Centre for Energy and Environmental Markets

Emissions trading for Australia:

Design, transition and linking options

DRAFT

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Centre for Energy and Environmental Markets

About CEEM and this paper:

The UNSW Centre for Energy and Environmental Markets (CEEM) seeks to provide Australian leadership in interdisciplinary research in the design and analysis of energy and environmental markets and their associated policy frameworks. CEEM brings together UNSW researchers from the Faculty of Commerce and Economics, the Faculty of Engineering, the Australian Graduate School of Management, the Institute of Environmental Studies, and the Faculty of Arts and Social Sciences, working alongside a growing number of international partners. Its research areas include the design of spot, ancillary and forward electricity markets, market-based environmental regulation and the broader policy context in which all these markets operate. You can learn more of CEEM's work by visiting its website: www.ceem.unsw.edu.au.

This draft discussion paper explores some key issues and design options for future multi-state or national emissions trading in Australia. In particular, it explores the choice between 'baseline and credit' and 'cap and trade' approaches to emissions trading, describing international and Australian experience to date with each approach. The paper then considers design options for an Australian 'cap and trade' scheme, including transition issues for the present NSW Greenhouse Abatement Scheme, and linkage opportunities with international schemes. Finally, it briefly discusses the potential interactions between emissions trading and other climate change policy measures.

Emissions trading options for Australia is an area of ongoing work for CEEM. This paper draws upon previous work exploring the NSW Greenhouse Gas Scheme and the EU Emissions Trading Scheme. Papers and presentations on this research are available on the CEEM website.

We welcome feedback and comments on the analysis methodology and findings outlined in this paper.

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Executive Summary

Climate change has emerged as one of the great policy challenges of our time. It is a global and longer-term environmental challenge with great uncertainties and almost certainly no easy technical fixes. Any effective climate change policy framework is going to have to ‘reach’ virtually all sectors of the economy and transform them, especially the energy sector.

There is considerable and growing worldwide interest in emissions trading as an economy-wide policy measure that effectively creates a competitive market for greenhouse emissions to efficiently deliver the necessary reductions for protecting the climate. Internationally, the EU Emissions Trading Scheme (EU ETS) began operation in January 2005, while the Kyoto Protocol’s Joint Implementation (JI) and Clean Development Mechanism (CDM) are also built around emissions trading. In Australia, NSW has introduced a state-based ETS, and while the Federal Government has expressed opposition to national emissions trading, Australian State and Territory Governments have begun exploring options for a multi-jurisdictional ETS.

Given the limited experience with ETS to date, there are many unanswered questions about what role they can play in climate change policy and key design issues for maximising their effectiveness. This paper explores these questions in the Australian context. It first discusses how emissions trading works and its potential role in climate change policy. We outline criteria for assessing scheme performance, and explore key design choices. We then consider the design and performance of five existing schemes – the ‘baseline and credit’ CDM, NSW GAS and UK ETS, and then the ‘cap and trade’ Kyoto Protocol and EU ETS. This provides a basis for evaluating options for a multi-jurisdictional ETS in Australia. We consider the specific design principles announced by the inter-jurisdictional working group, transition issues for existing policy measures and possible linkages between this scheme and other international ETS. Finally, we consider the wider climate policy framework that will be required in addition to an ETS.

The role of emissions trading in climate change policy
An effective climate change response seems almost certain to require major, rapid and then sustained physical reductions in global greenhouse emissions from fossil fuels. This will require much greater use of efficient end-use, lower emission fossil-fuel and renewable energy technologies. The key decisions are in infrastructure and major capital investment. Technical innovation is essential, as is a concerted effort to reduce the use of current polluting technologies.

Greenhouse emissions represent ‘unpriced’ externalities in most existing markets. Emissions trading can be established by setting a target of allowable emissions, establishing an associated quantity of allowances and then requiring market participants to have allowances sufficient to cover their emissions. Trading between participants with low-cost abatement options and those with only high-cost options maximises the economic efficiency of the process.

There are limits to what such schemes can achieve because emissions trading markets and the markets which they must drive (particularly those for energy) suffer from a range of market failures. Still, a growing number of countries envisage that an ETS will be their major climate change policy measure both in terms of driving action, and as a backstop that ensures environmental objectives are met regardless of how other policies perform. The interaction of ETS with other measures in an increasingly crowded policy space is therefore a key issue.

ETS design options
Emissions Trading Schemes are designer markets – governments create and can change the rules. There is, therefore, an enormous amount of flexibility in the chosen design of such markets and this poses both opportunities yet risks for policy makers. It is possible to create extremely complex and abstracted schemes, and the policy process is vulnerable to stakeholder pressure. Still, some fundamental design parameters are clear – any effective market design will require a tradeable commodity, willing buyers and willing competing sellers.

There is a fundamental choice to be made between restricting trading to physical measurable emissions or including 'estimated' and inherently uncertain net greenhouse flows from land-use activities or even so-called 'emission reductions' from BAU baselines. In many schemes this baseline is some estimate of 'Business As Usual' (BAU) emissions; that is, what would have happened without the scheme. Such baselines are, of course, essentially unknowable, and establishing them is a fraught process.

Finding willing buyers of externalities such as greenhouse emissions generally requires mandatory requirements placed upon some sectors of the economy. The greater the number and diversity of participants, the greater an ETS's capacity to drive low-cost emission reductions. The measurability of emissions is, however, a key issue. There is also typically a choice between making small numbers of upstream or larger numbers of downstream participants liable parties. The presence of willing buyers also depends greatly on the initial allowance allocation and the severity of the target. Allowances can be either auctioned, or grandfathered to emitters on the basis of historical emissions or, worse, BAU emission estimates. There are theoretical and practical reasons to believe that auctioning will drive greater innovation than grandfathering.

Willing sellers may also be in short supply, and depend on allowance allocation and the target. In 'cap and trade' schemes, participants are potentially both buyers and sellers, depending on their emission reduction options compared to others in the market. In 'baseline and credit' schemes, a similar arrangement is possible with participants buying or selling depending on how emissions depart from their baseline. Typically, however, emissions reductions are provided by project developers who don't have a direct scheme liability, but volunteer to act. The liability falls, instead, on institutional parties; for example, electricity retailers in NSW GAS. Such schemes effectively offer private incentives but socialised penalties – unlikely to be an effective approach.

Baseline and credit, and cap and trade schemes are closely related, and can under some design choices be theoretically shown to achieve equivalent outcomes. For example, 'cap and trade' schemes with grandfathering can resemble 'baseline and credit' schemes with historical baselines. Similarly, ETS is closely related to emission, or so-called carbon, taxes – for example, 'cap and trade' schemes imposed upstream with auctioned allowances become what is effectively a tax for most participants in energy markets. There are, however, important practical differences.

We first outline a number of existing ETS with regards to key design criteria including coverage, target, allowance allocation, flexibility, technical implementation and sanctions. We then evaluate scheme performance to date with regard to environmental effectiveness, economic efficiency, dynamic incentives, equity issues and competitive impacts.

Experience with 'baseline and credit' ETS

There is an enormous amount of flexibility in the design of 'baseline and credit' schemes. Just about any combination of coverage, target, allocation, flexibility, monitoring, sanctions and technical aspects can be used. Our interest here is in baseline and credit schemes trading greenhouse emissions rather than targeted schemes for renewables or gas generation such as the Mandatory Renewable Energy Target (MRET) or Queensland 13% Gas Scheme. The latter are less problematic because they require less complexity and trade something physically measurable – it is, of course, still possible to get them wrong. Emissions trading schemes, however, have more design choices and these can all greatly impact on scheme performance. We consider the NSW GAS, CDM and UK ETS. Each has somewhat different objectives and designs. Nevertheless, a number of key issues emerge.

Environmental effectiveness: The UK ETS had a mix of fixed and relative emission caps and historical baselines. All participants are potential buyers or sellers. The NSW GAS and CDM on the other hand, have large institutional buyers and generally private, project-based sellers who earn credits for reducing emissions from some estimated BAU baseline. The environmental effectiveness of the latter approach will always be questionable. The NSW GAS also suffers from a highly abstracted target – imputed per-capita emissions associated with electricity consumption.

A scheme's effectiveness has to be assessed in terms of the physical actions that result. Abstracted, imputed linkages weaken the relationship between these actions and policy intent.

Ensuring additionality from a projected baseline is problematic because it is inherently counter factual, yet essential for environmental effectiveness. The NSW GAS doesn't explicitly attempt to assess additionality at all. The CDM and UK ETS both do, but encounter problems. The UK National Audit Office has estimated that one third of claimed abatement by the four largest over-achievers in the UK ETS wasn't additional. Some work on the NSW GAS suggests that its additionality out to 2012 under current design rules may turn out to be low – 30% or less. The CDM has rigorous and transparent processes for testing additionality, however, these can cause challenges of their own in terms of getting projects accredited.

Economic efficiency: In economic terms, the efficiency of a scheme in delivering abatement equals the total costs of any 'additional' actions taken to physically reduce greenhouse emissions, together with all scheme transaction costs, divided by the actual emissions abated. Transaction costs in baseline and credit schemes arise from accreditation, auditing, registry fees and trading. Relatively high transaction costs and low additionality suggest low efficiency.

Price formation is also an important contributor to scheme efficiency. Baseline and credit schemes typically have lower liquidity than 'cap and trade' approaches because only emissions below the baseline create certificates. Lower liquidity reduces a market's ability to reveal true marginal costs. The NSW GAS and UK ETS both seem to have had problems here.

Even when these markets do prove efficient, the outcomes are not always entirely welcome. For example, the CDM has both sustainable development and greenhouse abatement objectives, yet investment is being directed towards large industrial projects abating non-CO_2 greenhouse gases. These certainly offer low-cost abatement but have questionable development outcomes.

Dynamic incentives: The UK ETS effectively gives every participant a baseline, and either rewards or penalises them according to whether their emissions go below or above this baseline. These schemes encourage every participant through both a 'stick' and 'carrot'. The NSW GAS and CDM, however, effectively impose socialised penalties while credits go to those particular participants who volunteer to undertake some action.

A possible strength of this latter approach is that there can be strong incentive signals to willing and innovative participants. However, voluntary participation for credits tends to attract participants who are doing something anyway. Those that are increasing emissions stay well away, and the costs they impose on society are shared by all participants. Mitigating climate change requires a transformation, and that depends not only on what we do, but on what we stop doing. Unfortunately, there may be little incentive for participants to stop adding to our problems.

Technical administration and practicability: 'Baseline and credit' schemes involve considerable administrative burdens, particularly in establishing baselines. The transparency of the schemes is also a design choice. The CDM has highly transparent processes, the NSW GAS far less so. Note also that participants will continue to test scheme rules and rule making processes – this is, after all, a major potential source of competitive advantage. Complexity may continue to grow.

Equity and competitive aspects: The flexibility of 'baseline and credit' is both an advantage – schemes can be carefully 'tuned' to resolve adverse impacts – but also a potential problem should powerful stakeholders influence rule design to their own advantage. Schemes that socialise costs while privatising benefits always raise equity concerns. The NSW GAS and UK ETS appear to have delivered significant windfall profits to some participants. Meanwhile, participants who genuinely wish to undertake innovative projects can struggle to compete against such 'free' abatement.

Experience with 'cap and trade' ETS.

Design options for cap and trade systems are generally more limited that those for baseline and credit schemes but, again, design choices of coverage, target, allocation, flexibility, monitoring, sanctions and technical aspects will have a large impact on scheme performance. We discuss and then assess two existing cap and trade schemes – trading under Article 17 of the Kyoto Protocol and the EU ETS. We focus particularly on the EU – the largest ETS yet implemented, covering more than 11,000 installations in 25 countries, and representing some 43% of EU greenhouse emissions.

Both the Kyoto Protocol and the EU ETS have physical emission caps and staged implementations. There are, however, important differences. The Kyoto Protocol covers all six greenhouse gases while the EU ETS includes only CO_2 for its first period. The EU ETS allows operators to use credits generated by the project-based mechanisms of the Kyoto-Protocol for compliance, excluding sink and large hydro CDM projects and 'hot air' from Russia. Allowances were allocated by the Member States. The EU ETS only commenced operation in 2005 so experience to date is limited. We focus mainly on the establishment of the scheme and its design.

Environmental performance: The EU ETS is expected to have reasonable environmental performance based on its sound overall architecture. Absolute targets for CO_2-emissions are very modest but do exclude risky accounting sources or gases as well as sink-projects, and this probably represents a reasonable approach for the first period. In addition, robust monitoring and reporting requirements as well as deterrent sanctions will help to reach the targets. The European Commission has played an important policing role in EU ETS design via the Directive. Trading in the Kyoto Protocol under Article 17 is less rigorous with inclusion of sinks and modest sanctions.

Economic efficiency of the chosen EU ETS design seems less favourable. The partial coverage of the scheme would not cause any problems if marginal mitigation costs were the basis for sharing the targets between covered and non-covered sectors. However, most countries have chosen modest ETS targets while imposing large reductions on non-covered-sectors to meet Kyoto liabilities. Also, current prices appear to be much higher than actual abatement costs. It seems likely that prices are being manipulated – an outcome made possible by almost complete grandfathering of allowances leading to low trading volume and potential strategic gaming of future scheme rules by large participants.

Dynamic incentive: This is also likely to be low in the EU ETS, and grandfathering of allowances is again a major reason. The 'new entrant' and 'closure' arrangements that attempt to compensate for this have only limited effectiveness in driving investment in cleaner new plant, and the closure of older high-emission plant. Finally, future allocation rules are unknown, adding to the uncertainty of benefits from new investments.

Technical administration and practicability impact on the transaction costs of the EU ETS for both the administrative body and the participating companies. The high number of small installations covered by the scheme imposes significant transaction costs.

Equity and competitive aspects: There is a clear potential for wind-fall profits going to electricity producers because of the free allowance allocation chosen in almost all NAPs. This will lead to potentially considerable wealth transfer between consumers and producers and hence impact negatively on equity. Again, auctioning would help address this problem.

Emissions trading options for Australia

In the absence of Federal Government progress on emissions trading, State and Territory Governments have declared their intention to investigate the development of a multi-jurisdictional ETS. A working group established a number design propositions including support for a cap and trade approach – a decision we strongly support. Decisions on what this cap should be and what sectors are included remain to be decided. We would stress the importance of setting challenging abatement targets, and assessing relative abatement costs between sectors and measurability in determining which sectors are included. The inclusion of all six greenhouse gases raises difficult measurability problems – they were excluded from the EU ETS for this reason. We support as much auctioning as possible to maximise the scheme's economic efficiency, dynamic incentives and equity impacts. The decision to allow offsets such as sequestration will risk its environment performance, and reduce opportunities for linkage with other international ETS.

Perhaps the most important lesson for Australia from the EU ETS concerns the process by which all these design choices will be made. As seen with the different National Allocation Plans in the EU, there is considerable potential for a 'race to the bottom' between nations or states attempting to protect particular industries or create competitive advantage. The European Commission has played a key role in policing such behaviour. The states and territories should explore institutional arrangements for managing the inevitable political manoeuvrings that will arise in scheme design.

Transitions from 'baseline and credit' to 'cap and trade' emissions trading.
The transition from the existing 'baseline and credit' ETS in NSW and the ACT to an inter-jurisdictional 'cap and trade' scheme is likely to be problematic. The existing scheme is mandated to run to 2012 and there is limited forward trading of NGACs out to this period. An inter-jurisdictional scheme will need to be introduced before 2012 if it is to contribute to Australia meeting its Kyoto requirements. Unfortunately, it is difficult to reconcile an ETS trading physical emissions with another that trades hypothetical 'emission reductions' from BAU baselines.

Transition options include cancellation of the NSW GAS prior to commencement of the national cap and trade scheme, or accepting a period of time where both schemes run in parallel. The key issues for the first option are the impacts of cancellation on those participants who undertook real abatement actions and, in particular, how these actions might be compensated within the cap and trade scheme. Key issues for the second option are overlaps or double counting, and whether to permit trading between the systems.

There is some international experience in such transitions with the UK ETS and JI projects established before the EU ETS. However, these schemes have better designs than the NSW GAS, which has no physical cap and questionable additionality. Full acknowledgement of its claimed abatement in any 'cap and trade' scheme would adversely impact environmental effectiveness and equity. The best option is probably cancellation of the NSW GAS prior to commencement of a national scheme, with full auctioning of permits to account for any early action that might have taken place.

Project-specific 'domestic project' arrangements with strict additionality tests might be appropriate for NSW GAS projects outside the new scheme's coverage. Accepting a transition period where both NSW GAS and a national ETS were operating may be unavoidable but raises many complications – in particular, double counting of emissions reductions. Opt-out provisions won't work well given NSW GAS problems, while trading across schemes by making NGACs fungible with allowances is likely to damage the effectiveness and fairness of the cap and trade system.

Linking of emissions trading schemes
Linking separate ET schemes will, all other things being equal, lead to higher efficiency gains because there will be more variety and cost differences in reduction options, greater liquidity and reduced market power. The EU ETS directive foresees potential linking with other national schemes but specifies that third parties should have ratified the Kyoto Protocol. Australia's ratification would open up trading under Article 17 as well as Kyoto's CDM and JI mechanisms. Without ratification, it is still possible for unilateral trading should an Australian scheme allow participants to comply with their targets by buying EU allowances.

A bilateral linkage would require EU agreement, and harmonisation of some key design features. These include coverage – the EU ETS includes only CO2 at present while the proposed multi-jurisdictional Australian scheme includes gases which are only quantifiable with high uncertainty. Similarly, unlike the Australian proposal, the EU ETS does not currently include sinks projects because of their measurability problems and longer-term uncertainties. The EU is unlikely to wish to import such uncertainties into their own scheme through linkage. Non-Kyoto ratification also raises problems with trading in Kyoto Units as these are required by EU member states for their own compliance. Allocation can be left to National Governments but the stringency of any Australian target will need to be compatible with EU objectives. Sanctions for linked schemes default to the least onerous. The EU ETS has a penalty for non-compliance yet still requires that participants ‘make good’ in latter periods. The Australian proposal is for a price cap only. This is less stringent and would put environmental outcomes of the EU scheme at risk.

Interactions between ETS and other policy measures

Idealised market theory suggests that a universal ETS is the only climate change policy required and that other climate change policies will not improve environmental effectiveness, cannot reduce the cost of meeting this target and will almost certainly increase it. The reality of course is that ETS have important limitations that will require other policy measures. In particular, these markets are unlikely to appropriately ‘price’ current uncertainties in both what level of emissions reductions will be required to protect the climate, and the potential of emerging abatement technologies.

Key policy areas would seem to include 1) improving ETS’s static efficiency by correcting other existing energy market failures such as those seen in energy efficiency and infrastructure provision, 2) improving ETS’s dynamic efficiency through support for innovation and diffusion of emerging emissions abatement technologies such as renewables, 3) other policy objectives such as energy security and equity and 4) compensating for the inevitable failures in ETS design.

Emissions trading is, in some ways, very well suited to policy frameworks with a mix of policy measures because the price of allowances is set by a market that can respond to these other policies. For example, strong policy support for renewables can offset fossil-fuel generation which therefore requires fewer allowances. The price of allowances should then fall in response to this reduced demand. These interactions can however be extremely complex and surprises are always possible. In particular, inefficient markets can blunt these price responses and some members of society may end up paying for emission reductions twice.

Finally, carbon taxes have some highly desirable characteristics, including simplicity and adherence to ‘polluter pays’ principles. Although it is sometimes claimed that such taxes are politically infeasible, they remain an option for pricing greenhouse emissions should ETS schemes prove impractical or excessively unwieldy in some particular sectors or more generally.

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1 Introduction

Mitigating climate change is one of the great policy challenges of our time. Reasons include the long time-frame and global nature of the problem, remaining uncertainties in how severe this problem is, and the societal transformation that is likely to be required in order to reduce emissions – particularly with regards to our dependence on fossil fuels.

An effective climate change policy framework requires a longer-term perspective and adaptive mechanisms that can be adjusted as we learn more about the climate change problem and our abatement options. The framework will have to 'reach' virtually all sectors of the economy, and be able to drive far-reaching changes in most of these, especially the energy sector. It also needs to be compatible with the many other societal policy objectives driving our energy choices such as energy security and equity concerns.

There is considerable and growing worldwide interest in emissions trading as an economy-wide policy response to climate change that takes advantage of the power of competitive markets to deliver desired environmental objectives at lowest cost. Internationally, the EU Emissions Trading Scheme (EU ETS) began operation in January 2005, while the Kyoto Protocol's Joint Implementation (JI) and Clean Development (CDM) mechanisms are also built around emissions trading.

Closer to home, the Federal Government's Australian Greenhouse Office (AGO), amongst others, has given considerable thought to how an Emissions Trading Scheme (ETS) might be implemented in Australia (AGO, 1999). The CoAG (2002) Energy Market Review called for a national ETS to replace an existing range of greenhouse-related policy mechanisms, while New South Wales (NSW) introduced a state-based ETS in January 2003 (the NSW Greenhouse Abatement Scheme or NSW GAS). Although the Federal Government announced in its 2004 Energy White Paper that it would not implement an ETS, the Australian State and Territory Governments have since announced their intention to develop a multi-jurisdictional ETS.

Given the limited experience with ETS internationally and in Australia to date, there are numerous unanswered questions about both the role that such schemes can and should play in climate change policy efforts, and the key design issues for maximising their effectiveness. In this paper we explore some of these issues in the context of ETS options in Australia, through either the multi-state efforts already underway or changed policy priorities in the Federal Government.

In the next Section we explore the general issue of what emissions trading is, how it works and its potential role in broader climate change policy frameworks. We outline the key criteria by which such policy approaches should be assessed, and explore some of the key design choices for such schemes. We focus particularly on the choice between 'baseline and credit' and 'cap and trade' schemes.

In Section 3 we consider 'baseline and credit' schemes in more detail. This includes design options and experience to date with a number of implemented schemes – in this case, the CDM, NSW GAS and the emissions trading scheme established in the United Kingdom (UK ETS). Section 4 does the same for 'cap and trade' schemes – in this case, we explore experience to date with the EU ETS and Article 17 of the Kyoto Protocol.

In Section 5 we focus on specific options for a multi-state ETS in Australia, beginning with an assessment of the specific design principles that have been announced by the inter-jurisdictional working group on ETS. We then consider transition issues for existing policy measures such as the NSW GAS, possible linkages with other international ETS and development of a wider policy framework built around a multi-state ETS.

2 Emissions Trading Schemes

2.1 The role of emissions trading in climate change policy

Climate change is unlike any other environmental challenge that we have successfully faced to date, and we are in largely uncharted policy waters. Our starting point for policy development is:

- avoiding dangerous climate change seems likely to require *major* (60 to 80% from present levels) *rapid* (emissions peaking within around 30 years) and *then sustained* (centuries or more) reduction in global GHG emissions,
- nearly all this reduction will have to come from reducing fossil fuel emissions,
- there is a wide range of proven options for reducing energy-related emissions through improved end-use energy efficiency, lower emission fossil fuel, cogeneration and renewable energy supply,
- infrastructure and major capital investment are by far the most important decisions that policies need to target,
- technical innovation and progress is essential as our present technology options are almost certainly inadequate for the scale of change required, and
- such transitions in infrastructure and technical innovation have important time lags, and therefore require urgent attention (IPCC, 2001).

In terms of policy frameworks, one key issue is the different role of broad measures that aim to ‘reach’ across many and diverse economy sectors versus mechanisms targeted at particular sectors or technologies. Policy measures can also be broadly categorised into:

- support mechanisms – eg. information, encouragement and perhaps financial assistance,
- direct control or regulatory mechanisms – eg. technical standards, and
- market mechanisms including environmental taxes and emissions trading, that change the effective ‘price’ seen by decision makers for different energy options.

Emissions trading represents a potentially economy-wide policy measure that creates a competitive market to deliver the policy objectives. The overall objective of climate change policy is to control greenhouse gas emissions. Such emissions generally represent ‘unpriced’ externalities in present markets. In its most general form, emissions trading can be established by setting a target of allowable emissions, establishing an associated quantity of allowances and requiring market participants to have allowances sufficient to cover their emissions.[1] Trading between participants with low cost options to reduce their emissions and those with only high cost options maximises the economic efficiency of the process. It's important to note that there are other ways to put a ‘price’ on emissions such as carbon taxes, and this is discussed later.

In theory, and by accepting a large number of assumptions, a universal ETS is the only policy required, and any additional climate change policies can only increase the cost of meeting the cap while not changing its environmental effectiveness (Sorrell and Sijm, 2004).

In practice, there are limits because emissions trading markets and the markets with which they must interact (particularly those for energy) suffer from a range of market failures that limit the effectiveness of an emissions price signal. Furthermore, markets can struggle to appropriately ‘price’ uncertainties about the future, both in terms of the emissions reductions required to protect the climate, and our various abatement options. Also, the political process required to establish a far-reaching policy such as ETS will inevitably involve compromises that reduce its effectiveness.

[1] The term permits might be equally used instead of allowances. Since under the EU ETS the term permit has a different meaning this paper uses allowances instead of permits to describe the right to emit a specified amount of GHG.

Still, some countries envisage that an ETS will be their major policy measure for climate change both in terms of driving action, and as a backstop that ensures environmental objectives are met regardless of how other policies perform. Other countries may implement ETS schemes, however, as strategic contributors to a wider range of policies.

While it is possible to argue what other policy measures might best complement emissions trading, there is no question that other policy mechanisms will be required. Key issues that seem likely to require additional policy attention include:

- correcting energy market failures seen in energy efficiency and infrastructure provision,
- support for innovation and the diffusion of emerging emissions abatement technologies such as renewables, and
- delivering other policy objectives such as energy security and equity, and compensating for the inevitable failures in ETS design (Sorrell and Sijm, 2004).

Some of these policy challenges are likely to respond best to mandatory approaches – energy efficiency is a good example (MacGill et al, 2004). Others may be well suited to market-based approaches. For example, the Queensland 13% gas scheme has driven gas infrastructure through a mandated State target for tradeable Gas Electricity Certificates (GECs) and the Federal Mandatory Renewable Energy Target promotes new renewable generation in Australia through a national target for tradeable Renewable Energy Certificates.

Emissions trading is, in some ways, very well suited to policy frameworks with a mix of policy measures because the price of allowances is set by a market that can respond to these other policies. For example, strong policy support for renewables can offset fossil-fuel generation which therefore requires fewer allowances. The price of allowances then responds to this reduced demand. These interactions can however be extremely complex and surprises are always possible in an increasingly crowded 'climate policy' space. We consider these policy interaction issues further in Section 5.

2.2 Assessing climate policy frameworks

An overall policy framework for climate change needs to be assessed on its:

- 'effectiveness' in actually mitigating the dangers of climate change, without causing more damage to other societal objectives that climate change would itself, and
- 'efficiency' in doing this at reasonable cost and effort compared against both the benefits of meeting policy objectives, and the other possible policy frameworks that might be used.

Effectiveness is the most important – protecting ourselves from dangerous climate change at slightly higher cost that was really necessary will still be worth it. Discussions of efficiency, however, often seem to drive policy assessment and it is important to clarify how the term is being used. Efficiency can be broadly categorised into:

- *productive*: relating to more efficient use of existing systems and processes,
- *allocative*: the most efficient mix of available options, and
- *dynamic*: referring to the processes of technological and organisational innovation responding to longer-term developments. This is clearly the most relevant for long-term climate action because it focuses on *transformation* through investment and innovation, rather than incremental improvements.

Assessing the potential contribution of ETS in such a climate policy framework can not be done against these objectives in isolation – as noted earlier, ETS can not be expected to solve all our problems. Nevertheless, given the key role that ETS is expected to play, it is important to assess it against the key criteria for avoiding dangerous climate change noted earlier: helping drive major, rapid and sustained reductions in emissions from fossil-fuel use by driving major investment, and technical innovation in a range of abatement options.

It is important to note that the ability of ETS to drive innovation in comparison to more traditional regulation has been questioned by researchers including Driesen (2003) and this is a major area of research – see for example, Schleich and Betz (2005). Furthermore, it is not enough to introduce new abatement technologies, a successful policy framework will also have to drive out those existing technologies that contribute to our problems. Regulatory ‘sticks’ as well as incentive ‘carrots’ will be required.

2.3 ETS design options

Emissions Trading Schemes are designer markets – governments create and can change the rules. There is an enormous amount of flexibility in the chosen design of such markets and this poses both opportunities yet risks for system designers. It is possible to create extremely complex schemes, and there are moral hazards for designers when trying to balance the various political compromises perceived to be required for policy development. In essence, any effective market will require:

- a tradeable commodity,
- willing buyers and
- willing competing sellers.

A tradeable commodity: There is a fundamental choice to be made in scheme design between ‘emissions’ trading and ‘estimated emissions’ trading and ‘emissions reductions’ trading. Climate change is driven by the actual quantity of greenhouse emissions going into the atmosphere. This is why the Kyoto Protocol sets fixed physical emissions caps on developed countries. Emissions trading therefore represents what is termed a ‘cap and trade’ system. A fixed quantity of allowances, each representing a right to emit a quantity of greenhouse gases, is available. ‘Cap and trade’ systems trade in measurable, physical emissions.

This is very different from ‘baseline and credit’ schemes that trade in ‘estimated net greenhouse flows’ from activities such as Land Use Change and Forestry (LUCF) or ‘emission reductions’ from BAU baselines. Net greenhouse gas fluxes from ecosystems are difficult to measure and inherently less certain than those from fossil fuels. Measuring emissions reductions requires a baseline. This baseline could be historical physical emissions. In many schemes, however, the baseline is some estimate of ‘Business As Usual’ (BAU) emissions; that is, what would have happened without the scheme. Participants then receive credited ‘emissions reductions’ if they don’t emit as much as they would otherwise have. Such baselines are, of course, essentially unknowable, and the process of establishing them is fraught with measurement challenges, assumptions and moral hazards.

Willing buyers of externalities such as greenhouse emissions can be hard to find. Generally, a mandatory requirement must be placed on participants in some sectors of the economy. As noted, by the AGO (2002: 8-9) “The greater the reach and consistency of the price signals generated by a trading system, the greater its capacity to drive emission reductions in those areas of the economy where this can be accomplished most cheaply.” Measurability is, however, a key issue – accurately estimating emissions outside fossil-fuel combustion activities can be challenging. Ecosystem sequestration is a relevant example (Lohmann, 2001).

There is typically a choice between making small numbers of upstream or larger numbers of downstream participants liable parties. The presence of willing buyers also depends greatly on initial allowance allocation and the severity of the target. Generally, allowances can be either auctioned or grandfathered to emitters. Grandfathering allocates allowances on the basis of historical emissions or, worse, hypothetical BAU emission estimates. Baseline and credit schemes effectively grandfather emission allocations. Cap and trade schemes can do either auctioning or grandfathering, or a mix of the two. While some economic theory suggests that allocation doesn't greatly affect the economic efficiency of ETS, Burtraw (2001) and others have argued that this finding is based on an idealised view of energy markets that isn't realised in practice. Other work has noted that auctioning is likely to drive greater innovation than grandfathering (Sorrell and Sijm, 2004; Milliman and Prince, 1989).

Willing sellers may also be in short supply, and their presence also depends on allowance allocation and the target. In 'cap and trade' schemes, participants can typically be either or both buyers and sellers, depending on their options for reducing emissions compared to others in the market. In 'baseline and credit' schemes, a similar arrangement is possible with participants being buyers or sellers depending on how emissions depart from their baseline. Typically, however, certified emissions reductions are provided by project developers who don't have a direct liability under the scheme, but volunteer to be involved on the basis of emissions reductions they deliver. This liability falls, instead, on major parties such as electricity retailers.

Some of the key differences between 'cap and trade' and 'baseline and credit' schemes are outlined in Table 1.

Table 1: Baseline and credit versus cap and trade for emissions trading

Baseline and credit	Cap and trade
Only emissions reduction compared to baseline or target are tradable	Allocated allowances are tradable
Ex-post	*Ex-ante*
Credits are generated after verification (and certification)	Allowances are allocated to covered entities
Wide participation in credit generation	Tradable surplus of allowances can only be created by covered entities
Examples:	**Examples:**
NSW Greenhouse Abatement Scheme	EU Emissions trading
Clean Development Mechanism	Article 17 of Kyoto Protocol
UK Emissions Trading Scheme	

These two types of schemes are closely related, and can, under some design choices, be theoretically shown to achieve equivalent outcomes. For example, 'cap and trade' schemes with grandfathering can resemble 'baseline and credit' schemes with mandatory liabilities on all participants. Similarly, ETS is closely related to emission, or so-called carbon, taxes – for example, 'cap and trade' schemes imposed well upstream with auctioned allowances become what is effectively a tax for most participants in energy markets. Carbon taxes have some highly desirable characteristics including simplicity and adherence to 'polluter pays' principles. Although it is sometimes claimed that such taxes are politically infeasible, a number of countries have introduced them, some in parallel with ETS. Carbon taxes remain an option for establishing a price for greenhouse emissions should ETS prove impractical or excessive unwieldy in practice.

The next section of this paper reviews experience to date with some ETS implemented here in Australia and internationally. We first briefly consider three 'baseline and credit' schemes – the NSW Greenhouse Gas Abatement Scheme (NSW GAS), the UK ETS and the CDM. It is widely accepted that 'cap and trade' schemes are preferable for economy-wide emissions trading (AGO, 2002) for reasons including higher market liquidity, fairer allowance allocation and credibility. Nevertheless, 'baseline and credit' approaches offer considerable flexibility in scheme design and were the main approach in early ETS efforts for climate change.

We then consider, in considerably more detail, 'cap and trade' schemes, focusing primarily on the EU ETS – the first and largest 'cap and trade' scheme for climate change – but also considering the trading provisions of Article 17 in the Kyoto Protocol (KP). This basic approach has been adopted by the inter-jurisdictional working group on ETS here in Australia.

The key design features considered for each ETS are shown in Table 2.

Table 2: Design choices for an ETS

Feature	Options
Coverage	liable entities, included sectors and greenhouse gases, flexibility
Target	relative or absolute, scale
Allocation	existing entities, new entities, arrangements for early action
Flexibility	banking and borrowing options
Monitoring/verification	on-line or annual, scheme administrator or third party agents
Sanctions	direct penalties, other possible arrangements
Technical aspects	including registry arrangements

We then evaluate the schemes according to the criteria shown in Table 3.

Table 3: Assessment criteria for ETS

Feature	Options
Environmental performance	the extent to which the environmental objective is achieved
Economic efficiency	the extent to which the required objective is met at least cost
Dynamic incentive	how technical and managerial improvements are achieved
Technical administration and practicality	the administrative costs for implementation and maintenance, practicality, transparency
Equity aspects	the extent to which any group is unfairly disadvantaged or favoured
Competitive impacts	the extent to which any sector or firm is unfairly disadvantaged or favoured

3 Lessons from experience to date: Baseline and credit approaches

3.1 Design choices and scheme assessment

As noted earlier, there is an enormous amount of flexibility in the design of 'baseline and credit' schemes. Just about any combination of coverage, target, allocation, flexibility, monitoring, sanctions and technical aspects can be used. This is both a strength and weakness. Schemes can be carefully constructed around specific objectives that contribute to climate change objectives but don't directly target emissions – for example, a target for gas generation as seen in the Queensland Scheme or new renewable generation as with the Mandatory Renewable Electricity Target (MRET). They can also be used by governments to regulate operation of an industry that extends beyond its jurisdiction in ways that wouldn't permit the use of a 'cap and trade' approach – for example, the NSW GAS. The main risks are complexity, excessive abstraction and the moral hazards that face policy makers.

Our interest here is in baseline and credit schemes that trade greenhouse emissions rather than the more targeted schemes for renewables or gas generation. The latter can be far less of a problem to design because they have a limited range of activities for which to establish baselines, and hence less complexity. They also measure the presence of something, such as a MWh of renewable generation, rather than the absence of something – for example, greenhouse emissions compared against a BAU baseline. Emissions trading schemes require more design choices and these can greatly impact scheme performance.

Environmental performance: A potential issue is the use of highly abstracted targets – for example, as used in the NSW GAS, per-capita emissions associated with electricity consumption according to complex calculations involving state electricity sales, a notional electricity pool emissions coefficient and a wide range of claimed abatement activities. In the end, a scheme's effectiveness has to be assessed in terms of the physical actions that are driven by it. Abstracted, imputed linkages between a scheme's policy intent and these actions can weaken this relationship allowing, for example, activities that don't reduce physical emissions to count towards abatement. Alternatively, the scheme may count actions that do reduce emissions but are driven by other factors – for example, other regulation or changing market conditions.

Baseline and credit schemes can be built around fixed emission caps and historical baselines – such an approach is similar to 'cap and trade' schemes with grandfathering. However, schemes may instead be built around emissions reduction targets compared against some estimate of BAU emissions growth. Thus, ensuring additionality is problematic because it is inherently counter factual – it requires an estimate of what would have happened 'otherwise'. The environmental effectiveness of this approach is questionable – the climate system responds to physical emissions, not any claimed efforts to reduce emissions growth from what it might otherwise have been. Additionality, however, is essential because if the scheme doesn't actually change physical behavior then there would seem to be no good reasons to implement it, and many good reasons not to.

The problems in attempting to estimate *additional* abatement are many. It may result from both:

- investment in activities that reduce emissions compared to the investments that otherwise would have occurred, yet also
- operational changes in existing projects – for example, increased production from existing gas-fired plant in response to the financial incentives provided by a scheme.

The many factors that can drive investment decisions make additionality hard to measure in the first case. Additionality from operational changes can be even harder to measure because of all the possible reasons why operational decisions such as those related to production levels might be made – everything from market demand to the weather. Given this complexity, additionality testing is an essential part of any 'baseline and credit' scheme. Some existing schemes, such as the CDM, have rigorous, detailed, and transparent processes for testing the additionality of proposed projects. Others, such as the NSW GAS, don't.

Economic efficiency: In strict economic terms, the efficiency of a scheme in delivering abatement equals the total costs of any 'additional' actions taken to physically reduce emissions together with all scheme transaction costs, divided by the actual greenhouse emissions abated. As noted above, the additionality of 'baseline and credit' schemes is always problematic. Transaction costs in baseline and credit schemes accrue on both scheme administrators and participants for accreditation, certificate creation, auditing, registry fees and trading. These transaction costs may be significant, particularly for small projects, because many schemes have rigorous auditing requirements. Relatively high transaction costs and low additionality would suggest low efficiency.

Price formation is also an important contributor to scheme efficiency. Baseline and credit schemes typically have lower liquidity than 'cap and trade' approaches because only emissions below the baseline create certificates. Lower liquidity causes problems for markets because it reduces their ability to reveal true marginal costs for taking action. Other types of market distortions are also possible under some design choices; for example, designs that give some participants considerable market power. Market prices that don't reflect true marginal costs reduce the economic efficiency of the scheme.

Dynamic incentives: Much, again, depends on specific scheme design. Baseline and credit schemes may give every participant a baseline, and either reward or penalise them according to whether their emissions go below or above this baseline. These schemes encourage every participant through both a 'stick' and a 'carrot'. More commonly, however, schemes effectively impose penalties across all participants – for example, by imposing liabilities upon energy retailers who pass these onto all their customers. Credits, however, go to those particular participants who effectively volunteer to undertake some action. A possible strength of this approach is that there can be strong incentive signals to willing and innovative participants.

There are, however, problems with this approach as well. Voluntary participation for credits tends to attract participants who are doing something that reduces emissions anyway. Those that are undertaking actions that increase emissions will stay well away, and the costs they impose on society are shared across everyone. Avoiding dangerous climate change requires a transformation that depends not only on what we do, but on what we stop doing. Unfortunately, there may be little incentive for participants to stop doing things that add to our problem.

Technical administration and practicality: As noted above, 'baseline and credit' schemes can involve considerable administrative burdens, particularly in establishing baselines. The transparency of the schemes is also a design choice both in terms of the schemes complexity, and in what information disclosure is involved.

Participants can be expected to continue testing scheme rules and rule-making processes by seeking accreditation for a wide range of different activities that can be argued to reduce emissions – their business activities can be, after all, a major potential source of competitive advantage. A scheme's administrative burden may continue.

Equity and competitive aspects: Again, scheme design can have significant impacts here. The flexibility of 'baseline and credit' is both an advantage – schemes can be carefully 'tuned' to resolve possible adverse competitive impacts – but also a potential problem if powerful stakeholders can influence rule design to exempt themselves from taking meaningful action. Schemes that effectively socialise costs imposed by some participants while privatising benefits that other participants deliver will always have equity concerns. Ensuring additionality is particularly important here or the scheme may end up delivering windfall profits to those participants who can earn credits without actually undertaking abatement action. The level of these windfall profits may be very large. Such an outcome also penalises those participants who genuinely wish to undertake innovative projects because they can't compete against 'freebies'.

We can now consider lessons to date from a number of existing 'baseline and credit' schemes with regard to the design choices noted above.

3.2 The NSW Greenhouse gas Abatement Scheme

Scheme design: The NSW Greenhouse Gas Abatement Scheme (NSW GAS) is the most significant state-based policy measure on climate change to date in Australia. It requires NSW electricity retailers and other liable parties to meet mandatory targets for reducing the greenhouse emissions resulting from the electricity they supply or use. These parties demonstrate compliance by annually surrendering NSW Greenhouse Gas Abatement Certificates (NGACs) for emissions above this target, or paying a penalty. NGACs can be created through certified generation demand side abatement and sequestration activities, as shown in Figure 1 and Table 4.

Figure 1: Design of the NSW Greenhouse Abatement Scheme

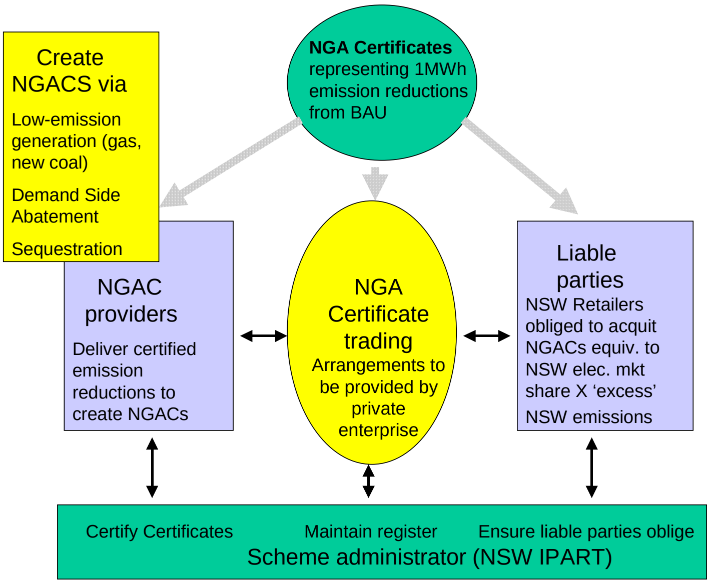
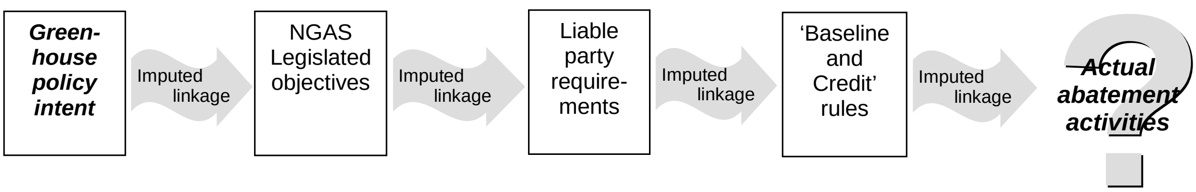


Table 4: Design of the NSW Greenhouse Abatement Scheme

feature	NSW GAS design
Coverage	Electricity-related emissions, although some sinks and non-electricity-related activities are included. A range of greenhouse gases is included. Tradeable instrument is the NGAC representing a notional tC02-e of emissions abatement.
Target	A ramping per-capita target translated into an NGA target for retailers by a complex series of abstracted calculations
Allocation	Liabilities allocated to retailers according to their market share of electricity sales. Certificates are created by voluntary actions by individual participants.
Flexibility	Banking and borrowing
Monitoring	NGACs created on project by project basis
Sanctions	Penalty (currently A$11 per NGAC of shortfall)

Environmental effectiveness: The scheme has been underway since January 2003 so there has now been some opportunity to assess its performance (MacGill et al, 2005). The scheme's target to reduce and then stabilise NSW's present per-capita electricity-related emissions does represent, on the face of it, a significant effort to begin action on climate change. Unfortunately, the complex 'imputed' linkages between the scheme's stated policy intent and the 'baseline and credit' rules, as shown in Figure 2, mean that physical emissions from the NSW electricity sector can continue to increase even while the scheme's declining State per-capita target is met and large numbers of NGACs are created.

Figure 2: The linkages between policy intent and abatement activities in NSW GAS.



The NSW scheme doesn't *explicitly* attempt to assess additionality at all.[2] While this approach avoids the enormous potential difficulties of actually trying to make this assessment, it does mean that the performance of the scheme can be brought into question. For example, over 95% of abatement certificates registered in 2003 appear to have come from installations that were built or committed well prior to the commencement of the scheme. No operational changes were required by these pre-existing projects to create the great majority of these NGACs following the scheme's introduction (Passey et al, 2005). Most of these activities, therefore, would not have reduced physical emissions from electricity sold in NSW from what they otherwise would have been. Additionality through to 2012, the scheduled life of the scheme, is difficult to estimate. Some scenario studies undertaken as part of this work, however, suggest that accredited activities that don't actually reduce emissions, policy overlap between NSW GAS and other Australian and State greenhouse related policy measures and new gas-fired generation in the Australian National Electricity Market driven by BAU demand growth, may mean that more than 70% of certificates will be non-additional (MacGill et al, 2005).

Economic Efficiency: Transaction costs are difficult to estimate for the scheme but are likely to be high given that the scheme administrator, the Independent Pricing and Regulatory Tribunal (IPART), has rigorous auditing requirements. Unfortunately, many of these audits may be ensuring compliance with rules that don't require additionality. This would be particularly unfortunate – high cost accreditation and auditing processes that don't necessarily improve the performance of the scheme. Relatively high transaction costs and low additionality suggest low economic efficiency for NSW GAS.

We have only limited information on the present market for NGACs. Current Australian Financial Markets Association (AFMA) pricing data suggests NGAC spot prices of around A$11, with forward prices rising to over A$14 for delivery in 2009 (MacGill et al, 2005). Liquidity appears to be relatively low, and the market is rather concentrated – there are three major buyers (all State Government-owned retailers) while 46% of 2003 NGACs were created by a single participant, who happens to be one of the three retailers.

Dynamic incentives: NSW GAS imposes targets upon electricity retailers and large energy users, and the costs of the scheme are therefore effectively spread across all energy consumers in the State. Most projects delivering certified abatement are coming from a growing (but still relatively small) number of private participants. There is no doubt that worthwhile and 'additional'

[2] Some early draft versions of the NSW scheme rules discussed the importance of additionality, however these were removed in the final scheme implementation.

projects are being facilitated by the scheme. Unfortunately, these must compete against the large amount of BAU projects that are also able to earn NGACs. Energy consumers in NSW who are increasing consumption effectively have the associated costs socialised across all consumers through general retailer liabilities. Because of generous baseline rulings, some very large emitters are actually able to earn significant numbers of NGACs for projects that are claimed to reduce emissions from the even higher levels they otherwise might have been.

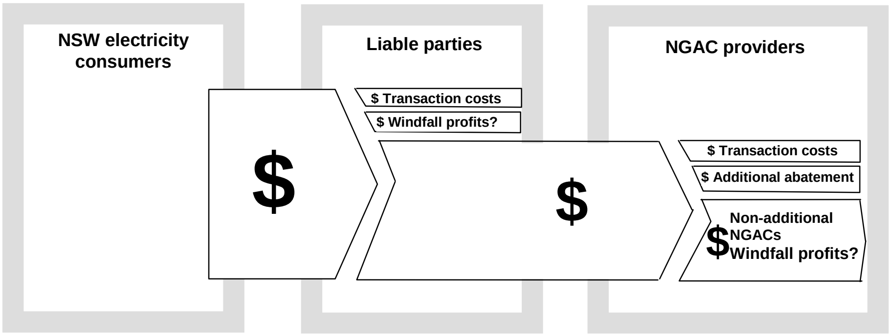
NSW GAS is the first emissions trading scheme to be introduced in Australia and has certainly caught the attention of many large energy consumers in NSW. A number have built up their institutional capacity to manage new obligations and opportunities under the scheme. Whether this provides 'early mover' advantage remains to be seen – both in terms of whether a multi-state or national scheme is established, and the compatibility of NSW GAS with such a new scheme. Its interesting to note that the UK ETS scheme which shares some common features with NSW GAS has been argued to have had mixed results in this regard (Sorrell, 2003).

Technical administration and practicality: The scheme has now been up and running for over two years, and there has been an enormous amount of effort in establishing the rules, accreditation and certification processes. These rules continue to be explored by participants with a wide range of projects.

Equity aspects: As noted earlier, the NSW GAS effectively privatises benefits and socialises costs and this can have significant equity impacts. The price impacts on energy end-users depend greatly on how much retailers are paying for NGACs, and how these costs are passed through to consumers, as shown in Figure 3. If end-users are paying close to current spot NGAC prices then the very low additionality of the scheme to date suggests considerable potential windfall profits to the certificate providers and/or retailers. Note also that some particularly large energy consumers have access to special arrangements where they can meet their obligations through non-electricity related activities that create Large User Abatement Certificates. The additionality of some LUAC projects to date is also questionable.

Competitive impacts: This has been a significant issue in the design of the NSW GAS. The NSW government implemented the scheme alone despite an interconnected electricity network that connects NSW with Victoria, Queensland, South Australia and the Australian Capital Territory. The potential to adversely impact on the State's competitiveness with the other States would seem to have played a key role in the scheme's design. Interestingly, NSW has the lowest electricity prices of any state.

Figure 3: Cash flow through NSW GAS.



3.3 The Clean Development Mechanism (CDM)

So far internationally two different baseline and credit based mechanisms have been developed under Kyoto's flexibility mechanisms: Joint implementation (JI) and the Clean Development Mechanism (CDM). They are different to the extent that projects take place in countries with different commitments and, consequently, they are subject to different project cycle requirements. The implementation of a JI project results in a transfer of credits from one Kyoto-liable country to the other, but the total emissions permitted in the countries remains the same (a "zero sum game"). CDM projects are to be hosted by developing countries (non-Annex I Parties to UN Climate Convention) which do not have quantitative emission reduction targets (a 'non-zero sum' game). We will focus here on the CDM.

The CDM was established with the dual purposes of assisting developing countries to achieve sustainable development while assisting developed countries in achieving compliance with their Kyoto targets (IEA, 2004). Assessment of the CDM's greenhouse reduction objective is led by the CDM Executive Board while the host country, alone, assesses the compatibility of the project with its sustainable development objectives. The design of the scheme is outlined in Table 5.

Table 5: Design of the CDM

feature	CDM design
Coverage	Projects in developing countries that reduce emissions. All greenhouse gases.
Target	No specific target.
Allocation	Credits awarded on project by project basis under strict assessment criteria
Flexibility	Banking
Monitoring	Project accreditation by the CDM executive board. NGACs created on project by project basis
Sanctions	A voluntary, credit only, scheme.

Although the scheme is only now being established there is a growing understanding of its likely performance. So far 12 CDM project activities have been registered, 7 have applied for registration and more than 23 baseline and monitoring methodologies have been approved. The total quantity of GHG emission reductions from registered project activities achieved through CDM is 5.4 $MtCO_2e$ per annum so far. However, a large number of projects are under development. The demand for credits is much higher – EU countries have indicated an annual demand for the Kyoto Mechanisms of around 100 $MtCO_2e$ in the period 2008-2012. Canada and Japan have indicated a demand of 100 and 20 $MtCO_2e/a$ respectively. It is important, nevertheless, to put likely CDM flows in perspective – these will be small relative to other foreign investment flows from developed to developing countries via Foreign Direct Investment and Official Development Assistance, although there is significant potential for leverage (IEA, 2004). The CDM therefore represents a fairly targeted ETS.

Environmental effectiveness: The CDM is supervised by the Executive Board which is has been up and running since Marrakech. Nuclear projects are excluded from creating credits under CDM and JI, and special conditions apply for sink projects in the CDM. JI and CDM projects must have the approval of all countries involved, and must lead to emission reductions that are additional to any that would have occurred without the project (Art. 12,5c KP). The Kyoto Protocol uses different approaches to demonstrate additionality:[3]

- Environmental additionality, which requires that the project leads to real emissions reduction against the baseline.

[3] More information on these additionality tests can be found on the CDM Executive Board website – www.cdm.unfccc.int.

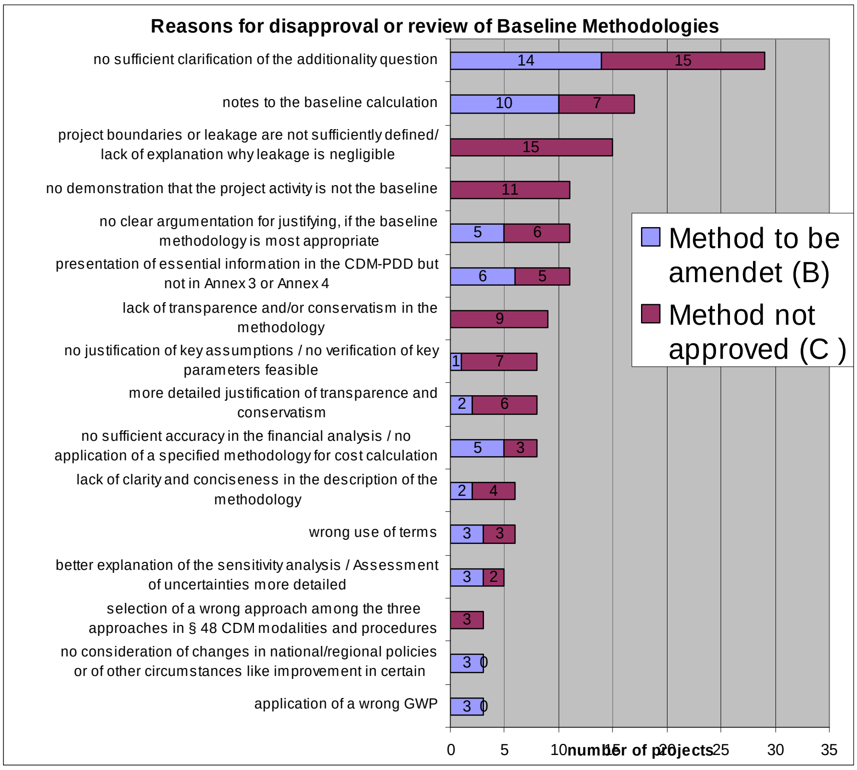
- Financial additionality (ODA): This is based on the Marrakech Accords and requires, that *„Public funding for the CDM [..] is not to result in the diversion of official development assistance"*.
- Investment additionality: This means that a project only becomes economic feasible due to its generation of credits. However, the interpretation of the Methodology Panel is that it is sufficient to demonstrate that the project is not the most economic feasible investment.
- Policy additionality: This means that the projects are not just complying with existing law and regulatory requirements or other governmental programs.

The difficulty in creating CDM projects lies in the additionality requirements. However, these are especially important, because non-additional projects would mean that global emissions are actually higher than they would be without the CDM. The Executive Board, which is the supervisory body of the CDM, is therefore assessing additionality very rigorously. Figure 4 shows that from the 74 new proposed methodologies baselines which have been assessed by the Executive Board (EB) by the beginning of 2005, 29 – around 40% - have been not approved, or need modifications because of additionality questions. Eleven projects have so far been rejected because the project participants were not able to demonstrate that the project activity is not the baseline – that is, the project would not happen anyway.

This has caused considerable controversy and a number of countries and business representatives have attacked the CDM EB for its work on ensuring that projects are truly additional. The ENDS Report (2003) highlighted concerns that;

> "Developers fear an unnecessarily strict approach to additionality will strangle the CDM by increasing bureaucracy and transaction costs. They are particularly opposed to so-called "financial" or "investment" additionality, which would require a developer to demonstrate that the project would not be financially viable without the extra revenue from the sale of credits. They argue that for many large projects, the additional revenue is unlikely to tip the balance, especially when CER prices are so low."

Figure 4: Reasons for disapproval of Baseline Methodologies by the Executive Board.



Source: UNFCCC, Methodology Panel decisions, February 2005.

In establishing the CDM it became clear that its additionality rules might actually have adverse as well as positive environmental outcomes. In particular, if a developing country introduces climate change regulation, it might be harder to prove that CDM projects there are actually additional. The CDM Executive Board has had to rule that additionality assessments will not take into account any policies in the energy sector after the Marrakech Accords were adopted (UNFCCC, 2004). In general, however, the CDM EB is to be congratulated on its rigorous and transparent additionality requirements that provide an example to other scheme developers on how it should be done.

The 'sustainable development' objective of the CDM also represents in some regards a measure of environmental effectiveness. There would seem to have been, however, a clear conflict between this objective and the CDM's other objective of providing low-cost abatement for developed countries. Almost all current and proposed emissions reductions under the CDM are coming from non-CO_2 reductions – primarily HFC and CH_4 reductions. Typically these projects involve large industrial facilities and have questionable sustainable development outcomes. They certainly do, however, represent low cost and additional abatement options. Sustainable development outcomes for projects are assessed only by the host country. Competition among developing countries for projects might lower requirements in a 'race to the bottom' for delivering project opportunities to developed countries.

Economic efficiency: By some measures the CDM has proved efficient. This has not, however, been in the way some had expected or hoped. As CDM Watch (2005) notes, there has been a "frequent complaint that CDM is 'not working' in that it is not driving sustainable development and not funding renewable energy projects …The real problem, conversely, is that it is working perfectly in doing what a market-based scheme is designed to do – discover and direct funding to projects that produce maximum carbon credits per dollar invested."

There are, however, certainly considerable transaction costs involved in CDM projects due to the rigorous project assessments involved, particularly with regard to additionality. The inevitable tradeoffs between rigorous additionality assessment and the ease with which the scheme can be used by project developers is a considerable challenge. The establishment of institutional capacity in developing countries to manage CDM projects is a valuable outcome but does also increase transaction costs.

Dynamic incentives: The CDM has certainly driven the development of abatement projects, increased awareness of greenhouse abatement technologies amongst investors, and strengthened the institutional capacities of many countries with regard to climate change. The use of a competitive market, however, does mean that highly innovation projects with strong 'sustainable development' outcomes have to compete against large projects on industrial facilities that involve little innovation but achieve very large reductions. The likely low price of such activities works against the availability of significant funding for highly innovative projects.

Equity and competitive aspects: The transfer of funding and abatement technologies from developed to developing countries is a valuable outcome for global action on climate change. The likely funds, however, are dwarfed by other financial flows so their impact can only be limited.

To date, CDM activity has focussed on a relatively small number of countries. As the IEA (2004) notes, "Many of the poorest nations that are unable to attract outside investment for other reasons also do not appear to be attracting significant interest in investment in CDM projects." This works against the scheme's 'sustainable development' objectives.

3.4 The UK Emissions Trading Scheme

The UK ETS was introduced in 2002 into a complex climate policy framework including an energy tax or Climate Change Levy (CCL), negotiated Climate Change Agreements (CCAs) that allowed participants to avoid 80% of this levy, and a range of other policy measures (Sorrell, 2003). The ETS was a pilot scheme, jointly developed by government and business that included direct participation in a 'cap and trade' auction to receive government subsidies, 'baseline and credit' trading by companies with a CCA, and possible project-based creation of credits – although this last form of participation stalled. The Scheme runs to end 2006 and is unlikely to continue given that the EU ETS began in 2005 and it has not proven possible to link its traded instruments with this much larger and EU-wide scheme. The scheme design is outlined in Table 6.

Table 6: Design of the UK ETS

feature	UK ETS design
Coverage	Voluntary participation for a range of greenhouse gases and types of energy intensive facilities.
Target	Direct participation absolute target emerged from an auction for government subsidies. CCA targets used for 'baseline and credit' trading. Total emission reduction targets of around 13 Mt CO_2-e in 2007.
Allocation	Voluntary participation. CCA allocation set by their negotiated agreements, direct participants by the incentive auction.
Flexibility	Banking up to 2007.
Monitoring	In accordance with IPCC, WBCSD and other standards. Independent third party verification.
Sanctions	Fine for excess emissions by direct participants, payment of full CCL for CCA participants.
Tracking	Registry maintained by UK government.

Source: based on Sorrell, 2003

Environmental effectiveness: The 'cap and trade' auction achieved commitments to reduce emissions in 2007 by 4Mt CO_2-e at a government subsidy of around 18 pounds per tonne. Nine bidders represented over 90% of this, largely based on non-CO_2 greenhouse gases. The actual environmental impact is, however, difficult to assess. Because participation was voluntary, it was always likely that the auction would attract companies who expected their emissions to be falling anyway. The very low post-auction price for abatement and clear oversupply supports this view. A National Audit Office inquiry concluded that around one third of emissions reductions achieved by the four participants who most over-achieved on their targets were non-additional (UK House of Commons, 2003). The House of Commons report concluded that "baselines need to be set according to a thorough understanding of participants' current performance and activity" and this had not occurred.

Most CCA participants have chosen relative targets – that is, baselines subject to production levels. Increases in production, and hence related emissions, may still be able to earn credit under these arrangements. It was estimated that reductions from a BAU baseline would be equivalent to around 9MtCO_2-e by the final year of the scheme. The weakness of targets has led to a situation of considerable over-compliance and oversupply in the market (Sorrell, 2003).

Von Malmborg and Strachan (2004) comment that the scheme "seems to have suffered from a very common problem: policy-makers in an attempt to secure industry support and cooperation become far too reliant on industry guidance, subsequently leading to regulatory capture and the extraction of concessions for industry cooperation."

Economic efficiency: The economic efficiency of the scheme does not appear to be particularly high. Direct participants received around £18/tCO_2-e yet these are now trading at well under £5/tCO_2-e (IETA, 2005). It is important to note that this auction was very different from proposed auctioning of allowances under a 'cap and trade' scheme because it was structured around a government incentive to 'accept' a physical cap rather than participant 'willingness' to pay for the right to emit greenhouse gases. The relatively small amount of trading by CCAs also suggests that trading has not provided particularly useful efficiency gains. Transaction costs are likely to have been high, and the government provided £215 million to encourage participation in the 'cap and trade' auction.

Interestingly, the proposed project-based participation in the scheme ran into difficulties because: proposed arrangements for estimating baselines and demonstrating additionality were extremely complex and certain to involve very high transaction costs; conflicts with existing policy measures risked double counting; the low carbon price provided little incentive since it didn't materially change the economics of most projects; and, finally, the EU ETS scheme was coming with linkage proposals that were unlikely to include the UK scheme (Sorrell, 2003).

Dynamic incentives: One of the objectives of the scheme was to establish the UK as an international centre for emission trading and educate participants in advance of the EU emissions trading (UK House of Commons, 2003). This has, to some extent, been achieved. However, it has also been argued that poor scheme design and its incompatibility with the EU ETS means that the "UK's early start in emissions trading may ultimately be judged a false start" (Sorrell, 2003).

Technical administration and practicality: The scheme is extremely complex, largely because of the need for it to fit alongside existing instruments. The scheme now faces challenging transition issues, and will largely cease to exist beyond 2007 (Sorrell, 2003).

Equity aspects: The windfall profits that accrued to some of the direct participants have already been noted. Interestingly, the UK House of Commons (2003) concluded that DEFRA should seek concessions from Scheme participants who benefited unduly from generous baseline provisions. A number have agreed to voluntarily give up some of their claimed abatement.

Competitive impacts: The CCAs for energy-intensive industry in the UK were negotiated with a view to potential competitive impacts. Some participants in some industries have certainly benefited from the scheme but it seems unlikely that many have suffered significant competitive impacts.

4 Lessons from experience to date: Cap and trade schemes

4.1 Design choices

In designing a cap and trade type system, design options are generally more limited that baseline and credit schemes.

Coverage: The first key consideration for the scheme is which entities and gases will be covered and held liable to surrender allowances. Usually three main options exist: upstream, downstream or a hybrid model. Under an upstream system the producers, processors or transporters e.g. of fossil fuel, are required to surrender allowances for the CO_2 emissions embodied in the fuel processed, transported or sold. Under a downstream approach the fuel users (e.g. power generators or industrial facilities), which are the direct emitters, are required to surrender allowances according to their emissions of the relevant period.

Further, it has to be decided if CO_2 only, or all 6 Kyoto gases are covered. The decision will depend on monitoring options, costs and accuracy. Some opt-in and opt-out provisions might aid to flexibility, meaning that some of the entities and gases might be temporarily excluded or included (FIELD, 2000).

Allocation: The second consideration to be taken is how the allowances are allocated (distributed to the covered entities). This occurs in both upstream and downstream systems. Usually three main options exist: free allocation, auctioning or a hybrid model. In this context it is important to remember that allowances have not only to be allocated to existing entities, but also to new entities that enter the market. New entities may have to buy allowances on the market or via specific auctions, or they may receive allowances free of charge from a special reserve.

If existing entities have to buy allowances from an auction, new entrants will most likely have to buy them from the market or from an auction too. However, if existing entities are allocated for free, new entities might still have to buy their allowances from the market (as occurs for the US Acid Rain Program). In general, when an installation closes, allocation may be terminated or continued. This however, depends again on the allocation method for existing installations. If existing installations have paid for the allowances by buying them from a periodic auction, a closing installation will most likely be able to keep their allowances. If they are going to be allocated annually for free, the allocation may be kept for the remaining part of the year and then terminated. Freed allowances may be transferred to the reserve.

In addition, it has to be decided whether early action is going to be taken into account, and if so, how (e.g. use an early base period or receive a special allocation). Other exceptions might be considered – for example, how to encourage cogeneration, and how to treat emissions changes caused by separate legislation (DIW/ Öko-Institut/ Fraunhofer 2003).

Flexibility, monitoring, sanctions and technical aspects: In addition to the allocation method, the frequency of issuance and surrender of allowances have to be decided - both can be annually or less frequently. Banking and borrowing can introduce some flexibility into the system. Entities would be able to bank surplus allowances for use in the future or take future allocation to comply with an earlier year's targets. In order to function well, a cap and trade system requires monitoring, verification and reporting of past emissions as well as enforcement procedures in case of non-compliance. Feasibility of monitoring options might vary by gas and entity, which will also impact on the reporting frequency and process. Penalties for an allowances deficit can either be low to cap the costs of compliance or high to ensure compliance. The following table summarises the different design options.

Finally, technical issues such as the registry have to be decided, which will track the transfer of allowances between entities.

Table 7: Key design features for cap and trade ETS

Feature	**Options**	
	From …….	**To**
Coverage:		
Liable entity	Upstream	Downstream or hybrid model
Gas	only CO_2	all 6 Kyoto gases (CH_4, N_2O, SF_6, Industry gases)
Flexibility	Opt-in for entities or gases	Opt-out for entities or gases
Accountable unit	Internal units (allowances)	Other units e.g. Kyoto Units
Target	relative	absolute
Unit	Allowances valid for 1 period to emit 1 t CO_2e	Long-term allowances
Allocation:		
existing entities	100% Auctioning	100% free
new entities	Buying on the market	Free allocation (Reserve)
Early Action	No credit	Taking it into account
Exceptions	No exceptions	Allow for exceptions
Treatment of closure	Allocation terminates	Allocation continues
Flexibility	banking / borrowing provisions	no banking / borrowing provisions
Monitoring/ reporting / verification	Continuous measurement and online reporting	Annually estimating of emissions and verified reports
Sanctions	Price cap	Deterrent sanctions
Technical aspects	Annual issuance and surrender	Periodical issuance and surrender
	Full electronic registry according to Kyoto	Simple Excel tool

4.2 Kyoto Protocol

4.2.1 Design

Coverage: Article 17 of the Kyoto Protocol (KP) allows for trading of Kyoto Units covering all six Kyoto gases. The allowance allocation (cap) was set by the targets established under Annex B of the Kyoto Protocol, which allocates each Annex B Party a fixed amount of allowed emissions in the first commitment period 2008-2012. This cap is called an assigned amount, whereby one assigned amount unit (AAU) equals one tonne of CO_2e. AAUs can be traded under the rules of Article 17 KP. Besides these AAUs, other Kyoto units include Emissions Reduction Units (ERUs) from JI projects, Certified Emissions Reductions (CERs) from CDM projects and Removal Units (RMUs) generated through Article 3.3 and 3.4 KP (internal sink enhancement).

Each of these units can be used for compliance by Parties to the Kyoto Protocol. Differences only exist for forestry-related CERs or so called ‘temporary CERs’ and in banking the units – that is, transferring surpluses in allowances in future commitment periods.[4] To be eligible to participate in international emissions trading under Article 17 KP, countries must have:

- ratified the Kyoto Protocol,
- calculated their assigned amount, as referred to in Articles 3.7 and 3.8 and Annex B in terms of tonnes of CO_2-equivalent emissions,
- put in place a national system for estimating emissions and removals of greenhouse gases within their territory,
- established a national registry to record and track the creation and movement of ERUs, CERs, AAUs and RMUs, and
- provide annual reports on emissions and removals to the UN Climate secretariat.[5]

The monitoring and reporting is based on the Intergovernmental Panel on Climate Change (IPCC) guidelines on good practice, and review teams periodically verify the data. Sanctions only apply after a grace period of 100 days, which starts after the expert review of the final annual emissions inventory has been finalised. If, at the end of the grace period, a Party’s emissions are still greater than its Kyoto Units in its registry, it must make up the difference in the second commitment period, plus a penalty of 30%. It will also be barred from ‘selling’ under emissions trading and, within three months, it must develop a compliance action plan detailing the action it will take to make sure that its target is met in the next commitment period.

In order to address the concern that an Annex B Party could ‘oversell’ any units, especially in the absence of financial penalties for non-compliance, each country has to maintain a so-called commitment period reserve (CPR). The CPR is to consist of an appropriate amount of Kyoto Units, and Parties are not allowed to fall below this special reserve in any time.[6] The provisions for monitoring, reporting and verification are at the country level and issuance and surrendering are done periodically.

Nation parties to the Protocol may authorise legal entities to participate in trading under Article 17 KP, but the Party itself remains responsible for the fulfilment of the Kyoto obligations. In summary, the Kyoto Protocol provides the framework for trading, but it is left to the discretion of each Party whether to allow entities to participate in trading under Article 17 or wether a domestic emission trading scheme is favoured without direct link to the international system. Table 8 gives an overview of the emissions trading provisions under Article 17 KP.

[4] For CERs and ERUs there is a banking restriction of 2.5% of the assigned amount of a country. RMUs are not bankable at all (UNFCCC, 2001).

[5] For the first Kyoto Commitment Period special conditions apply to sink reporting. Only those categories of sinks that meet these requirements can be counted.

[6] There are two options to calculate the reserve: either 90% of the countries assigned amount or the level of national emissions indicated in the countries most recent emissions inventory (multiplied by five, for the five years of the commitment period). The first calculation is likely to be relevant to Annex B Parties which prove, at the end of the commitment period, to be “net buyers” of units under the mechanisms. The second calculation option is likely to be relevant to Annex B Parties which prove, at the end of the commitment period in 2012, to be “net sellers” of units under the mechanisms.

Table 8: Key design features of Article 17 KP

Feature	Article 17 KP
Coverage:	
Liable entity	Annex B Parties to the KP
Gas	All 6 Kyoto gases
Flexibility	Legal entity may be authorised
Accountable unit	Kyoto Units: AAUs, ERUs, CERs (tCERs and lCErs), RMUs
Unit	1 t CO_2e
Target	Absolute target based on KP
Allocation:	Free of charge based on negotiated Kyoto targets
Flexibility	Borrowing between periods not allowed, banking allowed
Monitoring / reporting / verification	Based on national inventories (IPCC guidelines), which have to be annually reported to UNFCCC and review procedures
Sanctions	Penalty rate of 30% applied on target for next commitment period and national action plan.
Technical aspects	Periodical issuance and surrender
Special provisions	Commitment Period Reserve

4.2.2 *Assessing scheme performance*

Since the Kyoto Protocol has entered into force only recently (February 2005) there is only very limited experience with emissions trading according Article 17 KP to date. Unless the assigned amount is established and Marrakech eligibility requirements are met, AAUs can only be traded on a ‘forward contract’ basis. The following evaluation, therefore, is based on the chosen design.

Environmental performance is assessed by looking at the actual target (relative or absolute), the robustness and accuracy of the monitoring, reporting and verification rules, the stringency of sanctions, and the enforcement procedures in place. The Kyoto Protocol sets an absolute target, and monitoring, reporting and verification requirements seem sufficient to ensure some confidence in the value of the traded units for emissions reductions. However, the inclusion of land-use, land use change and forestry projects (RMUs) into the system – even though quantitative restrictions apply for Article 3.4 forest management activities – is negatively impacting environmental performance criteria. This is because accurate monitoring is far more difficult with land management activities, and the permanence of these types of activities is questionable. Finally, there seems to some risk that the scheme will fail to meet its targets given the lack of deterrent sanctions, although the Commitment Period Reserve reduces this risk to some extent.

Economic efficiency should be enhanced by the wide range of sources and gases covered by the scheme. However, in order to meet their targets at least-cost, Kyoto Annex B Parties would need to know the marginal abatement costs of all sectors within their country in order to implement domestic measures accordingly. Inefficiencies will most likely occur due to lack of knowledge about these marginal costs. A domestic emissions trading scheme may help uncover marginal costs for the sectors it covers.

The **dynamic incentive**s driven by this international trading regime will depend on the domestic policies implemented to meet national targets. The **technical practicality** of the scheme at the country level seems reasonable, since it requires little additional effort compared to the situation without trading. The only additional effort is the implementation of a national registry. However, the costs that arose when this was negotiated were far higher than necessary – largely because almost all developed countries were involved. To avoid the establishment of a number of different registries and consequent negotiations to harmonise them, designing and setting up the registry should have been given to a single technical consortium from the very beginning. Furthermore, there is a point where the costs of extensive reporting requirements outweigh the benefits of increased transparency.

Equity aspects are difficult to assess, since the targets were politically negotiated and agreed by consensus. It is almost certain that the agreed country targets put some at disadvantage although this can't be blamed on the trading provisions but is more a consequence of the target negotiations. Similar arguments apply to the **competitive impacts**. They will depend on the domestic measures introduced in order to meet the target. Trading might be one option which would lower the costs, thereby reducing overall compliance costs, but the final allocation might result in distributional effects that lead to competitive distortions.

Table 9: Evaluating emissions trading under Art. 17.

Criteria	Assessment
Environmental performance	+ absolute target + monitoring and reporting - inclusion of land-use, land use change and forestry activities - sanctions
Economic efficiency	depend on domestic implementation
Dynamic incentives	depend on domestic implementation
Technical administration/ practicality	+ little additional efforts
Equity aspects	depend on domestic implementation
Competitive impacts	depend on domestic implementation

Scheme design for each criteria is assessed as '-' (poor) or '+' (good)

In summary, trading based on Article 17 KP will help to reduce overall compliance costs of the Kyoto Protocol, however its enforcement systems and political acceptability could be improved.

4.3 European Union ETS

4.3.1 Design

Emissions trading in the European Union (EU-ETS) started in January 2005, and covers the CO_2-emissions of more than 11,000 installations from the energy and most other carbon-intensive industries.[7] It covers about 52% of total EU CO_2-emissions or 43% of emissions with respect to all six Kyoto gases.[8] The EU ETS is considered to be the world's largest company-based emissions trading program and is expected to help the EU and its Member States (MS) fulfil their obligations under the Kyoto Protocol in a cost-efficient way.

The key design features of the scheme were set by the European Emissions Trading Directive (2003/87/EC) which came into force in October 2003. To be able to adapt and up-date the system in the future (for example, phasing in Kyoto gases in addition to CO_2), the Directive specifies different periods to allow for an interim evaluation. The initial trading period started in 2005 and will end in 2007, and covers only CO_2. The second period will begin in 2008 and end in 2012 (in conjunction to the first Kyoto commitment period) and will enable Member States separately to include greenhouse gases other than CO_2. Any extension of the scheme would have to be proposed by the Commission. The first period is sometimes referred to as a "pilot phase", since sanctions are lower (40€/t CO_2e) compared to the following five-year periods (100€/tCO_2e). However, non compliant entities will be publicly notified and have to surrender any missing allowances in later years. Technically, compliance is required on an annual basis within the periods.

The EU ETS allows operators to use credits generated by the project-based mechanisms of the Kyoto-Protocol for compliance. However, the so called 'linking Directive' (2004/101/EC) accounts only for the use of CERs and ERUs, while excluding sink and big hydro projects (CEC 2004b). Assigned Amount Units (AAUs) are not eligible for compliance, thus 'hot air' from Russia is kept out of the EU ETS.[9] Moreover, Member States have to specify a quantified limit for the use of Kyoto Units for their installations in order to meet the supplementarity criteria of the Kyoto Protocol.[10]

Although the Directive sets out harmonised key design features for the Member States, internal allocation of allowances, which is politically most difficult, had to be solved by the individual Member States in developing a National Allocation Plan (NAP). In order to avoid competitive distortions the Directive set an upper limit for auctioning. Member States were allowed to auction up to 5% of the ET-budget in the first period (2005-2007) and up to 10% in the second period (2008-12).

In addition, the Directive requires Member States to demonstrate in the NAP that the total quantity of allowances to be allocated is consistent with their Kyoto target, and how these allowances will be allocated to each individual installation. The NAPs had to be based on objective and transparent criteria which have been specified in Annex III of the Directive and have to be approved by the European Commission, usually one and a half years before the period starts. The second NAP will have to be submitted to the EU Commission by mid 2006 for approval.

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[7] The types of installations to participate in the ET-ETS are listed in Annex I of the Directive and include combustion installations with a rated thermal input capacity of at least 20 MW, refineries, coke ovens, steel plants, and installations to produce cement clinker, lime, bricks, glass, pulp and paper if they exceed certain output thresholds.

[8] Total (CO_2) emissions of the EU ETS sector in the base periods (which are different for each country) were around 2,084.2 Mt CO_2. However total EU GHG emissions (all six gases) were around 4,857.8 Mt CO_2e, whereas CO_2-only was around 3.976,5 Mt CO_2 (European Environmental Agency, 2005).

[9] Where Kyoto targets allow for a great surplus of AAUs, as is the case for Russia and the Ukraine, this is referred to as "hot air".

[10] According to the Marrakech Accords, use of flexibility mechanisms can only be "supplemental" to domestic action; therefore Parties to the Kyoto Protocol have to limit the use of the Kyoto Mechanisms by their companies, which in turn depends on the government's own use of the mechanisms.

To assist Member States in developing their NAP the European Commission issued a guidance document (see CEC, 2004a). Nevertheless considerable differences in interpretation emerged. The Directive also allows for the unrestricted transfer of surplus allowances into future years with one possible exception: according to the principle of subsidiarity, individual MS may decide whether they prefer to restrict banking from 2007 into the second commitment period starting in 2008. This is because such banking could make if more difficult for countries to meet their Kyoto target.

To ensure the credibility of the traded unit, the European Commission (CEC, 2004d) has released legally binding harmonised rules for monitoring, reporting and verification (2004/156/EC). These are based on a tier system that defines a hierarchy of different verification levels for monitoring emissions. The higher the tier chosen, the higher the level of specificity and accuracy required. In the first commitment period low emitting installations usually only need to fulfil lower tier levels. However, the operator must, in principle, apply the highest tier level, unless they can demonstrate to the responsible authority that this is not technically feasible or would lead to unreasonably high costs. Reports have to be verified, and this is usually done by independent verifiers. Since there are no harmonised criteria for accrediting verifiers, accreditation requirements differ between Member States.

Each Member State needs to have its own national registry (or one set up in conjunction with another Member State) which has accounts to track the allowances of each regulated installation or voluntary participant under the scheme. These different MS registries are interlinked through the Community Independent Transaction Log (CITL), operated by the European Commission, which records and checks every transaction. National registries must, at the same time, fulfil the European Commissions' (CEC, 2004c) and Kyoto Protocol requirements, in order to enable MS to trade Kyoto Units and EU allowances simultaneously. From 2008 onwards EU allowances will consist of specially tagged AAUs, therefore transfers of EU allowances will be backed up by corresponding adjustments of the assigned amount of the involved countries.

Table 10: Key design features of EU ETS

Feature	EU ETS
Coverage:	
Liable entity	Operators of installations of Annex I
Gas	Only CO_2 1st period Opt-in of further gases in 2nd period
Flexibility	Opt-in and Opt-out provisions for installations, to be approved by EU Commission
Accountable unit	EU allowances and ERUs, CERs excluding sinks and big hydro
Unit	1 t CO_2-e
Target	Absolute
Allocation:	At least 95% for free in 1. period At least 90% for free in 2. period Varies among member states
Flexibility	Borrowing between periods not allowed, restricted banking from 1st in 2nd period. From 2nd period unrestricted banking.
Monitoring / reporting / verification	Based on EU monitoring guidelines (tier approach), annually verified reports to national authorities
Sanctions	1. period: 40 €/t CO_2-e + subsequent surrender + public notification 2. period: 100 €/t CO_2-e + subsequent surrender + public notification
Technical aspects	Annual issuance and surrender, tracking of units by electronic registry

4.3.2 Assessing scheme performance

The EU ETS commenced operation in 2005. Experience to date is therefore limited and this assessment focuses mainly on establishment of the scheme and its chosen design. We begin with a discussion on allocation, followed by an appraisal with regard to our standardised assessment criteria. The total allocation (ET-budget) in the first period is 2,190.8 $MtCO_2e$/a (3 year period: 6,572.5 $MtCO_2e$), including reserves for new entrants of 107.5 $MtCO_2e$/a (4.9% of allocation). Comparing this total allocation against BAU projections by Member States for the first trading period shows a shortfall of 3%. This is due to the European Commission, which reduced the total EU-budget by 68 Mt CO_2e/a compared to the initial NAPs submitted by the Member States.

Only four EU MS (Denmark, Hungary, Ireland and Lithuania) decided to auction off parts of their ET budget – a total of only 4.4Mt of CO_2/a or 0.2% of the entire ET budget in the EU. Since allocation to newcomers influences the location for new investments, an implicit harmonisation across MS took place in the sense that all MS created newcomer reserves in their NAPs so that new entrants could receive free allowances. Only Sweden requires some operators of new installations - new power plants in the electricity sector (but not cogeneration plants) - to purchase allowances on the market. To calculate the allocation for new entrants, the specific emission factors from best available technologies (BAT) or benchmarks are multiplied by projected output. Only eight MS have published benchmarks for particular technologies, primarily for electricity generation, in their NAPs.[11] A comparison of these values shows significant variations across countries, which may be explained by the underlying reference technologies, assumed load hours and fuel inputs. The Directive requires that allowances can only be allocated to installations which operate under a permit to emit greenhouse gases (Article 11 in combination with Article 4; CEC, 2004a). By their nature, closed installations cease to have permits and therefore no further allowances can be allocated. While countries differ in the definition of a 'closure', a closure of an installation during the first period generally means that allocation will be terminated in the year following the closure. In about half the MS, the transfer of allowances to a new installation is permitted, however – if MS provide any details at all – the transfer is typically restricted to the same type of installation or product group, to the same operator, and for a few years only. In some Member States special allocations provisions have been granted for cogeneration, early action and process-related emissions as well as for emissions changes due to other EU legislation (e.g. renewable energy targets or restrictions in sulphur content in fuels).

Regarding banking, with the exception of France and Poland, all Member States have banned the banking of allowances from the first to the second commitment period. The reasons are that they fear to miss their Kyoto targets and it seems technically difficult to estimate by mid 2006 – the date the National Allocation Plan for the next period has to be submitted – which amount will be banked. France and Poland allow for limited banking where the individual limit is related to emissions reductions from actual investments (Schleich / Betz, 2005).

Environmental performance: The EU ETS is expected to have a high environmental performance based on its sound overall architecture. Absolute targets for CO_2-emissions and exclusion of sources or gases that are difficult to measure, as well as sink-projects seem to be a reasonable approach for the first period. In addition, robust monitoring and reporting requirements as well as deterrent sanctions will help, as will prohibition of companies counting AAU against their target. Exclusion of AAU limits, for example, the extent to which "hot air" can be used to meet targets.

Economic efficiency of the chosen scheme design seems to be less favourable, although inclusion of the Kyoto Mechanisms will increase access to low-abatement-cost actions in non-EU countries. However, there will be a quantitative restriction from 2008 onwards to reflect the supplementarity requirement.

[11] France: 900 g CO_2 / kWh, Germany: 365-750 g CO_2 / kWh, Lithuania: 551 g CO_2 / kWh, Belgium/Flanders: 500 g CO_2 / kWh, Italy: 396-1.531 g CO_2 / kWh and 555 g CO2 / kWh, Denmark: 342 g CO_2 / kWh, Sweden: 265 g CO_2 / kWh, UK: gas-based benchmark for 5 distinctive technologies.

There are two key reasons to believe the scheme design won't lead to a high degree of economic efficiency. The first is the partial coverage of the scheme. This would not be a problem if equalisation of marginal mitigation costs and potential had been the basis for sharing the targets between covered and non-covered sectors. However, it seems that in most countries large reductions will be required in non-covered sectors (households, transport), as well as through high investments in Kyoto Mechanisms. This may lead to inefficiencies since marginal mitigation costs might be much higher in these non-covered sectors compared to the trading sector.

The second reason is that current prices seem not to reflect actual abatement costs. In addition, current prices for EU allowances seem far above actual abatement costs and don't reflect long term equilibrium prices according to supply and demand on the EU ETS. The huge gap between prices of CERs (CDM-Units) and EU allowances is difficult to explain especially since they are fully fungible for the first period (no quantitative restrictions apply). EU Allowances have been traded in 2004 at 7-9€ reaching a peak of 29€ in May 2005 (see Figure 5). On the other hand, CERs have been traded at a weighted average of $US5.63 in 2004 (around 4.5€) (World Bank / IETA 2005; p. 27). One could blame the higher delivery risk for such credits as the reason for the price spread. However, the above mentioned prices are based on contracts where registration risk is taken by the seller. Another reason might be the early stage of the CER market, which makes a timely guarantee of delivery difficult, especially for 2005-2007 vintages. An analysis of current registered CDM-projects shows they are planning to deliver CERs from 2005 onwards. However, a scarcity of early CERs should be reflected in the prices and lead to an increase of the value of early CERs which would decrease the price gap between CERs and EU allowances. Finally, technical reasons – for example, the lack of the CDM registry to issue CERs which prevents spot trading – might be responsible. However, CERs and EU allowances are traded as shown in Figure 5, and technical problems have not prevented these trades so far. In conclusion, these arguments seem rather weak to explain the price gap between CERs and EU allowances. Another reason could be that the prices are being manipulated in some way. The following arguments would seem to support this view:

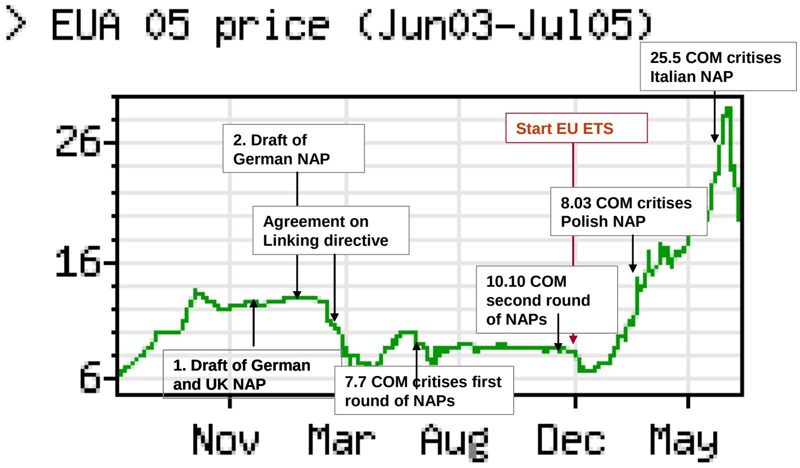
- Under low trading volumes it is much easier to manipulate prices. The low level of trading might be because borrowing within the period 2006-2007 is allowed, and so companies don't need to buy allowances today. If this is the case, higher trading volumes will be seen in the beginning of 2008 because banking between the first and second periods is not allowed, and this will most likely lead to a price decline. The low trading volume might also be explained by experimental economics studies (Nolles, 2005), which suggest that the holding costs of generous allocations of grandfathered allowances are low and their opportunity costs are not properly taken into account. This can then lead to lower trading volumes and higher prices.
- There is some evidence that companies would like to show that emissions trading is not functioning and that the market mechanism is not working.[12]
- Since National Allocation Plans for the period 2008-2012 are to be submitted to the EU Commission by mid 2006, companies might receive some advantage should high trading prices influence the allocation in 2008-2012.

Dynamic incentive: Since the overall allocation appears rather generous, allowance prices over the period are expected in the long run to be low, in particular since almost all MS prohibit banking into the second period. Thus, price-induced innovation effects will be weak. Similarly, the auction shares are too small to have any innovation effects. Closures result in a loss of allocation, providing disincentives for innovation because old plants are kept open rather than replaced with more efficient plants that would benefit from the retained allocation. In several MS these disincentives are softened because allowances may be transferred to new installations. New entrants typically receive allowances for free based on specific emissions and projected output. These specific values are either based on benchmarks for homogenous product groups or depend on best available technologies, thus limiting incentives for efficient new plant as they

[12] "Emissions trading is not yet showing the desired effects" according to Johannes Teyssen, chief executive of Eon Energie and board member of E.ON. (Point Carbon 26 July)

don't benefit with respect to existing less efficient plant. In some countries a plethora of benchmarks within the same product categories threaten to thwart the flexibility provisions of the EU-ETS. Finally, future allocation rules are vastly unknown, amplifying the uncertainty about the benefits of new investments. In conclusion, existing allocation rules provide only modest incentives for innovation (Schleich and Betz, 2005).

Figure 5: Price Development of EU Allowances



Source: Evolution Markets, 2005

Technical administration and practicality which impact on the transaction costs of both the administrative body and the companies, depend greatly on how it is implemented. Firstly, the large number of small installations with very low emissions covered by the scheme results in high transaction costs. Taking Germany as an example, around 2000 installations are covered yet 75% receive less than 50,000 tCO_2 of allowances per year. In addition, about 90% of the allowances are allocated to 10% of the installations with the highest emissions, in particular to the large power producers RWE, Vattenfall and Eon. It is likely that transaction costs would be significantly reduced by increasing, for example, the threshold for combustion installations from 20 MW to 50 MW (Schleich and Betz, 2004). Secondly, the ambiguous split of administration between the federal and the state level makes decisions difficult and increases uncertainty for companies (since rules take much longer to be agreed). Thirdly, the very complex allocation rules with around 60 variations have increased the number of legal cases dramatically (1,500 legal cases). This may not be representative of other European countries that may have chosen a less cost-intensive way of implementing the directive. Finally, the costs of linking and making all the national registries compatible could have been reduced if one institution such as the European Commission had taken responsibility for this.

Equity aspects: There is potential for wind-fall profits for electricity producers because of the free allowance allocation chosen in almost all NAPs. Electricity producers may reflect the opportunity costs in setting their electricity prices, even though the allowances have been allocated free of charge. Thus they may increase their electricity prices a similar amount to the situation where allowances were auctioned, and will benefit from higher electricity prices. This could lead to significant wealth transfer between consumers and producers and hence impact negatively on equity. In practice, the actual ability of generators to pass on opportunity costs through electricity prices depends on other factors (e.g. the market situation, elasticities and the shape of marginal cost curves). In a functioning competitive market, new entrants will be entering the market and so electricity producers might hesitate to pass on the full allowance price to consumers. Finally, one has to acknowledge that higher electricity prices are an actual aim of emissions trading in order to increase the incentive for energy savings. However, a wealth transfer from consumers to producers is the core of the problem and would be eliminated if electricity producers were obliged to buy the allowances instead of getting them for free.

One of the major problems of the implementation of the Directive is the different interpretation of Annex I of the EU ETS Directive by MSs. This Annex lists the activities to be covered by the EU ETS. Most MSs interpret their national implementation of the EU-Directive based on Integrated Pollution Prevention and Control (IPPC),[13] and include installations as requested by the Commission. However, since MSs differ in their implementation of the IPPC Directive and thus Annex I of the EU ETS Directive, unequal treatment of otherwise equal installations may lead to **competition distortions.** For example, in Germany, Poland and Luxembourg, steam crackers and melting furnaces are not (or would not be) covered, since the definition of combustion installation covers only activities which transform energy carriers into secondary or primary energy carriers such as electricity, heat or steam (Betz et al, 2004).

The experience gained in establishing the European market demonstrates that the guidelines of the Directive have not been sufficient to eliminate distortions. Currently the following harmonisation issues are being discussed informally by EU Member States to improve the system in 2008-2012 without a modification of the Directive itself:

1. Definition and thresholds for combustion installations
2. Treatment of small installations
3. Enlargement of regulated activities on other sectors and other GHG
4. Benchmarking

Table 11: Evaluating the EU ETS

Criteria	Assessment
Environmental performance	+ absolute target + monitoring and reporting, only CO_2, no sinks + deterrent sanctions
Economic efficiency	- partial coverage, burden sharing between covered and non-covered sectors seems not be based on marginal abatement costs - price seem not to reflect abatement costs + inclusion of Kyoto Mechanism
Dynamic incentives	- grandfathering, termination of allocation after closure (no opportunity costs) - uncertainty about future allocation rules + transfer rules to replace installations
Technical administration/ practicality	- a high number of small installations - Germany rather high: legal action against allocation decision and fees - different registries and harmonisation effort
Equity aspects	- windfall profits for electricity generators
Competitive impacts	- Different interpretation of Annex 1 of the Directive will lead to different coverage - Since allocation rules are almost not harmonised EU wide, there are major competitive impacts expected

Scheme design for each criteria is assessed as '-' (poor) or '+' (good)

[13] The purpose of the IPPC Directive is to minimise pollution from various point sources throughout the EU. All installations covered by Annex I *of* the Directive must obtain a permit from the national authorities, or else they are not allowed to operate. These permits have to be based on the concept of Best Available Techniques (or BAT).

5 Key questions for ETS in Australia

5.1 Emissions trading in Australia

The Federal Government's Australian Greenhouse Office (AGO), amongst others, has given considerable thought to how an ETS might be implemented in Australia (AGO, 1999). The CoAG (2002) Energy Market Review called for a national emissions trading scheme to replace an existing range of greenhouse-related policy mechanisms. An AGO submission responding to a request from the CoAG review made a number of recommendations on how such a scheme might be established. They recommended a 'cap and trade' scheme for fossil-fuel combustion-related emissions (AGO, 2002). Although the Federal Government announced in its 2004 Energy White Paper that it would not implement an ETS, Australian State and Territory Governments have declared their intention to investigate the development of a multi-jurisdictional ETS.

They established a working group in 2004. Its first report established a number of design propositions on which to base further investigations by the State and Territory Governments (Inter-jurisdictional Emissions Trading Working Group, 2004). The terms of reference for an ETS were that it:

- Provide a framework to reduce emissions
- Assist in meeting Australia's Kyoto target
- Position us for a carbon constrained future
- Reduce emissions beyond 2012
- Allow for international consistency
- Focus on energy but allow expansion
- Minimise compliance and administration costs.

The working group made its first report to Ministers in December 2004 with ten key design propositions for their consideration. Governments endorsed further investigation and analysis based on these design propositions in March 2005. These are discussed in Table 12.

Table 12: Chosen design principles for a multi-jurisdictional ETS.

Principles: The system should be….	Our comments
based on a **cap and trade** approach	A cap and trade system has significant advantages over 'baseline and credit' approaches to emissions trading (AGO, 1999; MacGill et al, 2005).
national and sector based	The greater the coverage of the scheme, both across states and across sectors, the greater the opportunity to maximise the environmental effectiveness and economic efficiency of the scheme. Market power issues are also reduced. However, some approach is needed to allow the scheme to be implemented even if one or more states choose not to be involved, or place excessive conditions on such involvement. Also, some sectors are unlikely to be appropriate for inclusion because of measurement and fungibility challenges.

Principles: The system should be….	**Our comments**
have a cap and consideration should be given to the **overall national emissions abatement target**, and how the abatement responsibility is allocated between sectors covered by the scheme and those outside the scheme	A physical cap is vital for the effectiveness of the scheme and needs to be established with regard to both short and longer term national emissions abatement targets. When allocating abatement responsibility between covered and non-covered sectors, their relative abatement costs are a key consideration. In order to enhance the incentives for innovation and increase investor certainty, allocation rules and caps should be decided for a longer period. Five years periods have proved to be too short for most industries with 20-30 year investment cycles. Finally, the risk of any updating (based on emissions) in the future will reduce the incentive for innovation.
initially cover the **stationary energy sector (including electricity, gas and coal)**	It is not clear why transport should not be included – the AGO (2002) suggests that all fossil-fuel combustion sectors including transport be included in an ETS. The report does not specify if the stationary energy sector should be covered by an upstream, downstream or hybrid approach. The EU experience with downstream coverage suggests that it might be more favourable to exclude small sources and focus on the larger emitters given administration and transaction costs – both regulator and industry. There is not much experience with upstream allocation although some discussion has taken place in the US (PEW Centre, 2003; Hargrave, 2000). It can be argued that an upstream approach will achieve higher economic efficiency and environmental effectiveness because it permits broader coverage (if it takes the transport sector into account). However, a well designed downstream approach is potentially superior in setting dynamic incentives, increasing market liquidity and decreasing market power (Betz, 2003).
cover all **six greenhouse gases** under the Kyoto Protocol	Non-CO_2 greenhouse gases were excluded from the EU ETS because of measurability concerns. Methane emissions associated with coal mining could be picked up in an upstream approach. However, there seems to be an inconsistency in covering all 6 Kyoto gases while focussing on the stationary energy sector. To include industrial gases such as HFC and PFC, the scope of coverage would seem to need to be increased, since these gases aren't mainly emitted by the energy sector.
allowance allocation should be made on the basis of a **mix** of **administratively** allocated and **auctioned** allowances, with both **long and short term** (annual) allowances	To enhance dynamic efficiency and to reduce the transaction costs of negotiating and implementing allocation rules, auctioning of all allowances would be the best solution. However, if this seems politically infeasible, the scheme should still include auctioning to the extent possible. The introduction of long and short term allowances might have negative impacts on derivative markets and on linking which should be further assessed. Allowing for banking of allowances in future periods and determining the allocation rules over several periods might be a better way to achieve investment certainty.
set a **penalty** to encourage compliance and to establish a **price ceiling** for the allowance market	Schemes will always require some form of penalty for non-complying parties. Using this penalty to cap prices in the allowance market is of course possible, however, the environmental effectiveness of the scheme may be compromised. Note that the EU ETS sets a penalty for non compliance yet still requires that these parties make up the shortfall in later periods. A penalty 'escape clause', however, can make sense if cheaper mitigation options exist outside the scheme, and action to drive these 'replacement' options is available.

Principles: The system should be….	Our comments
allow **offsets**	Including different kinds of offsets in the scheme (e.g. forestry sequestration projects) can have negative impacts on environmental integrity – for example, net greenhouse emission uptake by sink projects cannot be as accurately measured as fossil-fuel combustion, and there are risks that this captured carbon can be unexpectedly released (for example, through bush fires). Other types of projects might cause double-counting problems if indirect impacts occur in covered sectors – that is, emission reductions get counted by a project yet actually occur within a sector under the scheme's physical cap.
include mechanisms to address any **adverse effects and structural adjustments**	Any policy attempting to change behaviour can be argued to have adverse effects on some parties. While it is important to consider possible adverse outcomes, the process is fraught with difficulties as parties argue how they will be negatively impacted.
included mechanisms to allow a transition for participants who have taken **early abatement action and new entrants**	It is extremely difficult to identify participants who have undertaken early action when considering transition approaches. Even where actions have been undertaken as part of a previous scheme such as NSW GAS, there is little guarantee of additionality that would deserve such credit. Auctioning of all allowances solves all these problems for actions undertaken in sectors covered by the scheme – previous abatement actions will reduce the number of allowances that have to be purchased by these participants. Similarly the problem of new entrants and closures could be solved by 100% auctioning. If grandfathering must be used, experience with the EU ETS suggests that free allocation to new entrants should be based on Australian wide harmonised benchmarks in order to prevent any distortions.

Perhaps the most important lesson for Australia from the EU ETS concerns the process by which all these design choices are made. As seen with the different National Allocation Plans within the EU scheme, there is considerable potential for a 'race to the bottom' between nations attempting to protect particular industries, or create some competitive advantage through, for example, lower energy prices than other member states. The European Commission has played a key role in policing such behaviour. The states and territories might wish to explore how they can establish institutional arrangements that can manage the inevitable political manoeuvrings that will arise in scheme design.

5.2 Transitions from 'baseline and credit' to 'cap and trade' emissions trading.

The transition from the existing 'baseline and credit' ETS in NSW and the ACT to an inter-jurisdictional 'cap and trade' scheme is likely to be problematic. The existing scheme is mandated to run to 2012 and there is limited forward trading of NGACs out to this period. An inter-jurisdictional scheme will need to be introduced before 2012 if it is to contribute to Australia meeting its Kyoto requirements as noted in the terms of reference. Unfortunately, it is very difficult to reconcile an ETS trading physical, measurable emissions with another scheme that trades hypothetical 'emission reductions' from projected BAU baselines.

Transition options include cancellation of the NSW GAS prior to commencement of the national cap and trade scheme or accepting a period of time where both schemes run in parallel. The key issues for the first option are the impacts of cancellation on those participants who undertook abatement actions and, in particular, how these actions might be compensated within the cap and trade scheme. Key issues for the second option are overlaps or double counting, and whether to permit trading between the systems.

There is some international experience to consider. The baseline and credit UK ETS has a mandated life until the end of 2006, while the cap and trade EU ETS commenced at the start of 2005. Installations participating in the UK ETS that also fell within the coverage of the EU ETS were allowed to choose whether they would opt-out of the latter for 2005-2006. In the end, only 11 companies or 63 installations from more than 1,000 falling under the EU ETS decided to opt-out and stay within the former UK ETS. There is no trading across systems.

Similarly, a number of eastern European countries had commenced JI projects before joining the EU and hence being required to implement the EU Directive on emission trading. Joint implementation projects in sectors which subsequently are covered by the EU ETS (e.g. fuel switching in a district heating plant) create significant challenges. The same is true for other project activities which indirectly affect emissions from installations covered by the EU ETS, for example a hydro power plant or a demand side management project (energy efficient light bulbs or double glazing). For example, the Czech Republic NAP included the option for JI installations to opt-out of the EU scheme although there has been no application, or approval to do so yet. In other cases, according to the linking directive (CEC, 2004b) the options are as follows (however, note that no information is available so far regarding how they have been used by any MS):

- Direct emissions: (1) ERUs will only be allocated if allowances are cancelled by the operator of the installation under EU ETS, or (2) No ERUs and allocation includes emission reduction
- Indirect emissions: Allocation of ERUs if cancellation of EU allowances from the registry takes place. There is, however, still the question of which sector will bear the reduction.

In these approaches, there is effectively trading across systems.

The situation in Australia differs markedly from both these international examples. Participants in the UK ETS have individual baselines from which they either earn credit (if they emit less than their baseline) or liabilities (if they exceed their baseline). In the NSW GAS, individual parties volunteer to have baselines in order to earn credits only. JI has similar one-way project arrangements but, importantly, the physical emissions caps of the two countries participating in a particular JI project cannot be breached. Instead, some amount of the host country's cap is transferred to the sponsoring country. The NSW GAS has no such physical cap, and many of the existing and committed projects that will be creating NGACs to 2012 have questionable additionality in terms of reducing emissions from what they would otherwise have been (MacGill et al, 2005). Full acknowledgement of their claimed abatement in any introduced 'cap and trade' scheme would adversely impact its environmental effectiveness and equity. We consider two transition options.

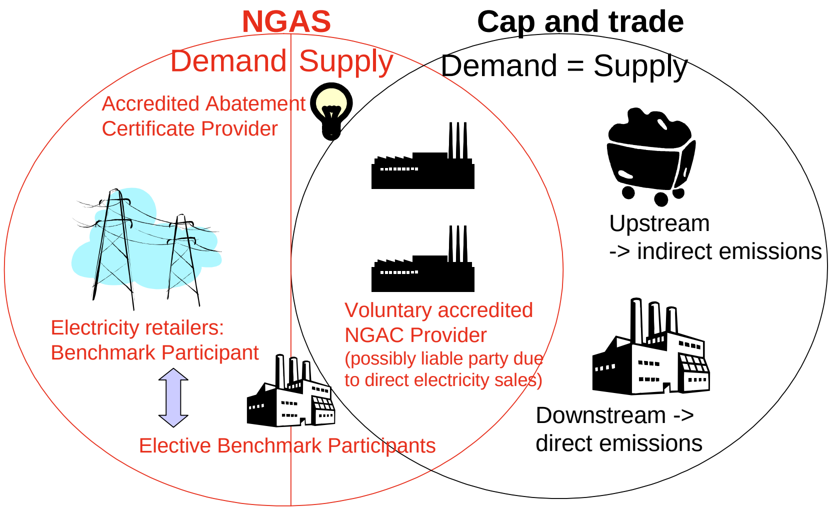
Cancellation of the NSW GAS immediately prior to commencement of a national scheme. This is an attractive option given the poor design and performance of the NSW GAS. Stopping new projects from being accredited should pose few difficulties. There is, however, the potential to adversely impact those parties who actually undertook 'additional' abatement activities. For activities that lie within the scope of the national scheme, there is an excellent way to compensate such parties – full auctioning of allowances. For example, energy efficiency projects earning NGACs would lose that revenue stream but benefit from their lower energy consumption given energy price increases resulting from the ETS. Similarly, investment in gas generation would no longer earn NGACs but would gain competitive advantage through relatively greater cost increases for coal generation. If the allowance price exceeds the NGAC price then such participants are actually better off without the NSW GAS scheme. Those who were earning NGACs without actually having taken action that reduced emissions will get nothing – an appropriate outcome. If grandfathering is chosen, determining allocation for participants will be particularly problematic.

There are some NSW GAS activities that will not fall within a national cap and trade scheme unless offset arrangements are in place. These might include landfill gas and sequestration projects. The additionality of some of these activities is questionable. Nevertheless, it might be possible to incorporate genuine abatement activities within the ETS through a so-called "domestic project" approach. In the European Union there is an ongoing debate regarding the inclusion of such domestic projects under the EU ETS (Betz et al, forthcoming 2006). Domestic projects would be projects similar to JI, but without an external investor or acquirer of credits. They face similar double counting problems as JI projects, however, these could be resolved by only allowing domestic projects in non ETS covered sectors and installations. A similar approach could be considered for a national ETS scheme which would focus on installations not covered by the potential cap and trade scheme and that have no indirect effects. Some NSW GAS projects might fall within this.

Accept a transition period where both NSW GAS and a national ETS were operating:
This may be unavoidable but raises numerous complications – in particular, double counting will be a major issue to resolve. This is the risk that one tonne of emission reduction could be rewarded twice in the carbon market by creating a surplus allowance yet also generating a credit. For example, in the NSW scheme retailers have the NGAC obligation while electricity generators may be in a position to volunteer to create NGACs. Under a cap and trade scheme, generators have the obligation while retailers face higher electricity prices because of the costs imposed on generators in meeting this obligation. In theory, prices in both markets would merely change to reflect changing marginal costs of abatement given two such revenue streams. In reality, the poor efficiency of one or more markets might see adverse price impacts and increased windfall gains to some participants.

Allowing participants to opt for one or the other during a transition period is also problematic. The liable parties in the NSW GAS are, in the main, electricity retailers without significant direct, or even indirect, emissions. Voluntary abatement providers under the NSW scheme include many participants such as electricity generators who do have direct emissions. However, these take on no emission obligations under that scheme – there is only upside through claimed abatement. They could hardly be permitted to opt-out of the only scheme that actually imposes some potential downside upon them. It might be possible to modify the NSW GAS so that participants who opt in have to take on baselines from which they can be penalised as well as rewarded depending on their emissions. Determining what credit for early action might be awarded in setting such baselines will be a challenge. As noted earlier, auctioning resolves many of these problems but is not an option where some parties can opt-out. Trading across schemes – for example, by making NGACs fungible with allowances – is almost certain to put the effectiveness and fairness of the cap and trade system at risk. Figure 6 highlights the potential overlap problems. Note that some generators are actually mandatory participants of NSW GAS due to some direct electricity sales they make. This adds further complications.

Figure 6: Potential overlaps between NSW GAS and a national cap and trade system.



In brief, the NSW GAS scheme might have established the grounds on which states and territories are now exploring a national cap and trade scheme, but it is likely to cause major transition problems. A similar experience occurred in the UK – it is has been argued that the poor design of the UK ETS may have actually hampered participants in the transition to the EU ETS (Sorrell, 2003). If a national ETS is to be introduced in Australia before 2012, the best option seems to be to cancel the NSW scheme and use auctioning of allowances to deal with equity concerns of those participants who undertook abatement actions under the earlier arrangements.

5.3 Linking of Australian and international ET

5.3.1 Linking Scenarios

A larger emissions trading market will, all other things being equal, lead to higher efficiency gains because there will be more variety and cost differences in reduction options, while no trades take place if no gains are available.[14] Furthermore, linking can increase the liquidity of the market and reduce market power. The latter might be a problem in a national Australian scheme, given experiences in the NGAC market in NSW (MacGill et al, 2005).

Article 25 of the EU emissions trading Directive (CEC, 2003) foresees the linking of different GHG trading schemes. However, linking will require harmonisation of some key design features, otherwise distortions, double counting and loopholes are likely to occur. These risk the environmental integrity of the schemes. According to Article 25 of the Directive "… third countries (should be) listed in Annex B to the Kyoto Protocol which have ratified the Protocol…" Kyoto ratification is especially important to enable countries to exchange a "currency" which is valid under the Kyoto Protocol and can be counted against the Kyoto targets. A number of more limited options are still available should Australia not choose to ratify. Table 13 outlines all these options.

Table 13: Linking scenarios

Linkage options	Assessment
Kyoto Ratification by Australia	
Project-based mechanisms	This means on the one hand that foreign companies or Kyoto Parties can invest in Joint Implementation projects in Australia. For these reductions the Australian government would issue ERUs (convert AAUs in ERUs) to the investors which might sell them abroad. On the other hand Australian companies might invest in CDM and JI projects and account for the reductions under their national scheme.
Article 17 trading	This would enable the Australian government to trade surplus Kyoto Units (e.g. AAUs or RMUs) with the other ratifying governments. Therefore if the Australian government experiences rather low-cost national abatement options it could e.g. through a tender process buy national reductions and sell them internationally through Article 17.

[14] A preliminary modelling of linking a potential Australian ETS with the EU ETS has shown significant gains from linking. However, such modelling does require a lot of assumptions on what the Australian scheme would look like and how the allocation would be undertaken. Therefore the results are not included in this paper and further analysis is suggested.

No Kyoto ratification	
Unilateral link with EU ETS	This would allow Australian companies to buy EU allowances and account them against their target. As the European Directive foresees the possibility that any private (also foreign) entity is able to open an account and trade allowances on the market, there appears to be no technical obstacles. However, its attractiveness would depend on the price differences between Australia and EU ETS. Since the proposed Australian scheme sets its penalty rate as a price cap, prices would certainly have to be under this penalty rate for trades to occur. If, from 2008 onwards, the Australian scheme was to accept EU allowances which are linked to AAUs or credits from CDM or JI, these would need to be cancelled when used for compliance with the Australian scheme. An additional option would be to allow Australian companies to sell allowances into the EU ETS. However, this would need to be restricted to the situation where enough EU allowances had already been acquired by all participants. A kind of gateway needs to be established where bought EU allowances will be exchanged for Australian ones that can be accounted against the national target. If enough EU allowances had been acquired, the gateway could be open for selling allowances to the EU. In the latter case, Australian allowances would be exchanged for EU allowances before they leave the Australian system. In this case a political agreement would not be absolutely necessary.
Bilateral link with EU ETS	Alternatively, linking through Article 25 would be another option to allow unrestricted trading .[15] Any bilateral linkage between Australia and the EU would then require the Australian scheme to be compatible with the design of the EU ETS.

5.3.2 Bilaterally linking an Australian cap and trade scheme with the EU ETS

The following issues would be critical in any bilateral linkage between an Australian cap and trade scheme and the EU ETS. Given that the EU scheme is underway, is much larger, involves 25 countries, and has to agree with any proposed bilateral linkage, it is the Australian scheme which will need to be designed with such a linkage in mind. Key design issues include the following.

Coverage: the broader the coverage of an emission trading scheme, the greater potential for gains from trading, since differences in marginal mitigation costs are more likely. Through trading the mitigation costs are equalised leading to a reduction of overall compliance costs. Different degrees of coverage, such as an upstream system in Australia linking to the European downstream system should not cause problems. Energy exports from Australia should not be covered (Baron / Bygrave, 2002) in keeping with the UNFCCC's approach for counting emissions at the country where they occur.

The major problem of linking systems with different coverage of greenhouse gases is the risk of importing increased environmental uncertainties into the linked systems. For example, it is proposed the multi-jurisdictional system will include gases which are only quantifiable with high uncertainty, and this could undermine the integrity of the EU ETS which covers only CO_2.

Similarly, the EU ETS does not include sinks projects for either JI and CDM due largely to their measurability problems and longer-term uncertainties. If an Australian scheme allowed sink projects while the EU ETS did not, linking both systems would effectively mean the EU scheme now accepted sinks. Even though the allowances created by Australian offset projects would not physically be accounted for under the ETS, they could still offset some of the emissions of EU installations because Australian companies would use credits created by offset projects for their compliance, and transfer only EU allowable allowances to EU installations. Inclusion of sinks

[15] Currently, the European Commission is negotiating linking conditions with Norway, and it has not yet been decided if linking will occur under Article 25 or under the arrangement of the European Economic Area that Norway belongs to.

would mean the total amount of available units in the combined systems would be greater than of the systems before. It is quite unlikely the EU will accept linkage to a system which will import the uncertainties from sink projects into the EU ETS, which were excluded from that scheme after long negotiations. If at all acceptable, strict additionality requirements will need to be established. The idea of capping the total allowable credits from offsets in the Australian scheme might be further explored (Blyth / Bosi, 2004).

Accountable unit: From 2008-2012 the traded EU allowances will be tagged Assigned Amount Units. Therefore if there is political willingness to allow linkage between an Australian system and the EU ETS despite non-ratification of the Kyoto Protocol, a mechanism would be needed for the EU to meet its Kyoto target. If there is net import of EU allowances or other Kyoto Units to Australia, these would need to be cancelled by the Australian government. If there was a net export of Australian allowances into the EU ETS the government might need to buy Kyoto Units on the market, in order to compensate EU Member States with a currency they can account against their Kyoto target.

Traded unit and flexibility: Under the EU ETS allowances are issued which allow emittance of one tonne of carbon dioxide equivalent (tCO_2-e) during a specified period. France and Poland are the only MS to permit a specified amount of allowances to be banked from the first (2005-2007) to the second period (2008-2012). In accordance with the Kyoto Protocol the ET Directive foresees unrestricted banking of allowances from the 2012 onwards. Thus, surplus allowances will be valid until they are used for compliance or cancelled, which will give investors higher certainty and allow for flexibility. However, banking can also reduce market liquidity and enable "over allocation" to be imported in following compliance periods. This would lead to smaller emissions reductions in the future.

The Australian design proposal is suggesting annual and long term units. The advantage of long-term allowances is questionable if unrestricted banking is permitted and allocation rules are transparent in the long run. Linking systems with different units of this type may cause fragmentation of the market, which can reduce its efficiency.

If banking is allowed in only one scheme, the concentration of banking in that scheme may increase, since transfers to it would allow banking through a third party. Countries which allow banking would then have an allocation for the next period that was much higher than expected. This is now causing administration problems under the EU ETS design, where the NAPs have to be approved before the total amount of banking will be known (Schleich et al, 2005).

The EU ETS allows for borrowing between years within a period, which means allowances and trading incentives may become only scarce in the final year of a multi-trading period (first time beginning of 2008). If the Australian system does not allow borrowing or have different periods, there might be liquidity benefits in linking the systems (Blyth / Bosi 2004, p.28)

Allocation: The method of allocation can have several impacts deserving attention. However, this should have little impact on linking since the EU ETS approach left allocation issues mainly to Member States. However, of political importance is the "stringency of the target". Differences in stringency of targets will impact on the initial distribution of wealth between companies and countries. Nevertheless, the competitiveness concerns would arise anyway and are not a result of linking. An overall reduction in environmental performance might occur if one scheme is setting targets above business as usual projections. Under a non-linking scenario the price in that system would be very low and if banking is not possible there might be no demand for the surplus allowances. If this scheme is linked to a scheme with more stringent targets, companies in the stringent scheme will buy the surplus allowances, and so the combined emissions of the linked systems would be higher than if they weren't linked (Blyth / Bosi 2004, p. 24).

Having different allocation methodologies (auctioning or free allocation) would have greater impacts on wealth distribution than would prevention of linking. Under given unrealistic assumptions, the efficiency of the systems would be the same with auctioning or free allocation, since the price should be independent of any allocation method. However, in reality there might be differences – for example, early price signals might better reflect marginal abatement costs if auctioning is used as the main method.

As EU experience has shown, market prices in an ETS can be highly influenced by political decisions and so don't reflect marginal abatement costs. An auction in the linked system allowing all participants to bid would increase the efficiency of the system since true prices are more likely to be revealed.

Thirdly, differences in future allocation or closure rules might lead to gaming and a distortion of incentives for new investment (similar to differences in banking rules). A scheme that doesn't use updating or terminate allocation after closure (e.g. through transfer rules) would provide greater incentive for reducing emissions. Where there is no transfer of surplus allowances between periods, there would be incentive to buy allowances in the prior period to achieve compliance and keep emissions high in order to get a higher allocation in the next period. Linking could facilitate such gaming through higher liquidity and lower prices (Blyth / Bosi 2004, p.25).

Sanctions: Differences in compliance systems will have an impact on linking as soon as the market price exceeds one system's penalty rate. Linking schemes with different compliance systems might therefore need additional requirements. Under the EU ETS, in addition to paying a penalty, an operator has to surrender any missing allowances in later periods in order to ensure the total abatement is achieved. The penalty rate can therefore not be considered as a price cap. In contrast the Australian proposal foresees a penalty rate which should function as a price cap – in effect, a tax on borrowing allowances from future years. If two such systems were linked, the fixed-price allowances will also be available to EU companies. Were prices to rise above the penalty rate in Australia, participants there would have an incentive to sell allowances to other participants facing higher penalty rates (Haites / Mullins, 2001, p. 58). Linking these systems would encourage non-compliance in the system with lower penalties and compromise the environmental integrity of the two schemes. This situation would not occur if both systems asked participants to surrender missing allowances in the following years since this would de-couple the penalty rate from the market price. Under such circumstance differences in penalty rates would be easier to handle. Different mechanisms to deal with differences in penalty rates have been assessed,[16] but all will have negative impacts on the gains from linking since they will split the market once the lower penalty rate is reached. Therefore the most efficient solution is to harmonise enforcement regimes as was done by the EU Directive.

Monitoring, reporting and verification (MRV): Differences in MRV might impact the legitimacy of the traded units and if not sufficiently robust in one system, might lower confidence in the traded units. The risk of systematically under-reporting in one system, which might be the case if emissions are not externally verified, would lower the environmental effectiveness of both schemes since 'false reductions' will be imported. Since monitoring depends on the coverage of the system (upstream, downstream and gases included) this has to be taken into account in the Australian decision. Implementing a downstream approach which is mainly based on CO_2 and uses similar MRV requirements as the EU ETS is clearly the most straightforward way to proceed. The registries should be technically compatible and secure.

Table 14 summarises the differences between the potential Australian scheme and the EU ETS in order to flag some of the key issues that would arise should there be efforts to link them.

[16] One option would be to issue to the domestic companies with price-cap type of penalties additional allowances up to an amount that covers the difference between their actual emissions and their initial allocation in a given year (see Blyth/ Bosi 2004 p. 30pp).

Table 14: Comparing EU ETS and potential Australian cap and trade, linking issues

Feature	EU ETS	Australian cap and trade	Linking issues
Coverage:			Differences in coverage do not preclude linkage.
Liable entity	Operators of installations of Annex I	Upstream, downstream or hybrid	Downstream with upstream: exemption for exported fuel
Gases	Only CO_2 1st period Opt-in of further gases in 2nd period	All 6 Kyoto gases	Diversity should improve efficiency. however, low accuracy in monitoring other gases may impact on environmental integrity
Flexibility	Opt-in and Opt-out provisions for installations	Not decided yet	Affects total supply of available credits, needs political agreement. Additionality will be important to ensure environmental integrity.
Accountable unit	EU allowances and ERUs, CERs excluding sinks and big hydro	Offset project should be included	
Unit	1 t CO_2e	Short term and long term units	Fragmentation of the market. Long-term units could increase total emissions in future periods.
Target	Absolute	Absolute	Stringency of target is important. If stringency of one system is very low e.g. more than business as usual, linking would affect environmental effectiveness of the other system, especially if units are not backed by Kyoto units.
Allocation	At least 95% for free in 1. period At least 90% for free in 2. period Varies among member states	Mix of auctioning and free allocation	Different allocation is acceptable since competitive distortion would exist without linking. Gaming could occur if updating is used in one of the systems (same effect as different banking rules).
Flexibility	Borrowing between periods not allowed, restricted banking from 1st in 2nd period only in two member states. From 2nd period unrestricted banking.	No decision so far	If difference in banking, companies will be able to bank via swap. Banking will increase total emissions allowable in future periods (impact on environmental effectiveness)
Monitoring / reporting / verification	Based on EU monitoring guidelines (tier approach), annually verified reports to national authorities	Not decided yet, will depend on coverage and approach (upstream or downstream)	As long as differences in monitoring accuracy have no impact on market confidence there may not be problems. But high inaccuracy might impact on environmental integrity.
Sanctions	1. period: 40 €/t CO_2e (2. period: 100 €/t CO_2e) + later compensation for under cover + publication	Penalty rate as price cap.	Difficult since once the market price reaches the level of the price cap, the market will split (incentive for companies to sell all allowances and become non-compliant) and this will reduce efficiency gains from linking.
Technical aspects	Annual issuance and surrender, tracking of units by electronic registry	Issuance and surrender timing is not decided so far.	Differences in timing of surrender might increase the liquidity of the market. Electronic registries should be able to be technically linked, and similar.

5.4 Interactions between ETS and other policy measures

Idealised market theory suggests that a universal ETS is the only climate change policy required. It will achieve an environmental objective at minimum cost by directing effort to those abatement activities in the economy with lowest marginal costs. Under this scenario, other climate change policies will not improve environmental effectiveness, cannot reduce the cost of meeting this target and will almost certainly increase it.

The reality of course is that emissions trading markets, and the key markets that they interact with – in particular, energy markets – are far from ideal. Greenhouse emissions from some sectors and activities of the economy can be difficult to measure accurately and have different risk and uncertainty profiles to other emissions – for example, those associated with land use change. Markets struggle to properly 'price' future uncertainties. Also, the political process required to establish a far-reaching policy such as ETS will inevitably involve compromises that reduce its effectiveness.

While it is therefore possible to argue what other policy measures might best complement emissions trading, there is no question that other policy mechanisms will be required. It seems unlikely that a single universal policy could reach across the widespread and diverse greenhouse emitting activities within the economy, appropriately motivate all the many possible decision-makers and stakeholders involved, and drive the fundamental transformation that appears to be required.[17]

Key issues that seem likely to require additional policy attention include:

- improving ETS's static efficiency by correcting other energy market failures such as those seen in energy efficiency and infrastructure provision,
- improving ETS's dynamic efficiency through support for innovation in emissions abatement technology and its diffusion,
- other policy objectives such as energy security and equity, and
- compensating for the inevitable failures in ETS design (Sorrell and Sijm, 2004).

Energy efficiency: End-use energy efficiency will play a critical role in any economically efficient and environmentally effective policy response to climate change. It offers some of the most cost-effective greenhouse gas emissions reductions available – many energy efficiency options have negative abatement costs – as well as offering many other environmental and social advantages (IPCC, 2001). The potential scale of efficiency improvements is also great.

Despite these many benefits, there is a clear need for policy intervention to promote energy efficiency as many of its benefits are market externalities while there is also widespread market failure in demand-side decision-making as energy users fail to undertake even cost-effective energy efficiency options.

While emissions trading can 'internalise' climate change externalities, the greater challenge appears to be in solving existing market failures in energy efficiency decision-making. The reasons for these failures are complex, but include:

- a poor understanding of energy efficiency by key decision-makers,
- little motivation for many participants facing generally low costs for energy, and

[17] This is acknowledged in the AGO (2002: 10) submission to the CoAG Panel – "In addition to a national emissions trading system, there is likely to be a need for supplementary measures that address market impediments and aim to promote consistent incentives for abatement and innovation in those areas of the economy that an emissions trading system would have trouble reaching."
Others have made the point more forcefully, such as the UK Energy White Paper (UK DTI, 2003) – "On its own emission trading will not be enough to deliver our environmental goals. We will need additional measures."

- institutional barriers to action for even informed and motivated decision-makers.

The UK Energy Saving Trust (2002) notes that "Price based mechanisms, in general, will not address the information and consumer related barriers to energy efficiency investment – here regulatory solutions tend to be more effective." In particular, "Neo-classical economic conceptions of regulation as inherently less efficient than market based instruments cannot be applied to energy efficiency, because of the extent of market failure… In practice, some examples of regulation have proved very cost-effective."

Infrastructure investments: Future infrastructure investments will play a critical role in major longer-term emission reductions. They define the available choices for many climate change actions, and their respective costs. The planning of our cities, building stock, transport networks and energy supply industries are all key infrastructure in this regard.

This infrastructure also typically has a long capital stock turnover – from decades to half a century or more (IEA, 2003). This means that inappropriate infrastructure investments now lock in significant greenhouse emissions for decades to come.

Many important decisions on infrastructure are made, or tightly directed, by local, state and federal governments. Price-based mechanisms such as emissions trading may not 'reach' these decision makers, without other policies to guide government decision-making. Examples include regulation of energy industry investment through revenue regulation for gas and electricity network service providers (CoAG, 2002). Other infrastructure investment decisions could be made by the private sector but some level of coordination is required. A possible example is the Queensland 13% gas scheme which was intended to create a critical mass of gas infrastructure investment in the state.

The potential for emissions trading to appropriately drive investment will critically depend on the longer-term price signal that it sends. An emission trading scheme designed to minimise the price of emissions over the shorter term may diminish this signal, and adversely impact on appropriate investment decision-making for the longer term.

Even with an appropriate long-term signal, particular investors may not be the party required to buy allowances to operate its infrastructure in the longer term. For example, the prospects for improving energy efficiency in building stock have been greatly damaged by the split incentives between builders paying capital costs and tenants paying operating costs.

The limitations of emissions trading in driving investment are very relevant to the Australian electricity industry given recent projections that very significant investments will be required over the coming decade (CoAG, 2002).

Technological innovation: The IPCC identifies "technology as a more important determinant of future greenhouse gas emissions and possible climate change than all other driving forces put together" (IIASA, 2002). Governments have an important policy role in driving 'public good' innovation through 'induced technical change' – measures that stimulate technological progress to rapidly drive down the costs of particular technologies.

One clear policy need is support for R&D. The problem of obtaining sufficient private investment in socially beneficial R&D such as that into sustainable energy systems is not just one of market externalities. Therefore, it cannot be solved merely through pricing mechanisms such as emissions trading. R&D is, however, only part of the story. Government activities to promote environmentally-driven technological development must also include demand-pull policies (Norberg-Bohm, 2000). This demand-side support cannot just be price mechanisms for environmental externalities such as emissions trading since current prices will not necessarily reflect future costs, and so will be insufficient to initiate development of infrastructure required for least-cost abatement in the future. The 'price' of new energy technologies can be greatly lowered through government support that drives learning from experience and economies of scale in these industries (Isoard / Soria, 2001).

Industry support programs will therefore still be required, even with the introduction of emissions trading. Policies to support the development of the renewable energy industry provide a good example. The EU has very ambitious renewable energy targets and associated policy instruments such a feed-in tariffs and renewable energy obligations. Australia will require similar support if its renewable energy industry is to prosper, and hence provide longer-term low-cost abatement options for the major emission reductions eventually required. The imminent failure of MRET to continue driving new investment is very troubling in this regard.

Meeting other policy objectives and compensating for failures in ETS design: It is entirely possible for an ETS to work against policy objectives other than mitigation of climate change. Examples might include a move to gas-fired generation supplied from non-indigenous sources. The potentially adverse equity impacts of ETS have also been noted. This has been a particular issue in the UK where climate change policy has in some ways suffered from fuel poverty policy objectives intended to avoid increases in energy costs (Sorrell, 2004).

ETS is not amenable to sectors of the economy where emissions are difficult to measure accurately or have considerable uncertainties. Agriculture and other Land-use change activities are a relevant example. In this case, other policies will be required to drive action.

Using a carbon tax instead of an ETS: Carbon or greenhouse gas taxes offer an important alternative to ETS for pricing greenhouse emissions in the economy. In theory the main difference between the two is that an ETS achieves a certain environmental objective at an uncertain cost while a carbon tax has a known cost but delivers an unknown amount of abatement. In practice, the differences can blur somewhat. An ETS with upstream liable parties, auctioning and a penalty structure that caps allowance costs has considerable similarities to a carbon tax.

Carbon taxes, in fact, have some potentially significant advantages over ETS. They are likely to be administratively simpler and help avoid questions of allowance allocation and the potential cost of the scheme. All parties in the scheme have an incentive to act although its important to note that a tax may be treated as a 'cost of doing business' while allowance trading is more clearly understood as a profit opportunity. It is possible that general industry opposition to carbon taxes arises from their view that it is easier to extract concessions when they are concealed in the complexities of allowance allocation in an ETS.

Designing ETS for policy interactions: Emissions trading is, in some ways, very well suited to policy frameworks with a mix of policy measures because the price of allowances is set by a market that can respond to these other policies. For example, strong policy support for renewables can offset fossil-fuel generation which therefore requires fewer allowances. The price of allowances should then respond to this reduced demand. These interactions can however be extremely complex and surprises are always possible. In particular, inefficient markets can blunt these price responses and some members of society may end up paying for emission reductions twice.

If sufficient policies are in place to meet an ETS target without the scheme even being in place there are no good reasons to implement the ETS, and good reasons not to. The inevitable transaction costs and market imperfections will reduce the economic efficiency of the climate policy framework. The performance of the NSW GAS to date raises this disturbing prospect.

What is certain is that the interactions between different climate policy measures and mechanisms need to be carefully considered in ETS design. Even with such consideration, there will be surprises and some are likely to be unpleasant ones.

6 Conclusion

A number of ETS have been established over recent years and we now have growing experience from which to draw lessons on scheme design. The challenges of baseline and credit approaches has seen growing interest in cap and trade systems. In this regard, the EU Commission and Member States have successfully implemented the largest carbon trading scheme to date with more than 11,000 installations in 25 countries. This scheme is likely to provide some of the most valuable lessons for design of future national ETS.

The underlying framework of the EU ETS seems to be sound including deterrent sanctions, a robust monitoring system and review options to improve the system in the future. However, it is likely that the market is not functioning efficiently at present and price signals might be being gamed instead of reflecting marginal abatement costs. This is in large part possible because of design choices in allowance allocation and the staged regulatory process. It seems likely that market prices will trend towards marginal abatement costs once pressure on trading increases and allocation for the second period has been decided.

The scheme would, however, also seem to have dynamic efficiency problems. Again, this is related to the generous allocations and minor role of auctioning, both of which will most likely lead to significant price distortions. However, another key factor will be the rules covering new entrants and closure. Allocating new entrants allowances for free on the basis of best available technology will not drive new investments if at the same time allocation is terminated when installations are closed. Benchmarking new entrants and giving investors the option to transfer the allocation from closed to replacement installations could promote innovation. Finally, the high uncertainty regarding future allocation rules is impacting negatively on investments since most operators will wait and see what might happen. There would seem to be good reasons to increase the amount of auctioning of allowances in the next period of the EU ETS and in other cap and trade schemes that might be implemented around the world. In this case, incumbents and newcomers will be treated more equitably. This would also resolve current issues in allowance recovery when older facilities are closed. Given present grandfathering, there could be value in permitting closed installations to keep their allocation. Such a rule would spur the closure of old plants, leaving space for new, more efficient technologies. Finally, future allocation rules and emission targets should be known a long time in advance in order to be more in line with the length of innovation cycles.

The ETS design processes to date have proven rather susceptible to lobbying efforts of affected industries. This was certainly the case for NAPs in the EU scheme. More harmonisation by the European Commission could have helped, since leaving key design issues such as treatment of new entrants to the Member States can lead to a 'race to the bottom' as these states try to ensure that their industries and economic development will not be adversely impacted.

Regarding possible options for an Australian ETS, there are many lessons from Europe and elsewhere that could usefully be incorporated into the scheme's design. The design principles established to date for a possible multi-jurisdictional scheme in Australia are an advance over the existing NSW GAS design but also raise some potential problems for scheme effectiveness and efficiency. Transition issues will need to be carefully managed. Linking the Australian scheme with the EU ETS might have considerable value but will reduce the available design options because of the need for some harmonisation. The key design features of the proposed Australian scheme which might cause problems are the inclusion of sinks and non-CO_2-gases, a price-cap for sanctions, and different allowance lifetimes.

Finally, emissions trading will not solve all problems of climate change and other policies are necessary to support aims such as increased renewable energy generation or energy security. Analysing the interactions of overlapping policies is crucial to ensure their effectiveness.

References

AGO, 1999, National Emissions Trading Discussion Papers 1-4, Canberra.

AGO, 2002, Pathways and policies for the development of a national emissions trading system for Australia. Australian Greenhouse Office response to the CoAG Energy Market Review. Canberra. Available at www.energymarketreview.org.

Baron, R. / Bygrave, S. 2002, *Towards International Emission Trading: Design Implications for Linkages*, OECD/IEA Information Paper, Paris. Available at http://www.oecd.org/oecd/pages/home/displaygeneral/0,3380,EN-document-517-nodirectorate-no-21-32543-8,00.html.

Betz, R: Emissionshandel zur Bekämpfung des Treibhauseffektes: Der Einfluss der Ausgestaltung auf die Transaktionskosten am Beispiel Deutschland, IRB Verlag, Stuttgart.

Betz, R. / Eichhammer, W. / Schleich, J. 2004, 'Designing National Allocation Plans for EU Emissions Trading – A First Analysis of the Outcome', *Energy and Environment*, vol. 15, no. 3, pp. 375-425.

Betz, R., Rogge, K., Schön, M. 2006, 'Opportunities and Potential of National Projects in Climate Change Policy: The Example of Baden-Württemberg, Germany', *Energy and Environment*, forthcoming 2006.

Blyth, W. / Bosi, M. 2004, Linking non-EU Domestic Emissions Trading Schemes with the EU Emissions Trading Schemes, IEA, COM/ENV/EPOC/IEA/SLT(2004)6, Available at: www.iea.org/textbase/work/ 2004/ghg/presentations/blyth_bosi.pdf

Burtraw, D. 2001, 'Carbon Emission Trading Costs and Allowance Allocations: Evaluating the Options', *The Journal of Resources for the Future*. Fall. Issue 145.

CDM Watch, 2005, The Clean Development Mechanism (CDM) as an option for Swiss climate policy, Report by CDM Watch, January.

CEC 2003, 'Directive 2003/87/EC of the European Parliament and the Council of 13 October 2003 Establishing a Scheme for Greenhouse Gas Emission Allowance Trading within the Community and Amending Council Directive 96/61/EC', OJ L275, 25 October 2003, 32–46.

CEC 2004a, Communication from the commission on guidance to assist Member States in the implementation of the criteria listed in Annex III to Directive 2003/87/EC. COM (2003) 830 final, Brussels 7 January 2004.

CEC 2004b, Directive 2004/101/EC of the European Parliament and the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, OJ L 338, 13.11.2004, 18-23.

CEC 2004c, Commission Regulation of 21 December 2004 for a standardised and secured system of registries pursuant to Directive 2003/87/EC of the European Parliament and of the Council and Decision 280/2004/EC of the European Parliament and of the Council. Available at < http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/oj/2004/l_386/ l_38620041229en00010077.pdf>

CEC 2004d, Commission Decision of 29 January 2004 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council, Available at: http://europa.eu.int/eur-lex/pri/en/oj/dat/2004/l_059/ l_05920040226en00010074.pdf

CoAG 2002, Towards a truly national and efficient energy market. Energy Market Review Final Report. Canberra. December.

DIW/Öko-Institut/Fraunhofer ISI, 2003, National allocation plan (NAP): overall concept, criteria, guidelines and fundamental organisational options, Berlin and Karlsruhe.

Driesen, D.M., 2003, Does Emissions Trading Encourage Innovation?, Environmental Law Review, 1-2003, available at http://www.eli.org.

ENDS Report, 2003, The Clean Development Mechanism – Kyoto comes home to roost, ENDS Report, 12 September.

European Environmental Agency, Trends in emissions of greenhouse gases (IPCC sector classification), Available at: http://dataservice.eea.eu.int/dataservice/metadetails.asp?id=29

FIELD, 2000, Designing Options for Implementing an Emissions Trading Regime for Greenhouse Gases in the EC, final report for the European Commission, viewed 4 July 2005, < http://www.field.org.uk/PDF/ecet.pdf>

Haites, E. / Mullins, F. 2001, Linking Domestic and Industry Greenhouse Gas Emission Trading Systems, Margaree Consultants Inc. and Environmental Resources Management Ltd., Prepared for EPRI, IEA, and IETA.

Hargrave, T. 2000, An Upstream / Downstream Hybrid Approach to Greenhouse Gas Emissions Trading, Centre for Clean air Policy, Washington.

IEA. 2002. Dealing with Climate Change – Policies and Measures in IEA Member Countries. International Energy Agency. Paris.

IEA. 2003. Energy Capital Stock Turnover: Critical to Reducing CO2 CO_2 Emissions. Forthcoming International Energy Agency report. Paris.

IEA, 2004. Taking stock of progress under the Clean Development Mechanism (CDM), IEA Report COM/ENV/EPOC/IEA/SLT(2004)4/FINAL, Paris.

IIASA. 2002. Transitions to New Technologies Project. International Institute for Applied Systems Analysis Website (accessed August 2002). Available at www.iiasa.ac.at.

Inter-jurisdictional Emissions Trading Working Group, 2004, A national emissions trading scheme - A Report to First Ministers from the Inter-jurisdictional Emissions Trading Working Group. Available at: <http://www.cabinet.nsw.gov.au/greenhouse/report.pdf>, viewed April 2006.

IPCC, 2001, Third Assessment Report, Intergovernmental Panel on Climate Change, Geneva.

Isoard, S. and Soria, A. 2001. Technical change dynamics: evidence from the emerging renewable energy technologies. Energy Economics. 23: 619-636.

MacGill, I.F. H.R. Outhred and K. Nolles, 2004, National Emissions Trading for Australia: key design issues and complementary policies for promoting energy efficiency, infrastructure investment and innovation, Australasian Journal of Env. Management, Vol. 11(1), March.

MacGill I.F., Passey, R., Nolles K. Outhred, H. 2005, The NSW Greenhouse Gas Abatement Scheme: An assessment of the scheme's performance to date, scenarios of its possible performance to 2012, and their policy implications, Draft CEEM discussion paper for comment, DP_050408, April.

Milliman, S. R. and Prince, R. (1989): Firm Incentives to Promote Technological Change in Pollution Control, in: Journal of Environmental Economics and Management 17, 247-265.

Norberg-Bohm, V. 2000. Creating Incentives for Environmentally Enhancing Technological Change: Lessons From 30 Years of U.S. Energy Technology Policy. Technological Forecasting and Social Change. 65: 125–148.

Passey, R., MacGill, I., Nolles, K., Outhred, H. (2005) The NSW Greenhouse Abatement Scheme: an analysis of the NGAC registry for the 2003 compliance period, Draft CEEM discussion paper for comment, DP_050405, April.

PEW Centre 2003, Summary of The Lieberman-McCain Climate Stewardship Act, Available at: http://www.pewclimate.org/policy_center/analyses/s_139_summary.cfm

Schleich, J., Ehrhart, K.-M., Hoppe, C., Seifert, S. 2005, 'Banning Banking in EU Emissions Trading?', forthcoming Energy Policy.

Schleich, J./ Betz, R.: EU Emissions Trading and Transaction Costs for Small and Medium Sized Companies, in: INTERECONOMICS, Review of European Economic Policy, Vol. 39, No.3, 2004, p. 121-123.

Schleich, J. / Betz, R.: Incentives for energy efficiency and innovation in the European Emission Trading System, in: Proceedings of the 2005 eceee Summer Study – What works and who delivers?, Mandelieu, France, 2005, p. 1495-1506.

Sorrell, S., 2003, The UK Emissions Trading Scheme, in: Domestic Greenhouse Gas Emissions Trading Schemes, IKEI, UNEP and IGES Report.

Sorrell, S. / Sijm, J., 2003, Carbon Trading in the Policy Mix, in Oxford Review of Economic Policy, Vol. 19, No. 3, p. 420-437.

UK DTI, 2003, Energy White Paper.

UK Energy Savings Trust 2002, Putting Climate Change at the Heart of Energy Policy. Submission to the UK Energy White Paper. London.

UK House of Commons,2003, The UK Emissions Trading Scheme: a new way to combat climate change, Forty-sixth Report of Session 2003-04, September.

United Nations Convention of Climate Change (UNFCCC), 2001, Marrakech Accords, FCCC/CP/2001/13/Add.2.

United Nations Convention of Climate Change (UNFCCC), 2004, Clarifications on the treatment of national and/or sectoral policies and regulations (paragraph 45(e) of the CDM Modalities and Procedures) in determining a baseline scenario, 16th Meeting of the Executive Board, Annex 3, Bonn.

Von Malmborg, F. and P.A. Strachan, 2004, Compromising ecological modernisation? An analysis of the UK emissions trading scheme, Paper for a panel on the use of 'New Modes of Environmental Governance' at PSA Annual conference, Leeds, 5-7 April.

World Bank /IETA 2005, State and Trends of the Carbon Market 2005, Washington DC.