. The problem is not that no early action is taking place, but whether current policy is creating consistent and sufficient incentives for early action in the context of the Kyoto Protocol.

Decision making under uncertainty

The early action problem amounts to a problem in decision making under uncertainty. Firms and the government must choose how to act towards the Kyoto Protocol before it is clear whether it will be enforced or what form it will take. While the Australian government has the capacity to reduce the uncertainty surrounding its own policies, considerable uncertainty will remain about the international abatement regime.

With this uncertainty, there are a number of reasons why the optimal early abatement decisions from the perspective of firms may in total differ from the what the government considers to be optimal early abatement. In the absence of prices today there is, for example, no mechanism to convey to firms the magnitude of the overall abatement target in the future. Further, firms and government may have different discount rates, or different evaluations of the likelihood of the Kyoto

Protocol coming into force – leading to different views about how much abatement it is sensible to do today.

The early action policy problem amounts to coordinating these different decisions and deciding whether to allow early abatement emerge from the variety of individual decisions and expectations or whether to take specific actions to target abatement in the lead-up to the potential implementation of the Kyoto Protocol.

Arguments for early action

There are a variety of arguments for particular early action policies. These mostly stem from the need to address the mixed incentives to undertake abatement currently facing firms. These mixed incentives emerge from the nature of the Kyoto Protocol and uncertainty about domestic policy response to the Protocol.

One of the major disincentives for early abatement action is the fear of an indirect penalty or disadvantage emerging from early action because of the potential structure of domestic policy responses to the protocol. If, for example, under emissions trading permits are grandfathered at a point in time after abatement action had commenced, those firms that abated early would be indirectly penalised.

Australian Kyoto Protocol policies should be established by observing a 'no disadvantage' principle which ensures that policies provide consistent incentives over time.

Policy objectives

Because of the uncertainty under which decisions today must be made, the objective of policy in the lead-up to the Kyoto Protocol is to meet the *expected* Kyoto Protocol target at *expected* minimum cost.

Early action approaches

There are a variety of possible early action approaches, ranging from early voluntary of compulsory trading schemes to early carbon taxes or subsidies.

A key finding of our analysis is that policies that seek to provide early credits from Australia's Kyoto Protocol allocation without sending price signals or without clarifying some of the key uncertainties will further complicate incentives and will involve significant risks. A better approach is to directly target price expectations by setting a minimum price of carbon (and equivalents) in the future.

Making polices early action friendly

It is important to ensure the Kyoto Protocol policies are 'early action friendly' by observing the no disadvantage principle. This ensures that these policies contain their own implicit credit mechanism, removing the need for explicit early credits.

Proposed policy actions

We have proposed three levels of early action policy response.

The first level involves undertaking minimal actions including:

- establishing the 'no disadvantage principle' to apply to all Kyoto Protocol response policies;
- setting out the details of the ultimate policies that will be used to achieve the Kyoto Protocol targets;
- establishing a minimum price for carbon and equivalent emissions in 2008; and
- clarifying the status of actions that will result in an increase in Australia's Kyoto Protocol allocation.

The first level of early action policy response will remove the currently mixed incentives for early abatement action and will create a consistent positive incentive for early voluntary abatement.

The second level involves considering additional, more stringent, policies to target early abatement. These include early carbon taxes and early compulsory trading. The choice of these depends on the ultimate policy instruments designed to achieve the Kyoto Protocol targets.

Implementing the second level policies requires careful justification as to why more action beyond the first level is required. This means identifying 'early action externalities' that result in the sum of firms' optimal decisions not being the same as the optimal decision from the national viewpoint.

As already noted, the appropriate target for these policies is not the Kyoto Protocol target itself, but the expected Kyoto Protocol target. That is, these second level policies must account for the uncertainty surrounding the implementation of the Kyoto Protocol.

The third level involves general information and support policies that provide ongoing support to:

- define and measure emissions;
- identify the implications for firms of the Kyoto Protocol, in particular the implications of a future positive price for emissions; and
- identify the implications of emissions trading.

1 Introduction

Purpose and scope of the report

Australia may have a legally binding obligation to participate in an as yet unspecified international greenhouse abatement regime. If Australia has an obligation, it is likely to take the form of a quantity target for emissions in the years 2008–12. The precise nature of the target will depend on the form of the international regime that emerges from the Kyoto Protocol. It may involve considerable flexibility – through international emissions trading, for example – or the flexibility may be capped or significantly curtailed.

Within this context, the Australian government needs to plan the continuation of its policy responses to greenhouse in general and to the Kyoto Protocol in particular. In the same environment – with the additional uncertainty of the Australian government's response – Australian firms must plan their activities for the next decade and beyond.

The purpose of this report is to examine whether the government should adopt particular policies designed to achieve early abatement in advance of the ultimate polices that may be required to achieve the Kyoto Protocol target. That is, it is concerned with the general issue of ***early action***, defined as unilateral national action taking place within Australia before

multilateral obligations commence (under the Kyoto Protocol or some variant that emerges from it).

In particular, we address the following questions as set out in our terms of reference.

- Is early abatement action in Australia's national interest?
- What are the possibilities for early abatement at minimal cost on a voluntary basis?
- What are the current incentives facing firms for early action?
- What are the policy options, and their costs and benefits, for encouraging early abatement?

Premises underlying the report

There are many uncertainties that significantly complicate the discussion of any policy options in the lead-up to the Kyoto Protocol's potential entry into force. To deal with these, we have adopted a number of starting premises that provide the context for the report's discussion.

- **Australia is committed to the Kyoto Protocol**. We take as given Australia's commitment to the Kyoto Protocol and assume that the objective of policy in the lead-up to the first budget period is to achieve the Protocol's target at minimum economic cost. However, we critically scrutinise the Kyoto Protocol for two broad reasons.
  - First, the nature and form of the Protocol have significant implications for early action. The Kyoto

Protocol is in many ways 'early action unfriendly', and much of the current concern about early action stems from the nature of the Protocol itself.

– Second, there are a variety of views about the Kyoto Protocol, its likelihood of enforcement and its costs and benefits. These views affect the incentives for early action on the part of firms while suggesting risks on the part of government. Without necessarily accepting any particular view, we recognise that subjective expectations are an important element of the early action policy issue.

- **Much remains to be resolved**. Most of the relevant details of the Kyoto Protocol have yet to be finalised. At the time of writing, there is no clear pathway to resolving many of the issues. This has important implications for the timing of early action.
- **Flexibility mechanisms are essential**. One of the strengths of the Kyoto Protocol is its recognition of the need for flexibility in any abatement actions. Flexibility mechanisms will be an essential component of any international policy response. Their existence has implications for early action, as does the fact that they may be under threat.
- **International action is likely**. It is likely that even if the Kyoto Protocol is not implemented in its current form there will subsequently be some form of international agreement on greenhouse. While this is far from guaranteed, it has important implications for the planning of Australia's response.

- **Some compulsory action will be needed**. We assume that voluntary action alone will be insufficient to achieve the Kyoto Protocol target. The Australian government will therefore need to impose some form of compulsory measure (for example, taxes or emission trading) to achieve the target. This premise is likely to be controversial. Some would argue that if the government were to encourage sufficient voluntary action, a compulsory target would not be required. We have adopted the premise for two reasons.
  - We consider it constitutes a realistic assessment of likely outcomes.
  - Much of the discussion of early action implicitly takes this view, and we believe it is important to make it explicit. As we will point out, there are internal contradictions in some proposals for early action on the one hand and expectations for compulsory action on the other.
- **A broad view of voluntary action is adopted**. While the overall concern in this paper is with *encouraging voluntary action*, this phrase contains a contradiction: to what extent is something voluntary if it is encouraged? A common view in early abatement discussions is that 'voluntary' is a response to a positive incentive (such as a credit) and 'involuntary' is a response to a negative incentive (the threat of a fine). In reality, there is a continuum of actions ranging from voluntary to involuntary, and particular actions could be either depending on the context within which they take place. Here we take a broad view of voluntary and judge early action policies on their merits in

terms of their flexibility and their overall economic costs and benefits.

Our approach

Our approach is to draw together literature, overseas experience and industry discussions along with economic analysis of incentives, costs and benefits.

Literature and overseas experience

Governments throughout the world are considering early action, and the policy environment changes almost daily. In conducting our research, we have incorporated developments and the evolving literature to the end of May 1999. It is likely that events will rapidly overtake some of the comments presented here.

Industry discussions

Industry discussions formed a large component of our approach to this task. (Appendix B summarises the key organisations consulted.) It is reasonable to say that to a large extent the industry consultations did not provide answers, but raised questions. This partly reflects the fact that it is difficult to think about early action without some knowledge of the ultimate policy instruments government will use. It also reflects that fact that there is unlikely to be any single early action scheme that satisfies the many industry circumstances and requirements.

We encountered a wide variety of opinions and perceptions and in many cases the views we received were put as 'preliminary' and 'not final'. This diversity and fluidity has two implications:

- first, in presenting the views throughout the report, we have had to summarise and abstract to a degree; and
- second, it is possible that the views we present have evolved since they were originally canvassed.

We have not attempted to summarise a single 'industry view'. Such a singular view does not exist. Rather we have identified where appropriate a variety of views. The analysis and policy recommendations presented in this report should not be interpreted as representing the views of any particular organisation or group.

Economic analysis

The economic analysis is broad. At this stage we have not used a quantitative modelling framework. Rather the objective has been to clarify the various tradeoffs involved and to provide a framework for discussing early action issues.

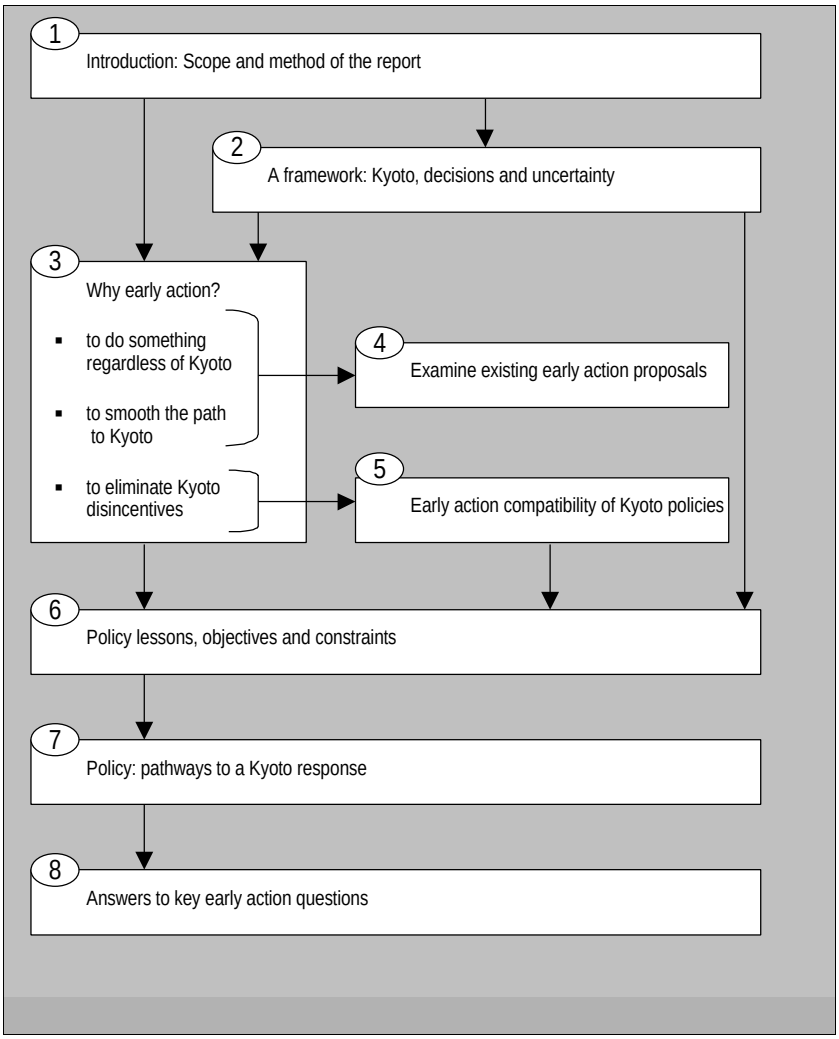
Structure of the report

To analyse early action policies, it is necessary to first understand the underlying cause of the early action 'problem' and the reasoning behind suggestions for particular early policy actions. Chapters 2 sets out a broad framework for thinking

about the problem while chapter 3 sets out some of the arguments for early action (derived from literature and industry consultations).

Chapter 4 then examines some specific early action proposals and evaluates them in an Australian context. Chapter 5 considers the early action compatibility or properties of possible policy approaches to the Kyoto Protocol. Chapter 6 draws some broad policy lessons from the previous discussion and chapter 7 applies these lessons by suggesting some possible early action pathways to the Kyoto Protocol. Chapter 8 concludes the report.

1.1 **Structure of the report**



2
A framework: Kyoto, decisions and uncertainty

The basic problem

The basic problem underlying early action is that both firms and government must choose how to act towards a multilateral obligation (the Kyoto Protocol) before it is clear whether the obligation will come into force or what the exact nature of the obligation will be.

These choices must be made within the broad constraints of the Kyoto Protocol. For example, because the Kyoto Protocol calls for a quantity target to be met regardless of the resulting cost of emissions – or equivalently, regardless of the cost of achieving the target – the choices must be made without the Protocol itself sending any clear signals about the opportunity cost of abatement.

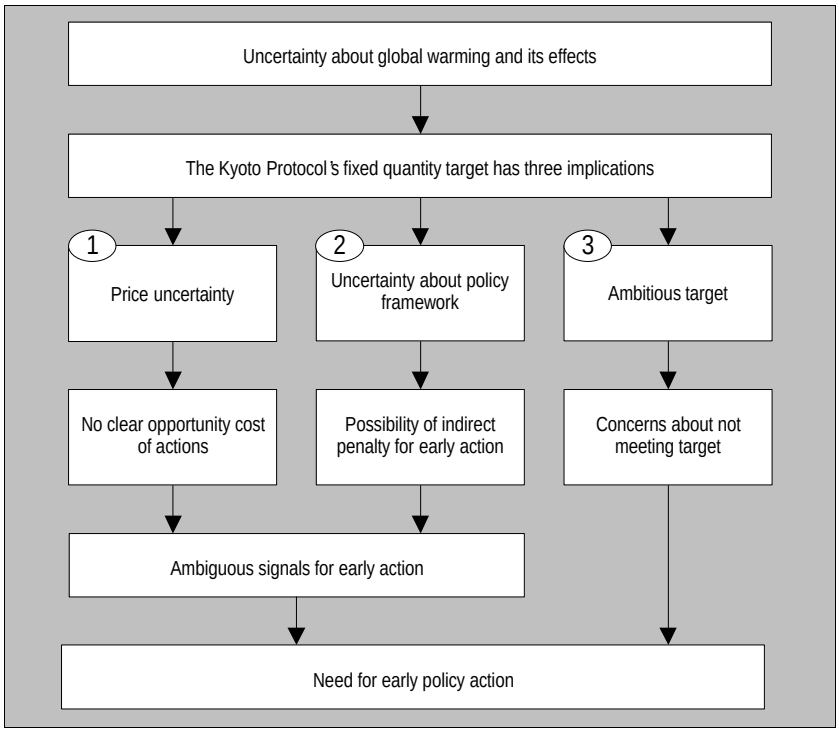
An additional policy problem for government is how to deal with the different perceptions of a variety of firms about the future state of the world (that is, with or without the Kyoto Protocol in force) and different perceptions about future policy. Should the Australian government let abatement emerge from a variety of individual decisions and expectations, or should it

take specific actions to target abatement in the lead-up to the implementation of the Kyoto Protocol?

Origins of the problem

Different perceptions and expectations about the future are not usually problems in themselves and are routinely dealt with in a variety of policy and industry environments. However, three features of the Kyoto Protocol make these standard issues relatively complex (chart 2.1). They all stem from uncertainty and risks surrounding human-induced global climate change and the need for a coordinated international response, which led to the Kyoto Protocol setting quantity emission targets at a point in time for a selected group of countries.

2. 1 **Origins of the problem underlying early action**



The three features are as follows.

- The quantity target for Australia is ambitious. It will potentially involve a significant change in the nature of Australia's economic growth and structural adjustment. If Australia's Kyoto target was 150 or even 120 per cent of 1990 emissions (rather than 108 per cent), there would be little discussion or concern about meeting the target. The target as it stands leads to concerns that either it will be missed if abatement does not start now or that, to minimise costs, abatement needs to start as soon as possible.

- The quantity target approach taken by the Kyoto Protocol turns uncertainty about climate change into uncertainty about the price of carbon (and equivalents). This is important because the lack of a price today inhibits calculation of the implications of abatement opportunities, making early abatement difficult – there is no clear opportunity cost of abatement. This means that there is no price to work through the market system. Further, the target year approach taken in the Protocol does not allow developed countries to earn 'credits' for emission reductions achieved before the first commitment period. The exceptions to this – sinks and clean development mechanisms (CDM) – and the extent to which they are in fact exceptions are surrounded by considerable uncertainty.
- The policies by which the Kyoto Protocol's quantity targets will be achieved are uncertain. This uncertainty raises three questions, all sending mixed signals.
  - Will the Kyoto Protocol itself come into force?
  - What will be the nature of the Protocol if it does?
  - What will be the domestic policy measures used to achieve the Kyoto Protocol obligations and will these indirectly penalise early action?

These three aspects of the Kyoto Protocol interact. For example, an ambitious quantity target in the absence of price information means that there is no mechanism today by which the magnitude of the overall future target can be signalled to firms. Of course, the objective of emission trading is to send these price signals, but in the lead-up to the Protocol the absence of

price signals has serious implications for the information available to firms in planning early abatement.

All of these various aspects of the Kyoto Protocol have received considerable comment from academics and policy analysts. Pizer (1997), McKibbin and Wilcoxen (1997), McKibbin (1998) and Nordhaus and Boyer (1999) are some of the authors who have pointed out the economic implications of the nature of the Kyoto Protocol.

The decision framework

Both firms and the government must make their decisions under uncertainty. This is broadly summarised in chart 2.2, which simplifies the problem into two states of the world and two possible actions. Either the Kyoto Protocol will come into force, or it will not, and firms and government have the choice to act now or to wait until it is clear whether the Protocol will come into force.

If firms or the government act now and the Protocol does come into force, then firms or the nation may hit the target at lower cost than if they wait until the Protocol comes into force before acting. But if the Protocol does not come into force, acting now means they impose the unnecessary costs of the abatement action. Waiting means there is no cost if the protocol does not come into force.

The optimal way to make the decision ex ante (before we know whether the Kyoto Protocol will come into force) is to weight the payoffs for each action by the probability of the Protocol

coming into force (or not) and then choosing the action with the highest payoff. Ex post (after we know the state of the world) the decision made ex ante may well appear to have been completely wrong – this is an inevitable implication of decision making under uncertainty.

2.2 A simple view of the decision matrix

		Possible states of the world		
		Kyoto in force p(k)	**Kyoto not in force 1-p(k)**	***Aggregate payoff***
Possible actions	**Act now**	Hit target at lower cost Depends on nature of Kyoto policies and price of emissions under Kyoto Payoff = $A	Impose unnecessary cost Payoff = -$B	p(k)*A - (1-p(k))*B
	Wait	Hit target at higher cost or miss target Payoff = -$C	No cost	-p(k)*C

For firms, the decision is made using their subjective evaluation of the probability of the Kyoto Protocol coming into force, along with their subjective view of the payoffs involved. The probability evaluations are subjective because they will not necessarily be the same for all firms, and firms' evaluations will not necessarily be the same as the government's evaluation.

While an oversimplification, this phrasing of the decision problem allows us to focus on a number of crucial elements of the problem.

- First, the various payoffs in the matrix in chart 2.2 must be further adjusted by an appropriate discount rate. Costs or benefits in the future must be discounted to put them on

the same basis as costs or benefits today. This means, for example, that the lower cost (or relative benefit) from hitting the target in the future must be discounted relative to the cost incurred in achieving the abatement today. In making a decision, firms may have a higher discount rate than the government has because of their need to achieve particular rates of return. The government, on the other hand, may not wish to pass environmental costs onto future generations.

- Second, while firms are likely to have the best knowledge of their individual abatement costs, there is no mechanism by which either the aggregate abatement target or the aggregate abatement costs appear in an individual firm's decision. Put another way, the government's decision problem may look quite different from that of the firm in this regard. The government, by focusing on the aggregate target, is likely to take a very different view of the tradeoffs involved.
- Third, an additional layer of uncertainty not explicitly shown in chart 2.2 is that, if the Kyoto Protocol comes into force, the price of carbon (that is, the price of permits) remains uncertain. As noted above, this will influence the relative payoffs in each of the cells. For example, if the Protocol comes into force and carbon has a very low price, firms may have incentive to do little abatement now. However, if carbon has a high price, there is a greater incentive for abatement now. Subjective views about the price of carbon under the Kyoto Protocol will have a major influence on firms' decisions.

- Fourth, there is a further layer of uncertainty about the nature and impact of domestic policy actions designed to achieve the Kyoto Protocol targets. Some ultimate Kyoto Protocol policies adopted domestically could change the payoffs by indirectly penalising early action.

A fundamental implication of this analysis is that the optimal decision from the government's point of view will not necessarily be the same as the summation of the optimal decisions from the individual firms' points of view. The government may have different views about the likelihood of the Protocol coming into force or about the economywide costs and benefits of abatement. Herein lies a crucial question raised by the early action policy problem: are there policies that can bring the two optimal decisions together at minimal cost, or should the government impose its optimal decision on firms?

Another implication is that any particular early action approach is unlikely to seem optimal (or even sensible) to all players. Because they have different subjective views about probabilities and the costs and benefits of actions, any one view could well seem irrational to other players. This implies that the rationale for any particular government action must be very clearly explained.

A more complex view

Of course, the problem is more complicated than is apparent from chart 2.2. A more realistic view (but still a summary) is set

out in chart 2.3. Here there are more dimensions both in terms of states of the world and in terms of actions.

Not only is there uncertainty about whether the Kyoto Protocol will come into force, there is also uncertainty about the form it may take. For example, flexibility mechanisms are a key feature of the Protocol, and presumably Australia's decision to sign was in part determined by perceptions of these. However, as recent statements from the European Union indicate, the flexibility mechanisms are far from being finalised. This means that the decision problem includes the need to make judgments about the nature of flexibility mechanisms in the Kyoto Protocol.

Chart 2.3 also illustrates that even if the Kyoto Protocol is not ratified in any of its potential current forms, there is still a possibility that there will be some form of international greenhouse action. International discussions may continue after 2005 regardless of the status of the Kyoto Protocol. Assigning a low probability to a successful Protocol does not necessarily mean assigning a high probability to no international action. This has an important implication: *even without the Kyoto Protocol, some form of early abatement action may to be appropriate*.

Chart 2.3 also illustrates that early action is not a 'now or never' proposition. There are points in time when there may be considerably more information than there is now. For example, we are likely to know in 2005 whether the Kyoto Protocol will be in force in 2008. Thus, the decision problem is complicated by the potential gains from waiting for more information. Of course, the tradeoff in waiting is that the costs of adjustment

may ultimately be higher. This amounts to saying that the extra information comes at a price.

2.3 **A more complex view of the decision matrix**

Possible actions	*Possible states of the world*				
	Kyoto Protocol in force			Kyoto Protocol not in force	
	Full flexibility	*Partial flexibility*	*No flexibility*	*No agreement*	*Some other agreement*
Act now					
Wait until ratification					
Wait to 2008					

3 *Why early action?*

Broad arguments

The arguments for early action roughly fall into three (closely related) categories.

- ***Do 'something' regardless of the Kyoto Protocol***. This argument is most evident in discussions in the United States (see, for example, Claussen 1999, Burnett and McDermott 1998, Kopp et al. 1999 and Nordhaus et al. 1998). It comes from, for example, 'green' organisations that are concerned that the uncertainties surrounding the Kyoto Protocol will prevent greenhouse friendly actions from taking place. They propose, therefore, to create incentives now that will start a process of abatement, valuable in environmental terms, regardless of whether the Protocol is finally implemented. Chapter 3 examines some of these proposals.

  An aspect of this argument is that businesses and policy makers could 'learn by doing' as a result of early action policies.

- ***Eliminate Kyoto Protocol disincentives.*** This argument recognises that policies designed to implement the Kyoto Protocol in the first budget period could create a disincentive for early abatement by penalising abatement

actions that take place before the budget period. This is examined below. At the very least, this argument implies that the very nature of the Protocol creates highly mixed incentives for action today.

- ***Smooth the path to the Kyoto Protocol target.*** This argument recognises that, without some abatement taking place before 2008–12, the rapid adjustment that may ultimately be required will impose significant costs on the economy. It would be preferable to have a smooth 'glide path' to the Kyoto Protocol target. Supporters of the Protocol are concerned that, without early action, the adjustments required will ultimately make the Protocol politically and economically infeasible.

  An aspect of this argument is that, as well as not *discouraging* early action, it may be appropriate to positively *encourage* it. This argument can be expressed in a number of ways; its most common form is in terms of an 'optimal' path for adjustment to the ultimate regulation. As its name suggests, the optimal adjustment argument involves recognising and comparing a number of different costs. Under some circumstances, adjustment early may be preferred to adjustment later. The notion of an optimal path helps answer the question: how much encouragement is appropriate?

  Some look at positive encouragement not in terms of an optimal path but simply note that, because the problem is big enough, it is important to start doing something now – to start on an abatement path regardless of what it is (see, for example, Claussen 1999).

In the Australian context, additional reasons for policy focus on early action are the recommendations from a number of bodies for an early trial of an emissions trading scheme.

The key elements of these various arguments are examined below.

Information gathering

Various aspects of greenhouse policy are characterised by considerable uncertainty. It may be possible for well-structured early action policies and programs to start to generate information for both firms and government.

To a degree, the information aspects of early programs are already evident from Australian initiatives such as Greenhouse Challenge. Greenhouse Challenge has, for example, given an impetus for firms to obtain information about their abatement profile and to begin to put together information on their costs of abatement. In our industry discussions there was widespread support for these aspects of Greenhouse Challenge, as well as for the general notion of government providing information and extension support to industries. Clearly, a sensible early action policy is to continue these types of program.

Early action programs have the potential to provide different kinds of information as well. They could be used, for example, to derive economywide information about the marginal costs of abatement and the existence of low cost abatement opportunities. There is currently considerable debate about what the costs of greenhouse policies are likely to be for the

Australian economy. Early action programs provide an opportunity to gather empirical information on these costs.

But information is never free, and it will be particularly important to assess the cost of information gathered from particular early action programs. It may be that additional risk is generated along with additional information.

The 'no disadvantage' principle

The 'no disadvantage' principle simply states that the policies adopted to meet the Kyoto Protocol target should not penalise or disadvantage firms that take abatement actions before the ultimate target period. This includes firms that have acted before today (1999) and those who will act before 2008. The penalty or disadvantage is relative to firms that do not take abatement actions, and relative to the outcomes under alternative policies.

This principle (expressed in a number of ways, but usually in terms of disadvantage relative to firms that do not take abatement action) received unanimous support in industry discussions (it was the only common view). In our view, the principle is fundamentally sound.

At its most basic, this is an issue of good regulatory design: regulations should not indirectly penalise the actions they are trying to encourage. In greenhouse terms, the ultimate regulation should not penalise abatement actions that have already taken place or will occur before the ultimate regulation is put in place. If a policy is to encourage a particular action at a

future point in time, it is counterproductive for the same policy to discourage the action today (or sometime before the ultimate point in time).

Policies send signals; so it would make no sense for those signals to contradict the purposes of the policies. If policies systematically or randomly counter their own objectives they are more likely to fail or to impose higher costs than necessary.

There are two broad ways to satisfy the 'no disadvantage' principle. One is to structure the ultimate regulation so that the disadvantage will not take place, making sure that this is clearly understood before the regulation comes into force. The other is to compensate those disadvantaged after the regulation has been put in place. Under most circumstances, the former is preferable because post-disadvantage compensation is likely to have a credibility problem and will be difficult to structure and implement.

Some early action approaches suggest compensating for the disadvantage before it occurs. There are clearly administrative and policy risks in taking this approach. It seems simpler and more reliable to ensure that the disadvantage never occurs in the first place.

Chapter 5 examines the policies that are 'no disadvantage' compatible.

Currently mixed incentives

While the broad objectives of greenhouse regulation may be clear (reduce greenhouse gas emissions) the details are not. In the period before regulations are introduced incentives may be mixed or positively skewed against the ultimate objectives. Early action policies may be required to correct this unintended consequence.

A clear finding from our industry discussions is that incentives are currently very mixed, and in many cases biased against taking voluntary early action. Firms know that they will probably have to hit some target, but the target is unspecified, as are the instruments by which the target will be achieved. The response to this will depend very much on the circumstances of the individual firm and will depend on factors such as energy intensity, greenhouse gas intensity, the size of the firm and general management attitudes.

Of course, many firms are currently involved in a variety of abatement actions through programs such as Greenhouse Challenge or on their own initiative. The problem arises because these actions are taking place in an environment in which the overall policy incentives are unclear.

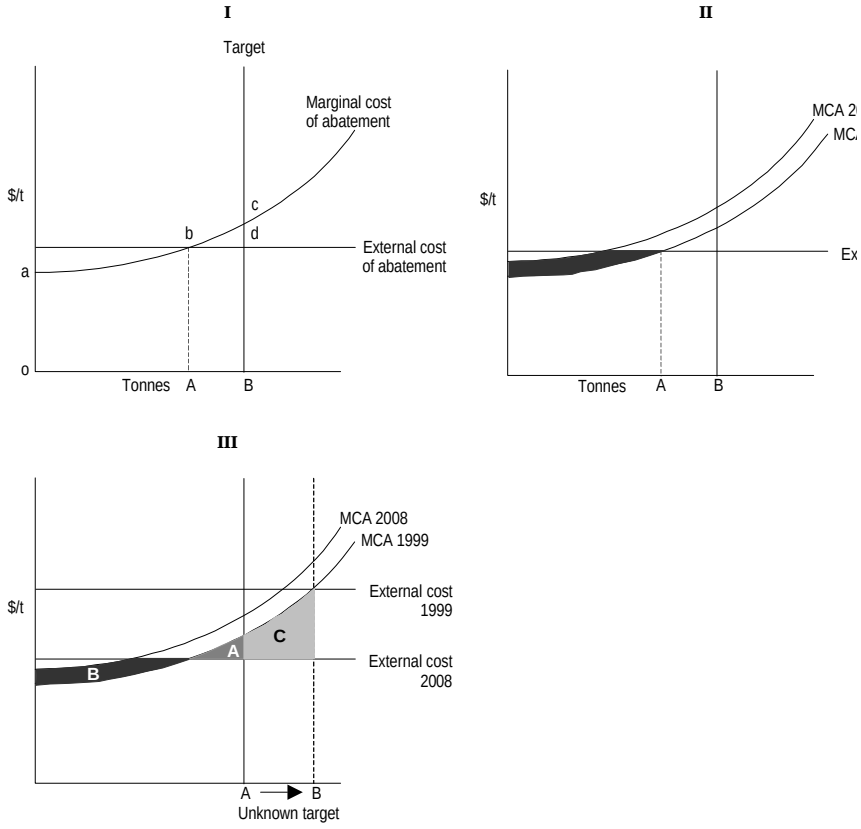
Chart 3.1 illustrates the nature of the incentives currently facing firms. The first panel of the chart shows the basic decision facing the firm that has an overall abatement target of B tonnes. The firm can either abate using internal projects, the cost of which are set out on its marginal cost of abatement curve, or it can abate using external options (such as emission trading, sequestration, etc.). In the example shown, the firm will abate

internally up to A tonnes and will use external abatement for tonnages between A and B. The total cost of abatement is the area *OabA* (cost of internal abatement) plus *AbdB* (the cost of external abatement). The cost saving from using external abatement is *bcd.*

The second panel of chart 3.1 shows the tradeoff between abating today (1999) and abating in 2008. In this case there are two cost of abatement curves, one for 1999 and one for 2008. For illustration we assume that abatement in 2008 is more costly than in 1999 (as argued below, this is not necessarily the case). We also assume that the cost curve in 2008 is expressed in present value terms (discounted to 1999). In this case, with a single external cost curve, it is cheaper for the firm to abate in 1999 than in 2008. The cost saving to abate today is the shaded area between the curves.

But what if the external cost is likely to be different in 1999 and 2008? And what if the abatement target is not known with certainty? This is illustrated in the third panel of chart 3.1. With abatement target A, the choice of whether to abate today or in 2008 involves comparing the shaded areas B and A. In this case, the lower external cost in 2008 does not offset the higher internal cost of abatement, and so the firm would prefer to abate today. If, however, the abatement target is B, the comparison is between the shaded area A plus C and the shaded area B. In this case the firm would be better off abating in 2008.

3.1 **Incentives for early action**



The point of this illustration is that all of the various curves in the charts are uncertain.

- The cost of abatement today may be known to a degree, but is generally not known with certainty throughout the range of abatement requirements.

- Knowledge of the internal cost of abatement in 2008 will vary between industries. It may be known to a degree in industries that make large lumpy investments. In other industries where adjustment can be made at the margin, it is highly uncertain. It may be higher than the cost of abatement today (because of factors such as adjustment costs) or it may be lower because of potential developments in technology. High discount rates may mean that from today's perspective the future cost of abatement is lower than today's.
- The abatement target is not known. Firms are not even sure whether there will be a target at all. How any particular policy will translate into targets for individual firms or sectors is uncertain.
- The external cost of abatement today is also unknown. In the absence of explicit schemes to allow trade in abatement it is presumably considerably higher than it would be otherwise. While some firms are looking to sequestration as a form of external abatement, there is no clear framework for this, making the actual costs of external abatement uncertain.
- The external cost of abatement in 2008 is also highly uncertain. It depends on a range of factors such as the policy framework and ratification of the Kyoto Protocol. Some modelling work suggests that with particular assumptions (including international emissions trading) the external cost to Australian firms in 2008 is likely to be lower than the external cost to Australian firms in the lead-up to the Kyoto Protocol (McKibbin and Wilcoxen 1999). The external cost of abatement in 2008 will also depend on the

actions of other firms taken today, including sequestration actions.

Incentives facing firms are genuinely mixed, and because firms face different circumstances there is a mix of responses. In many cases, risk analysis of costly abatement projects would suggest firms take minimal abatement actions. In others, circumstances suggest that firms take more early abatement. What the discussion shows is that policy makers need to consider ways to send clear signals that consistently work towards the objectives of greenhouse policy.

If firms knew the future price of carbon (and equivalents), the cost of current actions would become much clearer, providing at least positive incentive for early action.

Mixed incentives on sinks

An important aspect of the currently mixed incentives relates to sinks or carbon sequestration through tree planting. Our industry discussions found considerable uncertainty and concern about the implications of such actions. While firms are aware of the possibility that sequestration may contribute to Australia's Kyoto Protocol allocation, they are unsure about the implications for them of any actions they take. First, it was unclear whether and how the credits for such actions would accrue to the firms that planted the trees. Second, it was unclear how sequestration will be treated under international arrangements. Firms were concerned that, rather than giving them a credit, trees planted today could end up being a

greenhouse liability in 2008. Generally, firms were reluctant to engage in significant sequestration activities.

The optimal path argument

The 'optimal' path is the emissions in every year before and after 2008 that minimises the total economic cost of achieving the Kyoto Protocol target. While the target involves some kind of emissions reduction in 2008–12 relative to business as usual, if there are adjustment costs it may be sensible to start to reduce emissions before the commitment period. There is a tradeoff between incurring costs now and incurring costs in the future. The costs may be higher for a tonne of reduction in the future because of the additional cost of having to adjust quickly.

The optimal path argument is the economywide counterpart of the argument about incentives facing firms. Calculating the optimal path for emissions requires knowledge of a number of elements.

- **The end point or target**. The precise abatement target under the Kyoto Protocol is currently unknown, which is one of the reasons why individual firms do not know their abatement targets. It is also unknown whether there will be a legally binding target at all.
- **The cost of abating today**. In principle, individual firms either know, or have the means to discover, their own cost of abatement today. However, there is little knowledge of the cost of abatement opportunities outside firms

(sequestration, for example) as these costs in turn depend on a policy framework.

- **The cost of abating in the future**. The future costs of abating are highly uncertain as they depend on the future policy environment. Under one possibility (full emissions trading under the Kyoto Protocol), costs in the future may be lower than those today. Another possibility is that the cost per tonne will be higher in the future because of adjustment costs. This may be the case even if firms individually consider the costs to be lower in the future – the combined economywide costs of adjustment may be greater than expected by any individual firm.
- **The benefits of abating today rather than in the future**. In principle, earlier abatement brings greater environmental benefits. For Australia's actions alone, however, this difference is likely to be so small as to be negligible.
- **Perception of risk**. Because there is no guarantee that Australia will have an obligation to abate in the future, the optimal path must really be phrased in terms of the 'expected optimal path'. That is, the end point or target needs to be adjusted by the probability of that target coming into force.
- **An appropriate discount rate to compare future with present costs and benefits**. This is a long-standing issue in public policy.

Implications

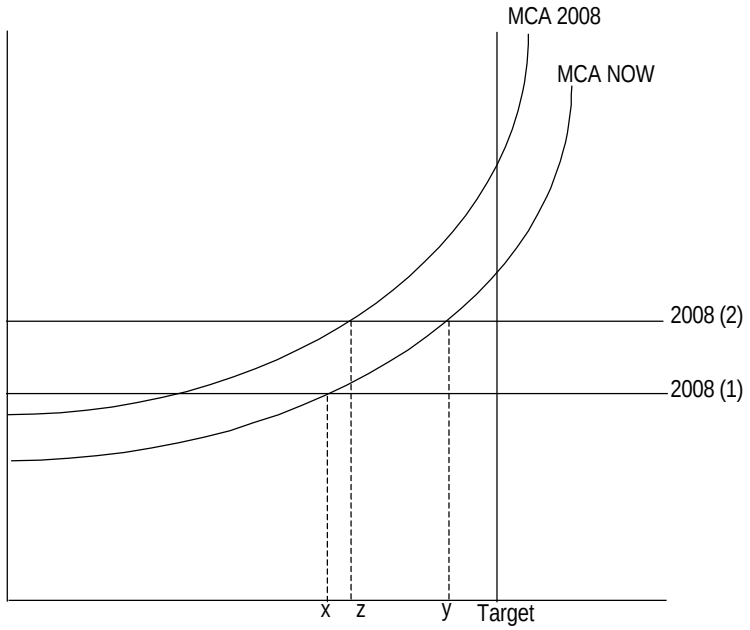
Clearly, the optimal abatement path is impossible to accurately calculate. Thinking about it, however, has two important implications.

First, a detailed risk analysis using information currently available is likely to show that some small amount of early abatement is sensible. [An example of this kind of risk analysis is the approach taken by Nordhaus (1994).] The amount of early abatement will depend on the perceived future adjustment costs and, in the Kyoto Protocol context, on the expected international price of carbon (and equivalents). This is illustrated in chart 3.2. If the expected future price of carbon is the line 2008 (1), then with today's marginal cost of abatement (MCA NOW) it is optimal to abate up to *x* today, and in 2008 meet the remainder of our obligations by buying permits. If the expected price is the line 2008 (2), then it is optimal to abate today up to *y* as waiting until 2008 would involve less abatement (up to *z*) but at higher economywide costs.

Chart 3.2 also illustrates the potential gain from taking a conservative view of the minimum price in 2008, even if the actual price turns out to be higher. Choosing a minimum price of 2008 (1) leads to abatement of *x*. Even if the price turns out to be 2008 (2) (where the optimal abatement would have been to *y*), there is still a net saving from abating today rather than abating in 2008. Of course, if the minimum price is set too high, then it is possible to impose unnecessary costs through too much early abatement. This is why a view on the minimum price needs to be conservative. As long as the cost of abatement

in 2008 is higher than the cost now an expectation of a minimum positive future price will involve lower costs that assuming that the future price is zero.

3.2 **Some early action will be optimal**



The second implication of thinking about the optimal path is a question: will a decentralised market approach provide an optimal path to achieving the Kyoto Protocol target? That is, do individual firms have sufficient information and incentives to lead them to take early abatement actions that will minimise the total cost to the economy?

At the moment the answers to these questions are 'no'. Individual firms do not have consistent incentives to abate, as discussed above, mostly because they do not have sufficient information on which to act. Some of the information required is unavailable because of the nature of the Kyoto Protocol (because, for example, it does not generate any price information). However, other aspects of the information needed could be provided to a degree by the Australian government. In particular, the policy framework for Australian action could be established in a way conducive to early action (see chapter 5). Firms with clear knowledge of policy and government intentions would be in a position to plan their own optimal adjustment paths.

Establishing a policy framework may not be enough in itself, however.

- The government may not be able to signal its policy intent with sufficient credibility, requiring more action than simply setting out the policy framework. Firms may take a bet that the government will change its mind and so not abate (see chapter 5).
- Even if policy is credible and firms are able to choose their own optimal levels of abatement, this will not necessarily generate minimum economywide costs. Imagine, for example, that there is a limited set of 'abatement resources' (highly trained engineers, for example) available at a point in time. Firms will include the costs of these resources in their own calculations but may not account for the fact that if all firms decide to abate in the future the price of these limited resources will increase. (The rapid increase in the

earnings of Y2K compliance experts is an illustration of this.) Individually rational actions may provide an outcome that is more costly than it need be.

- The government may have additional information that it would like reflected in firms' decision making. It then needs to explicitly inject that information in some way – either through particular early action policies or through general information and support measures (chapter 7).

An early emissions trading scheme?

A number of groups (including the House of Representatives Standing Committee, the Productivity Commission and the NSW Cabinet Office) have recommended the introduction of a trial early emissions trading scheme. Two related arguments underlie these recommendations.

- First, emissions trading, especially the aspects related to sequestration, is complicated and an early scheme will allow learning by doing for both firms and government. An early scheme will allow unexpected technical and policy difficulties to be ironed out before an actual scheme is implemented.
- Second, if emission trading is a major international policy instrument under the Kyoto Protocol, it will be to Australia's advantage to sort out the various issues in advance of a scheme being adopted internationally. Experience in trading may give Australian firms an edge in international trades, and government regulatory experience may provide the opportunity for Australia to determine the

structure of international trading to the country's advantage.

These arguments alone are not entirely convincing as they leave several questions unanswered. Will emissions trading be the key Australian policy instrument for meeting the Kyoto Protocol target? Will the Australian government pass on its rights to trade as a party to the Kyoto Protocol to Australian firms? The answers to these two questions will determine whether it is sensible to have an emissions trading trial.

Once these questions are answered, there are some important additional questions to be addressed.

- What incentives will firms have to participate in a voluntary scheme? Should additional incentives be provided by combining voluntary trading with carbon taxes, or should the trading scheme be compulsory?
- What exactly is it that firms will 'learn by doing' from a voluntary scheme? Are these lessons best delivered through voluntary trading or through some other information and support schemes?
- What is the likelihood of Australian experience influencing the shape of an international scheme, especially given European opposition to a broad based scheme?

Arguments put in industry discussions

We have already alluded to a number of arguments put to us in industry discussions. It is worthwhile, however, summarising a few additional points.

- The overall theme of most of the discussions was uncertainty: about the Kyoto Protocol and about the Australian government response to the Protocol. As noted, in the presence of this uncertainty, the current policy environment makes early action unnecessarily risky.
- With this uncertainty, firms were becoming increasingly unsure about the voluntary schemes they have been involved in, such as Greenhouse Challenge. While generally supporting Greenhouse Challenge, they were concerned about the implications of their continued involvement. Put another way, firms said that, for them to undertake further abatement, they require 'something' extra. For some, this 'something' is an explicit and well-defined credit for action. For others, it is policy clarity that generates information on opportunity cost.
- Some firms were concerned that the notion of early action – and in particular early credits – was subject to question at all. They had believed that credits for actions they had already undertaken were already secure.
- In the discussions, views about early action were inevitably mixed with views about the ultimate form that Kyoto Protocol policy should take. Some explicitly rejected emissions trading; others supported it under certain conditions. For some, early action was linked to allocations

under emissions trading; for others the two issues were distinct.

These points indicate a general recognition of the need for some policy response to early action. However, there was no common agreement on what form this should take.

4
Some early action approaches

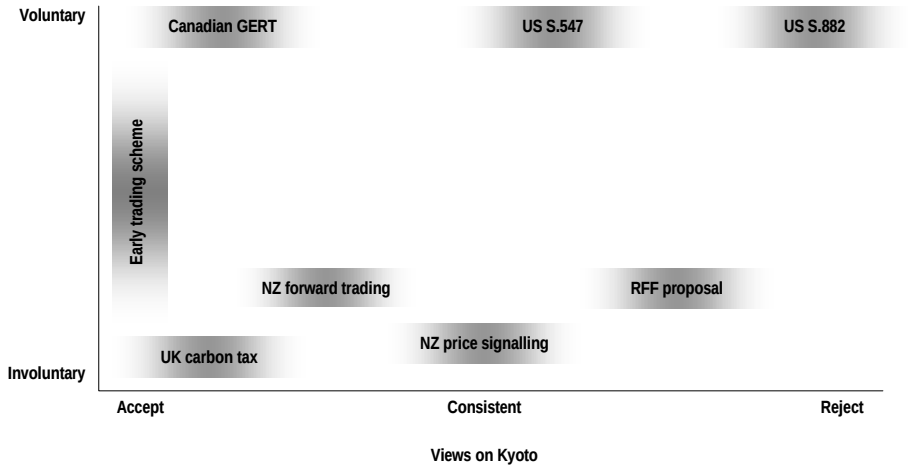
EARLY ACTION PROPOSALS AND APPROACHES reflect a range of possibilities. Table 4.1 summarises some of the proposals and chart 4.2 puts them in a spectrum.

4.1 Early action schemes

Country	*Key features*
United States: Senate Bill 547	Authorises President to make agreements for formal credits with US firms. Credits are tonne for tonne against any future compulsory regulation in the United States. Includes credits for sinks and for CDM activities. Mostly a prospective scheme but does contain provision for retrospective credits. Early credits can be traded. Bill currently receiving both support (from Environmental Defense Fund, for example) and criticism (from Resources for the Future, and groups such as the Small Business Survival Committee).
United States: Resources for the Future (RFF) proposal	Proposal for an early compulsory domestic trading scheme to start in 2002. Scheme to be administered upstream, with market signals providing incentives downstream. Ceiling price on permits (US$25/ton carbon), with government providing unlimited additional permits when price hits this level. Permit tradable but to expire after 2 years (after 1 year in the case of ceiling price permits). All permits to be auctioned and revenues returned to households. This proposal is similar to a price capped trading scheme set out by McKibbin and Wilcoxen (1997) and proposed by McKibbin (1998) as an early action policy for Australia.
United States: Senate Bill 882	Called the Energy and Climate Policy Act of 1999, this bill explicitly rejects the Kyoto Protocol. It proposes funding for research and development. It also intends to promote voluntary emission reductions and the Senators proposing the bill suggest further adjustments to 'remove regulatory obstacles that stand in the way of voluntary greenhouse gas emissions reductions'.

Country	*Key features*
Canada: GERT scheme	Essentially an early voluntary trading scheme. Prospective buyers and sellers are brought together and the proposals are verified before being approved. Carbon credits traded have no legal status.
United Kingdom: Energy tax	New tax on the business use of energy to be imposed from April 2001. Tax to be fiscally neutral. Energy intensive industry sectors could get discounts if they set targets for improving efficiency.
New Zealand: Options paper	A paper published in early 1999 set out three options for early action price signalling measures. Option 1: Enhancing awareness of trading and facilitating forward trading. Government to announce details of long term policy package including which emitters have an obligation to hold permits and timing and method of allocation of permits. Forward trades allowed, but no mandatory requirement to reduce emissions before 2008. Option 2: Pilot emissions trading and low level carbon charge before a comprehensive domestic emissions trading program. Involves a hybrid of pilot emissions trading for some emitters and low level carbon charge for the other emitters. Participants of trading would have caps (but would be exempt from carbon charge) and could earn credit for actions that reduced emissions beyond the cap. Package could be implemented around 2000. Option 3: Low level carbon charge before comprehensive domestic emissions trading program. The carbon charge would be introduced while work progressed on the design and implementation of a comprehensive domestic trading scheme. Charge to be set at the expected present value of international price during the commitment period.
Denmark	Proposal for new system of tradable carbon dioxide emission quotas in the energy sector. Each company to be allocated a quota and charged US$5.90 for each tonne of emissions exceeding the quota. Quotas may be banked.

4.2 **The spectrum of early action approaches**



United States Senate Bill 547

This Credit for Early Reductions Act provides credits to firms against unspecified future compulsory abatement policies (while some have interpreted the bill as providing credit against only emissions trading, this is not strictly correct). The bill generates a credit without the government clearly identifying:

- whether there is a need for future compulsory (regulatory) action; or
- what the nature of the future regulation will be.

The argument underlying the bill is that, because of the nature of greenhouse and the potential magnitude of adjustments under the Kyoto Protocol, it is important to start abatement

now. However, firms need to be given an incentive to abate. So this bill offers them a potential asset in exchange for abatement.

The debate on the bill has pointed out a number of problems with it, both in principle and in practice.

- It is not clear to what extent this kind of credit will change behaviour. It contains no price information, so firms' opportunity costs are not defined. Firms must still make a judgment about the likelihood of the Kyoto Protocol (or other regulations) coming into force and the potential external cost of abatement – the credit is against only *potential* regulation. The bill does, however, allow for trading of early credits. To the extent that trades take place, the bill will provide some information about prices.
- The bill contains an internal contradiction. The credit is valuable only if there is future regulation. If a large number of firms take up voluntary abatement (that is, if the bill is successful in its own terms) it is possible that future compulsory action will not be needed and the credits will be worthless. The bill can be successful only if it fails. Put another way, the bill creates a constituency for a particular kind of future regulation, creating the possibility of perverse incentives in the future.
- The legal instruments for the bill are ambiguous, so it generates an unknown liability for future government.
- As the bill is based on agreements (most likely confidential) between the President and individual corporations, its operations are unlikely to ever be transparent. Small

business groups have pointed out that the proposal is likely to disadvantage them.

- Under the Kyoto Protocol (apart from sinks and CDM) early credits must be taken off the 2008–12 allocation. This means that largely the bill is a zero sum game. Proponents of the bill downplay the size of this problem. But the problem must be as large as the bill is successful. The more firms that take up early action, the more credits must be reallocated, passing higher costs on firms that do not abate. This problem can be mitigated if emission reductions are permanent, but at the limit it means that *all* abatement is done before 2008.
- Further, the need for a cap on early credits in the context of the Kyoto Protocol means that firms have no guarantee that they will receive the credits that they planned on when undertaking abatement. If, for example, there are 100 credits available and 10 firms plan on abatement actions that require 20 credits each, and if each firm satisfies the conditions for the credit, then they can get only 10 credits each. This means that when firms are planning their own abatement they must take into account the abatement of other firms, which will ultimately determine how many credits they can get. The fact that firms must think strategically in this way is a major drawback of the approach.
- This approach also creates incentives for the firms with the easiest abatement options to claim credits, while firms with significant adjustment costs will be unable to do so. That is, the approach contains incentives contrary to its own intent.

- There is a risk, therefore, of distributing too many credits for questionable early reductions. Reducing this risk would involve carefully evaluating each project, a process that is likely to be very costly.

Proponents of the bill tend to focus on the nature of the 'signal' it sends to firms. By offering a credit, the bill does send a signal, but in the light of the above problems the signal is decidedly mixed. It is interesting to note that the same signal could be sent to firms by directly signalling the future price of carbon rather than trying to indirectly do so through a quantity measure. The price signalling approach would avoid the mixed incentives provided by the credit approach. Appendix A presents a simple model illustrating why this is the case.

In our assessment, this approach would be very risky in the Australian context. Establishing a credit of unclear legal status against unknown future policies in a way that is largely zero sum does not seem to go far towards resolving the fundamental uncertainties surrounding greenhouse policy.

However, the aspect of the legislation that gives firms the credits for actions they take that increase the nation's Kyoto Protocol allocation (sequestration and CDM) does have merit. But a credit mechanism alone is probably not sufficient to encourage these activities in the national interest.

Resources for the Future and McKibbin & Wilcoxen

Both Resources for the Future (see Kopp et al. 1999) and McKibbin and Wilcoxen (1997) have proposed price capped emissions trading schemes. McKibbin (1998) proposed this scheme as an early action option for Australia. While the details of the two schemes are different, the fundamental principles are the same – price certainty is generated by capping the price. In their early action context, both schemes are compulsory.

The key to these schemes is recognition of the costs of price uncertainty under Kyoto Protocol style permit trading. Rather than allowing trading to establish the permit price, under these schemes the government sets a fixed maximum price. Market trading then determines where abatement occurs, but at a fixed known cost (McKibbin and Wilcoxen suggest US$10 per ton of carbon; Kopp et al. suggest $25).

This approach creates well-defined opportunity costs for abatement actions (the fixed price of a permit). Firms that need to increase emissions (above some base level) face a clear price of doing so. As with other permit trading, permits could initially be allocated in a number of ways, but in this case the price of permits does not depend on the initial allocation.

While these schemes constitute 'involuntary' early action, in our assessment they are worth considering in the Australian context under the circumstances further set out in chapter 7.

United States Senate Bill 882

This Energy and Climate Policy Act of 1999 (along with its reading speeches) is notable for its blunt rejection of the Kyoto Protocol. It also rejects Senate Bill 547.

The bill proposes increased funding for research and development into technologies that will stabilise greenhouse gas concentration in the atmosphere.

The bill also proposes to establish a program of annual public recognition of entities that reduce or avoid emissions. Under this program, reductions are carefully monitored and verified. Presumably this public recognition is designed to encourage additional abatement. It may also help in establishing 'green' capital markets (ethical investment funds and so on). Firms that act in a verified environmentally friendly way may be able to attract additional investment funds. To the extent that ethical investments demand a lower return, these funds may have a lower cost than alternative sources.

The reading speeches for the bill also foreshadow potential adjustments to the tax code to favour greenhouse abatement projects. This may mean, for example, income tax offsets for expenditure on projects that involve greenhouse abatement.

Aside from the explicit rejection of the Kyoto Protocol, aspects of this bill do constitute potential early action alternatives for Australia. In particular, facilitating greenhouse research and green capital markets, as well as tax adjustments, could be given consideration.

UK and New Zealand taxes as early action

The United Kingdom has announced, and New Zealand is considering, carbon taxes or charges as key policies in the lead-up to implementation of the Kyoto Protocol.

For New Zealand, this is in the context of having announced the dominant policy response to the Kyoto Protocol – emissions trading. While the details have yet to be determined, the early charge is designed to smooth the path into emission trading by providing a clear signal to firms in the short term.

In the United Kingdom, the introduction of the tax stems from a report by Lord Marshall who, while recognising the benefits of international emissions trading and the potential benefits of an early trading scheme in that country, saw three advantages in introducing a tax in the short term.

- Taxes work through the price mechanism, allowing individual businesses to determine their appropriate responses.
- Taxes send a signal and will influence investment patterns well ahead of potential commitments under the Kyoto Protocol.
- Taxes could help to improve efficiency of small and medium sized enterprises including non-energy-intensive firms, some of which may never participate in international emissions trading.

A carbon tax or charge is an early action option for Australia. While not a 'voluntary' measure, in the context of uncertainty

and the need to provide clear, credible signals, taxes have advantages.

New Zealand forward trading

The New Zealand options paper (New Zealand Ministry for the Environment 1999) includes the possibility of the government facilitating forward trading in emission permits. This would take place in the context of a well-defined trading scheme with initial allocation of emissions already determined. Firms could then forward trade emission permits before these permits were binding. This would provide information about the future price of abatement.

This option clearly requires the establishment of the overall framework for achieving the Kyoto Protocol target. It is a possibility in the Australian context, but is not a 'stand alone' early action possibility.

5
Early action properties of greenhouse policies

THE DISINCENTIVES FOR EARLY ACTION arise from the uncertainty about the ultimate Kyoto Protocol response policies, but also potentially from the nature of those policies. This chapter examines what it is about Kyoto Protocol policies that makes them friendly or unfriendly to early action. A key finding is that policies based on pure price mechanisms are generally early action friendly, while those based on quantities in a particular year can be early action unfriendly.

Relevant features of key policies

Kyoto Protocol policies such as emissions trading have a number of dimensions or parameters that need to be determined before the policies are set in place. It is important to clearly identify the parameters of policies that are relevant to early action.

Emissions trading

Discussions of emissions trading have identified a number of key policy parameters, including:

- the overall structure of the scheme – baseline and credit versus cap and trade;
- the nature of the permit;
- the initial allocation of permits (will these be allocated by administrative means or by market mechanism such as auctions and, if permits are auctioned, how will the revenue be used?); and
- the coverage (what sectors will be included in the scheme and will the scheme be implemented upstream or downstream?).

The structure of the scheme

There are a number of ways that permit trading schemes have been structured in a variety of circumstances. A broad distinction is made between 'baseline and credit' schemes and 'cap and trade' schemes.

Under baseline and credit schemes, each participant is given a baseline profile of emissions. Where emissions are lower than the baseline profile, the firm receives a credit that it can trade. If emissions are higher than the baseline profile, the firm must purchase credits (from firms with a surplus) to cover the difference. The initial allocation of permits is implicit in the

structuring of the baseline for each firm. Essentially, the initial allocation is determined by administrative means.

Under cap and trade schemes, the total supply of permits is capped. Participants must buy permits to cover their own emissions. Permits can be initially allocated by a variety of means (see below).

A fundamental difference between the two approaches is the way in which an overall emission target can be imposed. It is considerably more difficult to target emissions under baseline and credit schemes than under cap and trade schemes. The Kyoto Protocol as it stands effectively mandates a cap and trade approach.

Another key difference between the approaches is the administrative burden involved. Baseline and credit schemes require the establishment of a baseline for all participants and constant monitoring of the system against that baseline. Cap and trade schemes require an initial allocation of permits, followed by accounting for emissions at the end of each period.

The structure of a scheme is relevant to early action in the following ways.

- Perceptions of how stringent or targeted the scheme will be – other factors constant – will influence incentives to abate early. This is closely related to the idea of a shortage of permits examined below.
- The broad structure of a scheme influences the way in which any overall emissions constraint is transmitted to

firms. In baseline and credit schemes, this is done largely through the way that the baseline is defined. Under cap and trade schemes it is done through the size of the cap and the subsequent transmission of prices. Under baseline and credit schemes, firms may believe that there is considerable scope to negotiate a 'favourable' baseline without hitting an overall constraint on emissions. Under cap and trade schemes, a favourable baseline for one firm means a less favourable baseline for another. The overall constraint is much more transparent, sending a stronger signal to firms.

The nature of the permit

The 'permit' to emit can potentially be defined in a number of ways. At the least the permit must have a unit and temporal and emission dimension. Under international trading, the unit is one tonne of carbon dioxide equivalent emissions. Potentially, the permit could last for one year or for the five years of the first commitment period. Under domestic trading these dimensions could be defined in a number of ways. The permit may also have other constraints on it (the Australian government may allow trading in only particular ways, for example).

However, what is crucial for early action is the fact that however defined, with permit trading under the Kyoto Protocol there must be a *shortage* of permits. That is, there must be insufficient permits for all firms (and others covered in the scheme) to continue emitting in the same way after the scheme is introduced as they were before the scheme was introduced.

The shortage of permits and the subsequent positive price is the fundamental mechanism by which an incentive to abate is transmitted throughout an emissions trading scheme. What creates incentive for early action is the recognition that permits will command a positive (and possibly large price) and that in one way or another permit trading will impose costs on the emitting firms that can be minimised by abating.

Initial allocation of permits

Under cap and trade schemes, permits can be initially allocated in a number of ways including auctioning and various forms of grandfathering. Permits can be grandfathered around a point in the past or a point in the future. They can also be conditionally grandfathered according to efficiency or other criteria.

The initial allocation of permits has a major influence on incentives for early action, imposing constraints on any emissions trading scheme if it is to be early action friendly. This is examined in more detail below.

If permits are auctioned, the expected use of auction revenue may also influence early action. A scheme that uses auction revenue to offset capital costs of abatement, for example, may encourage early action (although such a scheme suffers from some of the same problems as early credits in general). Alternatively, auction revenue could be used to offset other distorting taxation, which will itself influence firms' activities and could have a positive or a negative effect on emissions.

Coverage

The coverage of the scheme will determine who, in the first instance, has an incentive to begin abatement before the scheme is put in place. For example, if the scheme covers electricity producers, these producers can expect an increase in the price of emissions in the future and so will have an incentive to start abating before the scheme comes into place. However, producers and consumers further down the production chain will have less incentive to abate *before* the scheme comes into place because the expected price signal is more diffuse. Once the scheme is in place and once prices start increasing, price signals will move up and down the chain appropriately – this is why it is possible in principle to implement emissions trading upstream. But before the scheme starts, those not directly covered will have little incentive to abate. This result is a property of emissions trading because prices are not known until trading starts.

In a cap and trade scheme, coverage is also relevant to the size of the cap. If, for example, energy were the only sector covered by the scheme and there were no other abatement policies in place, the cap on the energy sector would be tighter than if, for example, the scheme included energy and agriculture. Expectations about the coverage of the scheme may also affect incentives for early action. In this example, agricultural producers with no expectation of being included in the scheme would have no incentive to begin abating.

The coverage issue also applies to the inclusion of activities that qualify as abatement. An emissions trading scheme could include or exclude sinks, for example. The coverage of activities clearly sends a signal to those in a position to undertake the activities. In the case of sinks, not only does the coverage need to be clarified, so do the rules by which sinks are to be traded.

Emissions taxation

An alternative to emissions trading as a Kyoto policy is the direct taxation of emissions. In this case, the coverage of the tax and the rate of the tax are important for providing incentives for early action.

Coverage

A tax provides direct early incentives for abatement by those initially bearing the burden of the tax. The broader the coverage, the greater the incentives for early abatement. As in the case of emissions trading, for those not directly covered (those further down the production chain), the signal for early action is diffused.

Tax rate

The higher the tax rate expected in the future, the greater the incentive for early abatement to avoid the tax.

Mandatory targets and other measures

A range of mandatory and other administrative measures could be used to achieve the Kyoto Protocol target. The early action properties of these measures depend largely on the particulars of the measure. In general, if the price of the measure is implicit or hidden, the incentives for early action will be weaker than when the price effect of the measure is explicit.

In principle, mandatory measures could be structured badly in many ways. For example, an efficiency target announced today, but based on what efficiency will be in 2005, creates an incentive to become inefficient up to 2005. Of course, other factors are likely to ensure that firms do not actually become less efficient, but the policy itself creates incentives contrary to its intent.

Making policies early action friendly

Early action friendly policies are those Kyoto Protocol response policies that create an incentive to reduce emissions at all points in time in the lead-up to the introduction or implementation of the policy (probably around 2008). Early action friendly policies are also those that satisfy the 'no disadvantage' principle discussed in chapter 3.

A simple example of this is a carbon (or carbon equivalent) tax or charge to be introduced in 2008. If the tax is announced in advance, firms have incentive to minimise their emissions in

advance of the introduction of the tax. How much they abate will depend on a number of factors (including the marginal cost of abatement relative to the tax and the firm's discount rate), but the tax itself will not penalise early action. The tax actually encourages early action, because the more a firm abates in the lead-up to the tax, the less tax the firm pays. In effect, the tax contains its own credit mechanism; each tonne of abatement today saves the firm a tonne of taxation in the future.

This is not true for all greenhouse policies, as illustrated in chart 5.1. Emissions trading with grandfathering taking place in some year after 1990 will, for example, penalise early action taken since 1990. In general, grandfathering at time *t* after abatement started at time *t-n* will penalise action before *t*. In this case firms have an incentive to increase emissions up to the time of grandfathering and then to reduce them after that. Of course, many other factors will determine firms' actual emissions, but in this case the policy gives an incentive to increase them. Grandfathering before *t*, at *t-n*, however, creates an incentive to abate at all points in time. This form of grandfathering also contains an implicit credit mechanism – any early abatement reduces the need for the use of the grandfathered permit and leaves it available for sale in the permit market.

Emissions trading with auctions of permits is also early action friendly. The more abatement before the auction point, the less need there is to purchase permits.

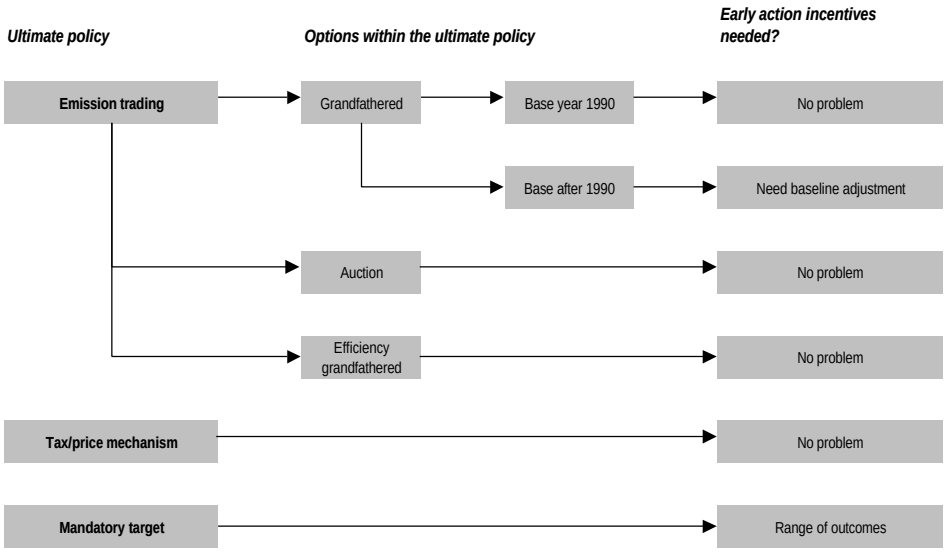
Grandfathering based on an efficiency criteria where firms are allocated permits based on what their emissions would be if

they were operating at benchmark efficiency is also early action friendly (as long as the benchmark is in the past). The more efficient the firm (in terms of emissions per unit of output) the more valuable the grandfathered allocation.

Making policies credible

Implicit in chart 5.1 is the idea that early action incentives also depend on the credibility of the announced policy. Credibility can be interpreted in a number of ways, but in this context it can be seen as the tendency for firms to bet that the policy will

5.1 **Early action compatibility of ultimate policies**



not eventuate. If, for example, government announces a future carbon tax, some firms may give the ultimate tax a probability of 1 and respond accordingly. Other firms may assign a probability of 0.5, essentially discounting the value of abatement actions by half because they are not convinced that the policy will eventuate.

In the greenhouse context, firms have many reasons to assign a low probability to an announced policy. They may expect to be able exert political influence or obtain special exemptions before the policy is implemented, or they may believe that the basis of the policy will change.[1]

The early action that emerges from announced policy will depend on the likelihood assessments made by various firms. It may be appropriate to accept these assessments and allow early action to emerge. In this case, there is a risk that little early action will emerge.

If, however, the government wants to ensure that firms do not discount the likelihood of the policies being implemented and consequently do not discount early action, then the future policy must be brought forward. This means phasing in a tax or interim targets (caps) in the case of emission trading.

[1] Most firms accept that there will be some form of international action on greenhouse. Some accept the underlying framework of the Kyoto Protocol. But in each case there is sufficient uncertainty about the form of action for a variety of subjective assessments to emerge. As noted in chapter 2, expectations about the basis of policy will have a significant influence on early action.

There are, of course, tradeoffs involved in bringing announced policies forward. For those firms that accepted the credibility of the announced policy, the early tax or interim target represents an additional burden – rather than helping them adjust, it may hinder them. This suggests that caution is needed in setting early rates or targets. In general early tax rates should be low and interim targets should be relatively easy to meet. Even a low tax may send a sufficient signal to establish credibility of policy.

Another option for achieving some credibility is to establish forward markets that relate to the appropriate policy – forward markets for emission permits, for example. In this case firms could buy or trade permits before the actual regulation commences. The emergence of credits in a market would signal some policy credibility as well as give firms information about the cost of abatement in the future.

Establishing a forward market (or allowing one to emerge) requires setting out details of how the trading scheme will work. The incentives created by forward trading would be limited by the extent to which the emerging permit price was discounted by the uncertainty surrounding the ultimate policy. That is, because firms are not convinced that the Kyoto Protocol will come into force, they would be prepared to pay less for a permit in a forward trade than they would if they were certain that the Protocol will come into force.

6 *Policy lessons, objectives and constraints*

Lessons for policy

The discussion in the previous chapters indicates that there is a broad range of early action policies that could be adopted. It also illustrates some fundamental constraints and issues associated with these possibilities. Following are some broad lessons for policy.

- A fundamental requirement of greenhouse abatement policies in general (and the Kyoto Protocol in particular) is that, for abatement to take place, the price of carbon dioxide (and equivalent) emissions must increase. While some policies may hide the nature of this price increase, it must nevertheless be present. Current policies do not send clear price signals to firms to indicate the appropriate amount of early abatement. In the absence of these price signals, there is no mechanism to inform firms about the magnitude of the abatement task. Further, without price signals, firms have no basis on which to evaluate early abatement actions.
- Early action policies that generate information about prices are most likely to result in minimum-cost early abatement

action. This information about price is not free, however. If signals about price are sent out before Australia's abatement obligations are resolved, there is a risk of encouraging early action at too high a cost.

- Put another way, early action policies need to generate information about the opportunity cost of abatement. Without this information there can be no assurance that any abatement will take place or that it will take place in the national interest.
- While some level of early abatement is likely to be optimal, the policy challenge is to harness the dispersed knowledge of firms in achieving this.
- Because of some early action tradeoffs, there is unlikely to be a single best policy approach to early action. The best that the government can do is resolve the uncertainty surrounding its own actions and then ensure that in general incentives for abatement all point in the same direction.
- Policies that implement the 'no disadvantage' principle – that do not indirectly penalise early action – will generate incentives consistently in the same direction at all points in time during the lead-up to the implementation of the Kyoto Protocol. As discussed in chapter 5, such policies include emissions trading schemes in which permits are initially auctioned as well as carbon taxes.
- Policies that give credits for early action from the Kyoto Protocol pool without resolving the no disadvantage issue, without providing additional price information or without giving firms reasons to change their subjective evaluations

of the likelihood of the Protocol coming into force will create highly mixed incentives. There are four broad reasons for this.

– First, such schemes provide an incentive to undertake the lowest cost abatement actions first, rather than the abatement that involves significant capital costs and a timeframe that merges into the first commitment period. It is this latter type of abatement that early action should ideally target because it is this type of abatement that involves the adjustment costs that early action policies try to minimise. This problem could be partly resolved by administrative means, but this is likely to be costly and non-transparent.

– Second, the Kyoto Protocol cap that must be placed on early credits creates strategic interactions between firms. Firms have no guarantee of receiving the full number of credits that they planned on when evaluating their abatement action. This means that they must account for not only their own actions, but also those of other firms.

– Third, the early allocation of Kyoto Protocol credits is a zero sum game – credits allocated early are not available for allocation by the government in the first commitment period. This passes higher costs onto firms with the higher costs of adjustment to start with. This may result in higher adjustment costs in the first commitment period than would otherwise have been the case – contrary to the intent of early action policies.

  - Fourth, early credits are valuable only if the Kyoto Protocol comes into force. Firms will therefore assess the value of the early credits using the same subjective probabilities that they used to evaluate the Kyoto Protocol. The credit does not then provide significant additional information or incentives.

- An alternative to these early credit schemes is to directly influence expectations about future prices. At a minimum this provides the same incentives as early credits are designed (but fail) to achieve, but it is also likely to provide better incentives (see appendix A).
- While the Kyoto Protocol involves a quantity constraint on Australian emissions, it will not necessarily be optimal to use early action policies to target the Protocol quantity. First, it is uncertain what the actual quantity will turn out to be. Second, there is no guarantee that Australia will have an international obligation. The optimal early abatement will be something lower than the optimal path to the Kyoto Protocol if it were certain. In price terms, this is the same as saying that the optimal early price signal is not necessarily the full price that would emerge under the Kyoto Protocol, but something less than that.

Retrospective or prospective

There is an important distinction between retrospective and prospective early action policies. Retrospective policies seek to

respond to abatement actions that firms have already taken. Prospective policies seek to encourage action in the future.

Much of the concern about early action expressed in industry discussions was to do with retrospective credits – some firms wanted or expected credits for actions they had already taken. The treatment of retrospective credits has important implications for expectations about future policy. The magnitude of the retrospective issue depends on the nature of the Kyoto Protocol policies ultimately adopted. As chapter 5 noted, some policies will automatically ensure that actions already taken will not be penalised.

It is important, therefore, that Kyoto Protocol policies are established in an early action friendly way, as discussed further in chapter 7.

Policy objectives and constraints

Key objectives

As noted in the introduction, we assume that the objective of policy in the lead-up to the Kyoto Protocol, and once the Protocol is implemented, is to achieve the protocol target at minimum economic cost. Given the decision making under uncertainty framework, however, this objective should be expressed as achieving the *expected* protocol target at minimum *expected* economic cost.

Key constraints

The discussion in previous chapters and the discussion above on policy lessons suggest that this objective must be met within some key constraints. These constraints apply both to early action policies and to the ultimate Kyoto Protocol response policies. They are as follows.

- **The 'no disadvantage' principle**. Policies must observe this principle (and must be known to observe this principle) to ensure that incentives to abate are consistent over time.
- **Generate price information**. Policies must generate price information, or information on the opportunity cost of abatement, to the maximum extent possible.
- **Minimise uncertainty**. Policies must be structured to minimise uncertainty and to generally eliminate uncertainty within the control of the Australian government.

7
Policy pathways to a Kyoto response

THE APPROPRIATE EARLY ACTION RESPONSE depends on the ultimate policies put in place. There are a number of options. This chapter sets out and evaluates the pathways in terms of those ultimate policies.

Three levels of early action policy response

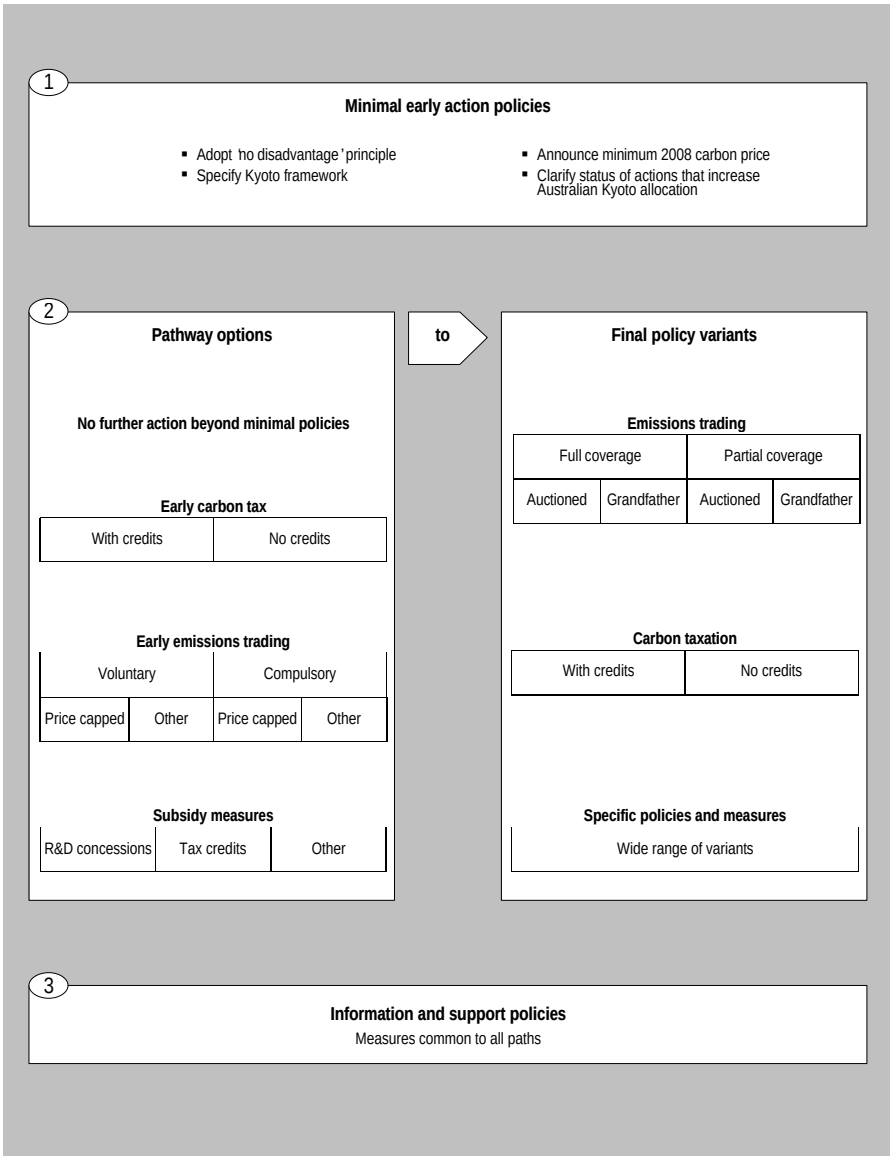
Chart 7.1 sets out three distinct levels of early action policies. The first level refers to a set of minimal policy actions – things that can and should be established almost immediately, regardless of what the ultimate policy or pathway is.

The second level refers to potential policy pathways to a variety of ultimate policy options. The ultimate policies include emissions trading, carbon taxation and broad measures. The pathways to get to these ultimate policies include no further action, early tax and early trading.

The second level of policy response involves additional action on top of the minimal actions established at the first level and potentially involves early compulsory action. The justification for the compulsory policies in the second level is different from the justification for policies at the first level. They are essentially based on 'early action externalities', where the government considers that early action must be explicitly brought about because of a particular market failure not addressed by the minimal early action policies.

The third level of early action response refers to a variety of support and information policies. Many of these can proceed independently of either of the other two levels of policy action, but will also be conditioned by them.

7.1 Three levels of early policy response



Level 1: minimal early action policies

Minimal early action policies are a significant step to resolving the mixed incentives covering early actions.

Establish the 'no disadvantage' principle

Establishing the 'no disadvantage' principle resolves many of the concerns expressed in industry discussions. It will, for example, ensure that firms are not indirectly penalised for the actions that they have taken to date.

It should be noted, however, that this principle will not resolve all of the 'competitive' concerns expressed by firms. It does not resolve the fact that emitting firms who compete with developing country producers will be at a disadvantage if the Kyoto Protocol is implemented. This disadvantage is an inevitable result of the Protocol itself and is not the result of early action per se.

Announce a minimum carbon price

A policy that directly sends a signal about the future minimum price of carbon (and equivalents) involves the government guaranteeing that, regardless of policy settings, the minimum future price of carbon (and equivalents) in 2008, for example, will be $X per tonne. The arguments for such an announcement follow.

- A key constraint to early action is uncertainty about opportunity costs. Announcing a minimum price begins the establishment of an opportunity cost of actions, but is in itself a minimal approach.
- A minimum price has the same incentive effects as intended, but not actually achieved, by various early credit schemes. As appendix A illustrates, it achieves early abatement more efficiently than early quantity credit schemes.
- The minimum price can be used to adjust expectations under a variety of possible states of the world. It allows the government to send a signal that, even if the Kyoto Protocol fails, there is still likely to be some international obligation to abate in the future.

Of course, firms may still take a bet that the minimum price will not eventuate, but at least it becomes clear what they are taking a bet against.

The choice of the minimum price is clearly a fundamental issue. We suggest that it be set lower than the minimum credible estimate of the price of emissions under full Kyoto Protocol emissions trading.

Specify details of the Australian Kyoto policy framework

The Kyoto Protocol policy framework is the policy approach that the Australian government intends to take to achieve the

Protocol objectives. It may involve, for example, announcing that the policy instrument will be emissions trading, and setting out the important parameters of emissions trading.

This step also involves clarifying whether there will be compulsory measures to achieve the Kyoto Protocol target and, if so, setting out the nature of these measures.

Clarify status of actions that increase Australia's Kyoto allocation

One form of early credit that should be established is credits to firms for actions that increase Australia's allocation under the Kyoto Protocol. For example, it should be made clear that credits for sequestration activities that increase Australia's Kyoto Protocol allocation should go to the firm that undertook the sequestration. To some extent, this may be implicit in current thinking, but it is important to make it explicit.

Of course, this step alone will not reduce the uncertainty around sequestration that arises from Kyoto Protocol itself. Much of this is beyond Australia's control, but needs to be resolved through ongoing negotiations. Information support on this issue should form part of the level 3 options.

Level 2: early pathway options

Rationale

While the minimal policy actions are likely to have a significant effect, it may be important to further plan the paths into the ultimate policy in order to address 'early action externalities'. These externalities relate to the factors set out in chapter 2 that mean that firms' optimal decisions under uncertainty are not the same as the economywide decision under uncertainty. These factors include the following.

- **Discount rate**. Firms may have a higher discount rate than appropriate because of the nature of the environmental concerns underlying the Kyoto Protocol. Early policies, by bringing action forward, can offset this effect.
- **Divergent expectations**. Firms' expectations and government expectations about the likelihood of the Kyoto Protocol coming into force may be quite different. If the government has extra or more reliable information, then it can impose its expectations on firms through early action.
- **Congestion costs**. If all firms abate at the last minute, there may be economywide 'congestion' costs that do not feature in firms' individual decisions. Early action can generate information about these costs.

Put another way, proceeding with an early action pathway – particularly early compulsory options – requires that the government is explicit about which of the above conditions

hold. Note that the last two of these conditions imply that the government has information not available to firms. If this is the case, then the first best policy is to pass this information on – perhaps through the information and support policies set out in level 3 below.

In what follows, we consider each of the early pathways in turn.

Early carbon tax

Basic parameters

The option of introducing an early carbon tax can be used either as a prelude to an ultimate Kyoto Protocol tax scheme or as a lead into a Protocol emissions trading scheme. As a lead into to a tax scheme, the early tax could be used to 'calibrate' the magnitude of the tax necessary to achieve particular abatement targets. Because an ultimate tax approach to the Kyoto Protocol cannot guarantee to hit a particular target, experience with an early tax could assist in setting the ultimate rate of the tax.

The early tax could be set up to allow for credits against the tax for particular abatement actions. One reason for doing this is to not penalise firms with abatement plans when the tax is introduced. Although a tax contains implicit incentives and rewards for abating, the rationale for an early tax is to achieve additional abatement relative to what the government expects from the level 1 policies. Firms already planning to abate, however, would be unnecessarily taxed early. A credit

mechanism against the early tax could be used to offset this effect.

The early tax could be imposed at a variety of points in the production chain – either upstream or downstream. Because a tax works within the market system, the incidence of the tax would be passed up and down the chain regardless of where it is imposed.

Advantages

An early tax could be used to achieve wide coverage both of greenhouse gases and sources of those gases. It could be used, for example, not only to send price signals throughout the energy production chain, but also to other sectors, such as agriculture and transport, which might not otherwise be covered by emissions trading.

If an early tax were used as a lead-in to emissions trading, the tax could be maintained for those sectors that are not covered by emissions trading, helping to ensure that the marginal cost of abatement between sectors is equal.

Through the setting of the tax, the government could directly control the price signal sent through the production chain. This would allow the tax to be set very low initially, potentially increasing as Kyoto Protocol approaches, or once the likelihood of Protocol coming into force becomes clearer. This contrasts with an early cap and trade system (see below) under which the government would have no control over the price that emerges.

Disadvantages

The early tax increases the average cost of emissions rather than just the marginal cost, because it applies to all emissions. While this can be offset somewhat by administrative means, this is a drawback.

While the early tax does involve the collection of emission data, it will produce minimal 'learning by doing' relevant to more complex abatement measures such as emissions trading.

The inclusion of sequestration and sinks within an early tax scheme is also complicated. Incorporating them would require a tradable system of tax credits or offsets. While this is possible, it would make the early tax start to look a lot like an early trading scheme.

Early voluntary trading

Basic parameters

Early voluntary trading is useful only if the ultimate Kyoto Protocol policy measures involve emissions trading. There are a variety of ways of establishing an early voluntary trading scheme including:

- variants of the Canadian GERT scheme, where a government and business joint venture plays a coordinating role between buyers and sellers of credits for essentially one-off trades;

- full baseline and credit trading schemes where a central market is established for trading credits; or
- voluntary cap and trade schemes where participants agree to an overall cap, and trade abatement to achieve the cap.

Advantages

The main advantage of early voluntary trading is its potential for 'learning by doing'. The voluntary nature of the trades is also likely to be attractive to those firms that would like a controlled environment to learn about trading and abatement without the risk of harsh penalties for making mistakes.

Voluntary trading schemes sponsored by the government provide an excellent forum to transmit general information to firms. They could act as a form of enhanced Greenhouse Challenge program, challenging firms to take the extra step of understanding not only abatement, but trade in abatement.

Disadvantages

A key problem with voluntary trading schemes is the general lack of incentives for firms to participate in them. While schemes can be made relatively attractive by not being too onerous (such as a baseline and credit scheme), such schemes are unlikely to achieve significant abatement. In this sense, early voluntary trading is more like an information and support policy than an enhanced early action policy.

Combining a voluntary trading scheme with an early tax scheme could provide incentives for voluntary trading. Credits established or traded under the trading scheme could be used to offset tax obligations. Again, such a hybrid scheme is coming very close to compulsory trading.

Early compulsory trading

Key parameters

An early compulsory trading scheme could be either a cap and trade scheme, with the cap adjusted each year as the Kyoto Protocol approaches, or it could be a price capped trading scheme, with the price adjusted each year as the Protocol approaches.

There are, however, two problems with a cap and trade approach to early compulsory trading.

- First, such a scheme provides limited information about prices, either before it is implemented or as the cap is altered.
- Second, there is a risk that a domestic cap and trade scheme would result in significantly higher permit prices than the international permit prices that eventuate from Kyoto Protocol trading. This means that domestic participants would be paying a higher price for abatement than is socially optimal.

In contrast, a price capped trading scheme avoids these problems by allowing the government to directly control the maximum price of permits. A price capped scheme would work by requiring firms to purchase permits (either at a fixed price from government or from other firms) for each tonne of emissions above some baseline level. If emissions fall below the baseline level, firms would have permits that they could sell.

The definition of the baseline must observe the no disadvantage principle in the same way that the allocation of Kyoto Protocol permits must. One option would be to set the baseline at the 1990 level of emissions, although this would involve significant data collection problems in many cases. Alternatively, firms could be allowed to choose some later date, as data allows. Given that this is an early trading scheme, there would be scope to be 'generous' in the definition of the baseline. It might be possible to use a path baseline rather than a single point in time (making the scheme approach a baseline and credit method); however there would be an administrative tradeoff involved (see below).

Advantages

A price capped trading scheme affects only the marginal emissions above the baseline level. This eliminates the additional burden imposed on firms already abating firms through a tax option. If firms abate below the baseline, the scheme also creates the possibility of permits that could be sold, creating revenue for abatement.

Price capped trading also allows 'learning by doing' in most aspects of emissions trading that are likely to emerge under the Kyoto Protocol. The exception is that it would not provide experience in price discovery.

Disadvantages

Price capped early trading involves an administrative burden in establishing the baseline. The burden goes up significantly if the baseline is a path rather than a single point in time.

With a price capped scheme, the government does not directly control the quantity of abatement. Depending on the price, it is possible that relatively little abatement will take place. However, there is scope for 'learning by doing' on the part of government in adjusting the permit price.

Subsidy measures

Key parameters

Various subsidy measures are the direct counterparts to taxes. Rather than providing a 'stick' per tonne of emissions, they provide a 'carrot'. They could be established in a large number of ways by, for example, interacting with the existing company tax system in the same way as the R&D tax deduction. Expenditure on specified abatement measures could be offset against or deducted from company tax.

Alternatively, the government could establish a direct fund for abatement measures, to which firms put specific proposals for funding. This could be similar, for example, to the National Heritage Trust funding or to the way in which agricultural R&D funds or Cooperative Research Centers are currently administered.

Advantages

Subsidies are likely to be politically attractive, because they 'encourage' abatement.

Disadvantages

Subsidy measures that interact with the tax system may run counter to the current trend of tax simplification, creating a conflict between general policy instruments and targets. If greenhouse policy is a new target, it is likely to be better to establish a new instrument to address it.

With subsidy measures it is not possible to control the total level of abatement and it is harder to directly control the price signals sent through the measures. Subsidy measures may be difficult to cost and may result in unexpected burdens on the taxpayer. In line with the target and instruments principle, its is likely to be better to target this burden according to greenhouse criteria.

Paths to policy: evaluating the options

Table 7.2 summarises the costs and benefits of the various early action pathways. There is no clear ideal option: each involves costs and benefits.

7.2 Summary of the early action tradeoffs

Early action option	*Rationale*	*Advantages*	*Disadvantages*
Early tax	Lead in to emissions trading or tax scheme.	Allows broad coverage May allow coverage of sectors not otherwise covered by emissions trading Directly controls price signals Clearly defines credits or penalties for abatement	Taxes firms already abating Provides minimal 'learning by doing' Is difficult to incorporate sinks and sequestration
Early voluntary trading	Lead in to emissions trading	Allows 'learning by doing' Transmits information	Lacks incentives to participate Results in minimal abatement
Early compulsory trading: cap and trade	Lead in to emissions trading	Allows 'learning by doing' Controls abatement	Results in unpredictable price/no control of price
Early compulsory trading: price capped	Lead in to emissions trading	Allows 'learning by doing' Controls price Clearly defines credits or penalties for abatement	Results in unpredictable abatement Has administrative burden in setting baseline
Subsidy measures	Lead in to emissions trading or tax scheme.	Will be attractive to firms	Has unpredictable cost

Timing of level 2 policies

As noted in chapter 2, the early action policy problem is not simply whether to abate or not. It is a choice about how much to abate and when to abate. This means that the policy problem also involves a choice about when to introduce early action policies (beyond the minimal actions that can be introduced almost immediately).

The timing of early action is largely conditional on the Kyoto Protocol process itself. For example, in 2005 it will be clear whether the Protocol will come into force. But by then it may be too late to start the process of abatement without involving significant adjustment costs. While there is a benefit in waiting for further information, there is also a potential cost.

It is important for the government to clearly set out the key expected milestones in the evolution of the Kyoto Protocol to 2008 and to identify where key pieces of information are likely to emerge.

Level 3: information and support measures

General information and support policies are crucial to any ongoing greenhouse policy package. In the context of early action these policies need to continue the process of informing firms about greenhouse abatement in general, and the Kyoto

Protocol in particular. These policies fall into a number of categories.

- **Emissions definition and measurement**. This will remain a significant technical problem requiring ongoing support for existing and new activities.
- **Kyoto Protocol principles and implications**. Both the rationale and objectives of the Kyoto Protocol and its implications need to be continually reinforced and explained. The key implication of the protocol is that the price of emissions must increase via one mechanism or another.
- **Abatement decision support**. Decision making about abatement is not a trivial exercise. The implications of the Kyoto Protocol or other abatement policies need to be set out in the context of the decision making procedures of firms.
- **Emissions trading support**. Emissions trading, if implemented, will require considerable development of expertise by either firms or the intermediaries that they may engage to trade on their behalf.

8
Answers to key early action questions

Is early abatement action in Australia's national interest?

Generally 'yes'. If the government is committed to the Kyoto Protocol target, then specific early abatement policies could contribute to achieving this target at minimum economic cost. Australia's commitments under the Kyoto Protocol are not certain, however, and this uncertainty must be taken into account when considering early action policies.

Early abatement also carries some risks. Too much abatement could impose unnecessary costs on the economy. In general, firms have the best information to judge their own best abatement strategies. Unfortunately, their information is incomplete because of some fundamental uncertainties surrounding the Kyoto Protocol and because of the mixed incentives generated by current policies. Early abatement is in Australia's national interest to the extent to which it reduces these uncertainties and creates a consistent set of incentives.

What are the possibilities of early abatement at minimal cost on a voluntary basis?

There are various early abatement actions that firms could undertake and many actions that firms are undertaking, although the extent of these varies considerably from industry to industry. There is no central register of abatement actions, however, and some abatement opportunities will be discovered only when firms are given consistent incentives to abate.

There is currently no clear opportunity cost for abatement actions. This has two implications. First, its affects the incentives for firms to search for abatement opportunities – why do so if it is not clear they are worth anything. Second, without an opportunity cost, it is impossible to define what is 'minimal cost'.

What are the current incentives for early action?

The current incentives for early action are very poor. The lack of information about policy and the general uncertainty about the Kyoto Protocol in many cases are a disincentive for early action. Because firms do not know the tradeoffs involved, forward planning is unnecessarily difficult.

As noted, a major part of this uncertainty is the lack of information about the price of abatement (equivalently, the price of emissions).

What are the policy options for achieving early abatement?

There are a variety of policy options for early action that are being tried or recommended in a number of countries. Some of these involve providing information about prices and resolving uncertainty; others involve providing quantity credits without providing additional information about prices or without reducing uncertainty.

Our analysis suggests that a systematic approach to reducing uncertainty and to transmitting price signals is essential for early action policies. Policies that provide quantity credits without resolving uncertainty will further confuse incentives. Information that targets price expectations is likely to be considerably more effective than this kind of credit.

Further, establishing Kyoto Protocol response policies in an early action friendly way will ensure that these policies already contain their own implicit credit mechanism, removing the need for explicit early credits.

We have proposed three levels of early action response. The first level involves undertaking some minimal actions including:

- establishing a 'no disadvantage principle';
- setting out the details of the ultimate policies to achieve the Kyoto Protocol targets;
- establishing a minimum price for carbon and equivalent emissions in 2008; and

- clarifying the status of actions that will result in an increase in Australia's Kyoto Protocol allocation.

The second level involves considering additional, more stringent, policies to target abatement. These include early carbon taxes and early compulsory trading. The choice of these depends on the ultimate Kyoto policy instruments chosen.

The third level involves general information and support policies.

A
Early credits versus price signals

This appendix uses a simple framework to analyse the similarities and differences between policies which provide early credits and those which provide direct price signals (that is, those which directly influence price expectations).

Model 1: Abate or wait

Consider a single firm making a simple decision to abate now, or wait, with two possible states of the world – the Kyoto Protocol in force or the Protocol not in force. (This is analogous – but not identical – to the problem summarised in chart 2.2. In what follows the notation is different.)

Let:

- $P(1–A)$, $P'(1–A)>0$, $P''(1–A)=0$, be the cost of having to purchase permits (this is the analog of -$C in chart 2.2);
- $C(A)$, $C'(A)>0$, $C''(A)>0$, be the cost of abating (the analog of -$B in chart 2.2);
- $A \in [0,1]$ be the amount of abatement;
- α, be the subjective probability of Kyoto (the analog of $p(k)$ in chart 2.2); and

- B(A), B′(A)>0, B′′(A)=0, be the expected benefit of earning a credit (the analog of $A in chart 2.2).

Then, the firm's objective is to choose A so as to maximise

$$\alpha B(A) - C(A) - \alpha P(1-A)$$

The first order conditions defining the firms optimal choice of A are:

$$\alpha (B'(A) + P'(1-A)) = C'(A)$$

That is, the firm chooses the level of abatement to equate the marginal cost of abatement to the expected marginal benefit from abatement. The marginal benefit from abatement is determined by both the benefit from the credit and the permit price. In fact, each provides the firm the same incentive to abate. This means that the same effect generated by a credit can be achieved by directly targeting the expected permit price.

Model 2: Two periods before Kyoto

In this model, the firm must choose the level of abatement in each of two periods before Kyoto comes into force.

Let:

- A_t be the abatement in each period (t=1,2), normalised so that
  $A_t \in [0,1]$, $A_1 + A_2 \in [0,1]$;

- $R_1 (1–A_1)$, $R_1'>0$, $R_1''<0$, be the firm's revenue in period 1;
- $R_2 (1–A_1 – A_2)$, $R_2'>0$, $R_2''<0$, be the firm's revenue in period 2;
- $C_t (A_t)$, $C'>0$, $C''>0$, be the cost of abatement; and
- $P(1–A_1 – A_2)$, $P'>0$, $P''=0$, be the cost of buying permits to cover the emissions not removed by abatement. P' is thus the per unit price of a permit.

In this case the firm's objective is to choose abatement (A_t) in periods 1 and 2 so as to maximise:

$$F = R_1 (1–A_1) + R_2 (1–A_1–A_2) – C_1(A_1) – C_2(A_2) + R_3 (1–A_1–A_2) – P (1–A_1–A_2)$$

The first order conditions for this problem define the firm's optimal abatement (A_1^* and A_2^*).

These are:

$$\frac{\partial F}{\partial A_1} = –R_1'–R_2'–C_1'–R_3'+ P' = 0$$

$$\frac{\partial F}{\partial A_2} = –R_2'–C_2'–R_3' + P' = 0$$

The introduction of a credit is the same as increasing the value of P' in period 1. If we refer to the expected benefit of the credit as P_1, then to examine the effect of introducing a credit with the effect of targeting the permit price, we want to compare

$$\frac{\partial(A_1+A_2)}{\partial P_1} \text{ with } \frac{\partial(A_1+A_2)}{\partial P'}$$

By differentiating the first order conditions we can derive:

$$\frac{\partial A_1}{\partial P_1} = \frac{C_2'' - R_2'' - R_3''}{Z} > 0$$

$$\frac{\partial A_2}{\partial P_1} = \frac{R_2'' + R_3''}{Z} < 0$$

The net effect of the credit on abatement is:

$$\frac{\partial (A_1 + A_2)}{\partial P_1} = \frac{C_2'}{Z} > 0$$

where $Z = (C_2'' - R_2'' - R_3'')(C_1'' - R_1'') - C_2''(R_2'' + R_3'') > 0$

In the case of increasing the value of the permit price

$$\frac{\partial A_1}{\partial P'} = \frac{C_2''}{Z} \quad \text{and} \quad \frac{\partial A_2}{\partial P'} = \frac{C_1'' - R_1''}{Z}$$

So the net result is:

$$\frac{\partial (A_1 + A_2)}{\partial P'} = \frac{C_2'' + C_1'' - R_1''}{Z} > \frac{C_2''}{Z}$$

This analysis suggests that, by creating a bias in favour of abatement in period 1, the credit encourages firms to substitute some abatement that would have taken place in period 2 with abatement in period 1. For a given increase in the value of a credit, this results in more abatement in period 1 but less abatement in period 2 (abatement is brought forward in order

to get the credit) combining to give an increase in total abatement. In contrast, increasing the expected permit price gives incentives to increase abatement in both periods – resulting in more abatement in periods 1 and 2, and so more abatement in total. An increase in the permit price results in a greater increase in total abatement than an equivalent increase in the value of the credit.

B
Organisations consulted

Organisation	Person	Title
AIGN (Australian Industry Greenhouse Network)	John Eyles	Executive Director
ALCOA Australia	Brian Wills-Johnson	Corporate Relations Manager
ALCOA Australia	Graham Slessar	Environmental Manager — WA Operations
Australian Aluminium Council	David Coutts	Executive Director
Australian Aluminium Council	Tony Puclin	Research Officer
Australian Cement	David Cusack	Group Technical Manager
Australian Paper	Dr Noel H Clark	Manager, Safety, Health and Environment
BHP	Dr Durham C Davis	General manager Environmental Policy and Planning Safety, Environment and Research
BHP	Ian B Wood	Manager, Environmental and Community Affairs
Boral Energy	Dr Lorraine Stephenson	Manager, Sustainable Energy Development
BP Australia	Ray Smith	Health, Safety and Environment Affairs Adviser
Bunnings Forest Products	John Tredinnick	Development Manager, Pulpwood Operations
Caltex Australia Limited	Frank Topham	Government Affairs Manager
Cement Industry Federation	John Tilley	Chief Executive
Department of Environmental Protection (WA)	Michael Waite	Assistant Director, Policy Coordination Division, State Greenhouse Coordinator

Organisation	*Person*	*Title*
Department of Resources Development (WA)	Ian Briggs	Senior Manager — Environment
EH&S Systems Pty Ltd	Alex Armstrong	Director
Ford Motor Company of Australia Ltd	Russel G Scoular	Government Liaison Manager
Gorgon Australia LNG	Lawrence R Fletcher	
Great Southern Energy	James (Jim) Bain	General Manager, Business Development
Hammersley Iron Pty Ltd	James A Stoddart	Manager — Environmental Affairs
Hammersley Iron Pty Ltd	Samuel Thawley	Business Analyst
Hammersley Iron Pty Ltd	Terry Box	General Manager — Resource Development
M.I.M. Holdings Limited	David M Hughes	Group Environmental Adviser
NAFI (National Association of Forest Industries)	Warren Lang	Deputy Executive Director
Orica	Alan Cope	Safety, Health and Environment Affairs Corporate SH&E
Orica	John M O'Connor	Government Relations Manager
Pacific Power	Tony Sproule	Business Development Analyst Development
Pacific Power International	Paul Flanagan	Manager/Environmental Services
Pulp and Paper Manufacturers Federation of Australia	Bridson Cribb	Executive Director
Queensland Mining Council	Michael K Pinnock	Chief Executive
Rio Tinto	Alastair C McClure	Manager Environmental Policy
Rio Tinto	Kathryn D Tayles	General manager Environmental Policy
Rio Tinto	Neil Marshman	Principal Consultant

Shell Services International	Dr Jim Le Cornu	Energy/Alternative Fuels Adviser (Asia Pacific)
The Chamber of Minerals and Energy of Western Australia Inc	Ian Satchwell	Chief Executive Officer
Wesfarmers Limited	Keith Kessell	Manager, Corporate Affairs
Organisation	***Person***	***Title***
Wesfarmers Limited	Michael Wedgwood	Manager, Business Projects
Wesfarmers Limited	Warren J Murphy	Executive Director, Corporate Affairs, Managing Director, Wesfarmers Bunnings Limited
Western Power	Adrian Chegwidden	Manager, Energy Technology and Environment
Western Power	Pelham Weir	Program Coordinator, Energy Technology and Environment
WMC Resources Ltd	Gordon Drake	Group Manager, Public Policy and Environmental Affairs
Woodside Australian Energy	Steve Waller	Environmental Approvals Coordinator Health, Safety, Environment and Risk Department
Woodside Australian Energy	Steven Gerhardy	Approvals Coordinator — Commonwealth North West Shelf Ventures

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