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The governance challenge for implementing effective market-based climate policies: A case study of The New South Wales Greenhouse Gas Reduction Scheme

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ABSTRACT

The New South Wales (NSW) Greenhouse Gas Reduction Scheme (GGAS) in Australia is a baseline and credit emissions trading scheme with the stated aim of reducing the per-capita greenhouse emissions associated with electricity consumption in the state of NSW. Here we provide a detailed assessment of the GGAS design and operation, with a particular emphasis on its effectiveness in delivering physical emissions reductions that would not have occurred in its absence. We find that a number of design features mean a significant proportion of the tradeable 'abatement' certificates are unlikely to correspond to the claimed emissions reductions. While some of these adverse design choices might be corrected, others would seem inherent to the underlying scheme design. Our analysis highlights the major governance challenges with emissions trading approaches and hence the importance of good policy implementation processes including the need for separation of powers through a scheme development process that involves design, assessment and revision. These GGAS lessons would seem relevant for governance with all emissions trading schemes, and has particular implications for cap and trade schemes that incorporate baseline and credit offset schemes, as well as to the 'White Certificate' schemes increasingly being seen as a means of fostering enhanced end-use energy efficiency.

1. Introduction

With escalating climate change concerns, there is an increasing focus on market-based policy measures, particularly emissions trading, to help reduce greenhouse emissions. Although such schemes have promising characteristics, they are very complex, where changes to aspects of scheme design can have unexpected consequences, and so currently they are essentially an experimental policy instrument. There is only limited practical experience in the use of tradeable environmental instruments for climate change mitigation, with the European Union Emissions Trading Scheme (EU ETS) being the most significant example, and early signs of its performance are concerning (Betz and Sato, 2006).

Such schemes can be classed as either cap and trade (e.g. EU ETS) or baseline and credit. Cap and trade schemes set a cap on emissions and then, after distribution of emission allowances (certificates that correspond to a certain amount of CO_2, e.g. 1 tonne) for either free or some form of payment, allow trading, and at particular times liable parties are required to surrender certificates that correspond to their level of emissions. Baseline and credit schemes set no overall cap on emissions but instead allow accredited projects to create 'abatement certificates', where each certificate corresponds to the absence of emissions e.g. 1 tonne CO_2. These certificates can also be traded—although some baseline and credit schemes have no or limited trading—and, again, must be surrendered by liable parties. The baseline and credit approach is the basis of the increasing number of 'White Certificate' schemes that governments are using to foster enhanced end-use energy efficiency—for example, in Connecticut, USA (George et al., 2006), Flanders (D'haeseleer et al., 2007), the UK (DEFRA, 2007a), France (Monjon, 2006) and Italy (Pavan, 2005). Another example is the New South Wales (NSW) Greenhouse Gas Reduction Scheme (GGAS),[1] which commenced in 2003. It is a baseline and credit scheme with the stated policy intent of reducing greenhouse gas emissions created through NSW electricity consumption and encouraging activities that offset these emissions. The tradeable instrument is called a NSW Greenhouse Gas Abatement Certificate (NGAC).

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[1] The scheme's name was changed from the Greenhouse Gas Abatement Scheme to the Greenhouse Gas Reduction Scheme in early 2007 but retains the acronym GGAS.

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Although a significant amount of theoretical analysis of baseline and credit schemes is available in the literature (for example Fischer, 2005; Buckley et al., 2006; Oikonomou et al., 2007; Kartha et al., 2007), there is very little independent assessment of the operation of existing schemes. Most is either carried out by the body responsible for designing and/or implementing the scheme (Pavan, 2005; IPART, 2006a; George et al., 2006; D'haeseleer et al., 2007; DEFRA, 2007b), largely based on that analysis (Monjon, 2006; Farinelli et al., 2005; Langniss and Praetorius, 2006; Hamrin et al., 2007; Mundaca, 2007; Oikonomou et al., 2007), or where the terms of reference have been set by government (Lees, 2006). The Euro WhiteCert Project does include some research that, while not based on an independent and detailed analysis of scheme outcomes,[2] does focus on scheme design and methodologies used. As we have found here, they also found that baseline and credit White Certificate schemes have considerable difficulty in ensuring that uptake of energy efficiency is additional and occurs at least cost (Adnot et al., 2006).

Here we provide an entirely independent and detailed assessment of the GGAS for the 2003, 2004 and 2005 compliance years. The identified shortcomings provide valuable lessons not only for White Certificate schemes (as discussed in Langniss and Praetorius, 2006) but also for international cap and trade schemes that allow the use of offsets, since offsets also use a baseline and credit approach (as discussed in Fischer, 2005). They also show that there is often a great deal of difference between theoretical analysis and the actual outcomes of emissions trading schemes.

After describing the design of the GGAS, we explain how we assess its additionality—that is, its ability to deliver physical emissions reductions over and above any that would have occurred in its absence. We then discuss specific design features of the scheme and their contributions to its additionality, with a focus on its effectiveness, efficiency and equity.

Finally, we use this scheme to highlight the importance of good governance in scheme design and implementation, and the need for separation of powers between the organisations charged with designing, operating and assessing schemes such as the GGAS.

2. NSW Greenhouse Gas Reduction Scheme

The GGAS is a baseline and credit scheme that imposes a mandatory, declining per-capita greenhouse gas target for NSW on all NSW electricity retailers and certain other parties for electricity consumed in NSW. The scheme compares each year's emissions target to an approximation of actual emissions from the NSW electricity sector. The resulting annual emissions reduction target is assigned to liable parties based on their respective market shares of NSW electricity sales. These parties can then demonstrate compliance with their targets by annually surrendering an appropriate number of NGACs, each representing an imputed 1 tonne of CO_2-e of 'avoided' greenhouse gas emissions. Alternatively, a liable party must pay a penalty for each imputed tCO_2-e by which it exceeds its target. NGACs can be created through certified low-emission generation and a range of offset activities involving waste methane in Australian States/Territories connected to the National Electricity Market, demand-side activities in NSW and the Australian Capital Territory (ACT), and afforestation or reforestation activities (according to the United Nations Framework Convention on Climate Change definitions) in NSW. Large electricity users can create non-tradeable large user abatement certificates if they have elected to manage their own greenhouse gas benchmark and undertaken accredited 'offset' emission reduction activities that do not relate to electricity consumption (IPART, 2007).

The NSW Department of Energy, Utilities and Sustainability managed the design of GGAS. The GGAS is administered by the NSW Independent Pricing And Regulatory Tribunal (IPART), which is also tasked with ensuring compliance. The legislative framework involves amendments to the State's Electricity Supply Act and Regulation, supported by five benchmark rules issued by the Minister. The GGAS commenced on 1 January 2003, and on 1 January 2005 the ACT government established the ACT GGAS, which is modelled on the NSW GGAS, with IPART also designated as the scheme administrator. In 2006, the NSW Government decided to extend the GGAS to 2020 and beyond on a rolling 15-year basis or until an Australian national emissions trading scheme is established (DEUS, 2006). The Australian Government has committed to implement a national emissions trading scheme starting in 2010 (ALP, 2007) and the NSW Government is currently considering options for transition (DWE, 2008).

By end June 2006, all certificates created from certified activities undertaken for the 2003, 2004 and 2005 compliance years had been recorded in the NGAC registry. The registry contains information on the project that created the certificate, the certificate owner, the date the certificate was created and the GGAS Rule under which the certificate was created (IPART, 2007). The GGAS Rules and the registry are the primary data sources for this analysis.

3. Key design challenges for emissions trading additionality

In baseline and credit schemes, the additionality of a particular project is assessed with respect to one or more baselines. For example, the additionality tests applied to clean development mechanism (CDM) projects under the Kyoto Protocol are: environmental additionality (that the project leads to a real reduction in emissions from what would have occurred otherwise), investment additionality (the project is only economically feasible due to the creation of credits) and policy additionality (the projects are not just complying with existing regulatory requirements or due to other government programmes) (CDM, 2007).

Unfortunately, in our assessment of additionality in the GGAS, we do not have access to investment information and so have assessed additionality using three overlapping types: abatement additionality and two subtypes defined as business as usual (BAU) additionality and policy additionality.

Abatement additionality is defined to be where projects have reduced emissions since the start of the GGAS compared to what the emissions would have been otherwise.

a. *BAU additionality*: where the abatement was not driven by what could reasonably be expected to occur in the sectors included in the GGAS, for example, by technological progress, changes in primary energy availability (e.g. low hydro inflows) and changes in primary energy price relativities or changes in demand characteristics, and
b. *Policy additionality*: where the abatement was not driven by some other government policy designed to reduce greenhouse gas emissions.

Thus, only projects that have abatement, BAU and policy additionality would reduce global emissions compared to before

[2] As stated in Mundaca and Neij (2007), "The EWC project has not covered any detailed assessment and justification procedures of TWC in Europe. This is due to the enormous complexity of such an evaluation process and the need of having a better understanding of policy making processes and detailed data of technologies, market actors and segments, energy efficiency policy instruments already implemented etc., for each European country."

the GGAS started and are unlikely to have occurred in its absence. We discuss these types of additionality separately because their absence has very different implications.

Lack of abatement additionality is a crucial failing from a climate change perspective. It means that emissions have not been reduced by as much as is claimed. Lack of BAU additionality or policy additionality means that although abatement may have occurred, it would have occurred anyway and so could imply free riding and windfall profits for the certificate creators. Given the considerable amount of effort that goes into developing and complying with schemes such as GGAS, it is obviously important that they actually drive change that would not have happened anyway.

4. Key GGAS design choices and their consequences

In this section we discuss some of the GGAS's key design features and their impacts on scheme performance. Some of these features are fundamental to the scheme design and so cannot be altered without essentially creating a new scheme, while others are more peripheral to the scheme design and so are more amenable to change.

4.1. Fundamental design features

The first fundamental design flaw is that the number of NGACs created by projects under the Relative Intensity Rule (explained below) assumes that each generator displaces another generator with an emissions intensity equal to the NSW pool coefficient.[3] However, new generators built to meet growth in demand will not displace existing generators, and if they are not incorporated into the pool coefficient calculation,[4] will increase emissions. All new generators built outside NSW, such as the coal-fired generators discussed below, are not included in the pool coefficient calculation, and so NGACs created by such generators lack abatement additionality. This design flaw will only apply to other baseline and credit schemes that reward low-emission generation with respect to an average scheme emission intensity that does not adjust for additional generation.

Just over 82% of the NGACs created for the 2003, 2004 and 2005 compliance years were created under the Relative Intensity Rule. Under this rule, generator owners can create NGACs for any generation above their NSW Production Baseline where the emissions intensity of that generation is lower than the NSW pool coefficient—see Fig. 1. Appendix B shows the NSW Production Baseline for the different generator categories and explains how these generator categories are defined.

Between 2002/03 and 2005/06, demand in the Australian NEM increased 19.7% (NEMMCO, 2006). The 445 MW Tarong North coal-fired power station in Queensland started operation in August 2003 and created 118,981 NGACs for the 2003, 2004 and 2005 compliance years, while at the same time emitting an estimated 3.1 million tonnes[5] of CO_2-e per year. The 840 MW Millmerran power station's two coal-fired generating units started operation in 2002 and 2003, respectively, and have so far created 171,177 NGACs for the 2003, 2004 and 2005 compliance years. These are supercritical steam-cycle units of a similar size to the Tarong generator and so would have emitted approximately 6 million tonnes of CO_2-e per year. Both Tarong North and Millmerran power stations have created NGACs and so, according to the scheme's rules, have reduced per-capita emissions since the GGAS began. Ironically, the more electricity (and therefore emissions) they produce, the larger the number of NGACs they can create.

A second fundamental design flaw is that each NGAC corresponds (in principle but not necessarily in practice) to 1 tonne of CO_2-e abated, or in other words, the absence of emissions. An absence of emissions cannot be measured but must be estimated with respect to a projection of what would have happened in the scheme's absence. This is inherently counterfactual and cannot be independently verified (the exception to this is NGACs created through biosequestration projects; however, these can only be estimates and are in a constant state of flux). One study in eastern European countries estimated the range of counterfactual uncertainty for demand-side projects to be $\pm 35\%$ (Parkinson et al., 2001). This problem applies to all baseline and credit emissions trading schemes, and the CDM's additionality tests attempt to minimise its impact (UNFCCC, 2007) but their effectiveness has been questioned (reviewed in Hepburn, 2007).

4.2. Peripheral design features

Several peripheral GGAS design features reduce the plausibility of additionality:

1. the NSW pool coefficient is determined by a subset of generators
2. some project baselines are either defined or calculated in an unsatisfactory manner
3. the eligibility of certain projects to create NGACs is questionable
4. the number of NGACs to be surrendered is calculated with respect to a target for per-capita emissions, rather than a target for actual emissions.

These features are discussed in the following sections.

4.2.1. NSW pool coefficient is determined by a subset of generators

The NSW pool coefficient is derived from Category B generators and inter-state flows from other states in the NEM, and so is not altered by emissions from any other category of generators. This means that the emissions from newly constructed generators that are not classified as Category B will not be fully incorporated into the calculation of the requirement for NGACs (except to the limited extent that they affect inter-state flows). This reduces the GGAS's abatement additionality. This design flaw will only apply to other baseline and credit schemes that do not increase the requirement for certificates as new generation is brought on-line.

4.2.2. Determination of project baselines

The clear majority[6] of the 2003, 2004 and 2005 NGACs were created by plant built and commissioned before the start of the GGAS—see Table 1. A majority were also created under the Relative Intensity Rule by plant commissioned prior to GGAS.[7]

[3] An explanation of the NSW pool coefficient, which is also used to calculate the state-wide annual requirement for certificates, is given in Appendix A.

[4] As explained in Appendix A, their inclusion in this calculation would increase the NSW annual requirement for NGACs.

[5] Tarong North had an emissions intensity of 0.86 tonnes CO_2-e/MWh and an availability of 93.5% (TN, 2004).

[6] Over 1 million NGACs were created by plants that could not be identified using the information in the GGAS database and so it was assumed these started operation after the scheme began. If they did not, the pre-scheme certificates increased to over 98%, 89% and 74% for 2003, 2004 and 2005, respectively.

[7] The other pre-GGAS certificates were created under the Efficiency Improvement Rule (e.g. fossil fuel plants such as Hazelwood under GES).

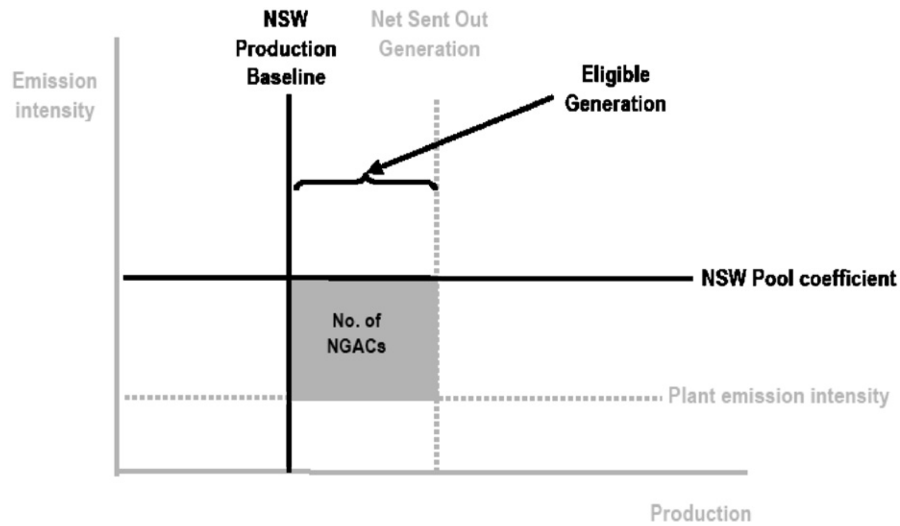

Fig. 1. Certificate creation under the Relative Intensity Rule (IPART, 2006b). *Note:* A retailer that has a power purchase agreement with a Category A generator can create NGACs for generation below the NSW Production Baseline. In this case, NGACs created through activity above the NSW Production Baseline accrue to the generator.

Table 1
NGACs created by plant commissioned before the start of the GGAS

Year	Created by plant commissioned before start of GGAS (%)	Created under the relative intensity rule (%)
2003	95	83
2004	85	76
2005	69	52

Table 2
Hazelwood's emissions and NGAC creation

Year	Change in emissions compared to 2002 (tonne CO_2-e)	NGACs created
2003	+10,780	251,199
2004	+85,638	130,906
2005	−890,192	675,881
Total	−793,776	1,057,986

As shown in Appendix B, Table 7, the NSW Production Baselines for generators that create NGACs under the Relative Intensity Rule were often set well before the GGAS commenced operation. The NSW Production Baseline for Category A generators is zero, meaning all generation is eligible to create NGACs, and they contributed 35.6% of the 2003/04/05 total, with a significant majority being from plants built between 1994 and 1997. Similarly, all generation from Category A renewable plants, built between 1928 and 1996, is eligible to create NGACs, which accounted for another 17.8% of the 2003/04/05 total. IPART has stated these backdated baselines were to reward these generators for undertaking early action (Macdonald, 2007). However, providing financial reward is only one of at least two functions of certificates in an emissions trading scheme. A second function is to act as an accounting tool to quantify and track emissions. Setting a generator's NSW Production Baseline some years before the GGAS commenced means that the generator can create NGACs without contributing any additional 'abatement' activity since the scheme began. This design flaw will only apply to other baseline and credit schemes that allow pre-scheme projects to have baselines lower than their level of activity at the time the scheme commenced.

4.2.3. *Moving NSW Production Baselines*

Category B fossil fuel generators can create NGACs using Method 1—Generator Efficiency Standards (GES) Gain for operational efficiency improvements that do not involve changes to their design or fuel mix and are recognised under the Commonwealth GES programme. In this case, NGACs can be created according to the degree to which the emissions intensity is less than the GES lower greenhouse intensity (GI) value. The lower GI value may move due to changes in fuel quality and the operating regime and age of the plant, and so it is possible for NGACs to be created without any reduction in the generator's emissions intensity. From the information available in the NGAC database it is not possible to tell if a Category B generator in fact used method 1, 2 or 3. However, it is worth noting that the number of NGACs created by Category B generators show little correlation with the emissions reported in their annual reports. For example, the emissions intensity of Delta's Vales Point and Wallerang plant increased from 2002/03 to 2003/04 and yet they created 94,537 NGACs for the 2003 compliance period (Delta, 2004). During each of the years 2003, 2004 and 2005, Hazelwood Power Station was credited with abatement through the creation of NGACs, despite that fact that in both 2003 and 2004 its emissions were higher than in 2002—Table 2. In 2005, the NGACs created were fewer than the corresponding decrease in emissions, bringing the total to 264,210 more NGACs created than emissions reduced for 2003 to 2005 (IPH, 2006). While it is difficult to compare years (NGACs can be created during an 18-month period), the link between the creation of NGACs and a reduction in physical emissions is certainly not clear. Although this design flaw is based on a particular aspect of another Australian scheme, it could apply to other baseline and credit schemes that allow the use of moving baselines.

4.2.4. *Activities on only one side of some baselines are recognised*

As explained in Section 4.1, creation of abatement NGACs by a generator under the Relative Intensity Rule assumes it displaces generation with an emissions intensity equal to the NSW pool coefficient (which is more emissions intensive than the generator creating the NGACs). On this basis, generation below its NSW Production Baseline would displace less of the more emissions-intensive generation and so the generator should 'lose' abatement NGACs when this happens. However, this is not the case, meaning that the GGAS explicitly assumes that activity levels above the baseline reduce emissions whereas activity levels below the baseline do not increase emissions. This problem may have occurred for Pelican Point gas-fired plant, which reduced output in 2004 because of delayed supply of gas from the new Minerva gas field in Victoria (IP, 2004), and created NGACs for 2003 and 2005 but not for 2004. A total of 26.5% of the 2003/04/05 NGACs were created by activities that could go below their NSW Production Baseline. This design flaw will apply to all other baseline and credit schemes that do not penalise activity below the project's baseline (or for schemes that reward activity below a project's baseline, then it will apply if they do not penalise activity above a project's baseline).

4.2.5. *Eligibility of certain projects to create certificates*

4.2.5.1. Mandatory Renewable Energy Target. The Mandatory Renewable Energy Target (MRET) is a scheme designed to increase the use of renewable energy in the NEM. Renewable energy certificates (RECs), which correspond to 1 MWh of electricity produced by accredited renewable generators, are used to track compliance with the scheme's annual targets. RECs that are associated with electricity sold in NSW can be used to meet participants' liabilities under GGAS. The RECs are multiplied by the NSW pool coefficient to give an equivalent number of NGACs. The associated low-emission generation would occur regardless of the GGAS and so these NGACs lack policy additionality. For the 2003/04/05 compliance periods, 2,503,619 RECs were converted into 2,271,203 NGACs. These NGACs made up 28.7%, 12.9% and 11.2% of those used to meet liabilities for each of these years, respectively, and so made up 13.6% of the 3-year total. As the MRET target increases, the number of REC-derived NGACs is also likely to increase, although because of the increasing GGAS target, REC-derived NGACs will make up a decreasing proportion of the total GGAS liability. This design flaw will apply to all other baseline and credit schemes that allow the credits from one scheme to count towards fulfilling the obligations of another.

4.2.5.2. Greenhouse Gas Abatement Program. The Greenhouse Gas Abatement Program (GGAP) was a Commonwealth programme that provided funding for activities that are likely to result in substantial emissions reductions or activities to offset greenhouse emissions. Projects that received GGAP funding after 1 January 2003 can create NGACs under GGAS in proportion to the funding provided by the generator. Projects initiated before 1 January 2003 have no such restriction. The GGAP rules stipulate that funding will only be provided over and above that which is commercially viable for the proponent. This means the GGAS rewards post-2002 activities for doing what was already commercially viable, and so lacks BAU additionality. The GGAS rewards pre-2003 activities both for doing what was already commercially viable as well as what the Commonwealth government paid for, and so lacks both BAU and policy additionality. This type of design flaw will apply to all other baseline and credit schemes that allow overlap between different government schemes.

4.2.5.3. Biosequestration. Biosequestration activities create NGACs in GGAS under the Carbon Sequestration rule, and contributed 2.9% of the 2003/04/05 total. It is likely the number of NGACs created through biosequestration activities will increase as the rules for sequestration have been finalised and the programme has been extended to a relevant investment timeframe. Assessing the additionality of biosequestration is complex, both in terms of measurement uncertainty and in verifying there are reasonable grounds for believing the project would not have happened anyway. Biosequestration activities allowable under the GGAS can have commenced any time from 1990 onwards, and so may not have been driven by the scheme. Such activities are project-based, meaning they apply only to the Eligible Forests on the Eligible Lands that are creating NGACs. This means leakage may occur because they do not incorporate other compensating activities by the organisation that may offset the sequestration abatement, e.g. increased logging in other areas because the GGAS project area is no longer available for logging.

Non-permanence is also an issue for all biosequestration projects since carbon stored in biomass is at continuous risk of being emitted to the atmosphere. Project-based afforestation and reafforestation are allowed in the CDM but non-permanence is addressed through the issuance of temporary credits that must be replaced with some other credit on expiry. Temporary certified emission reductions (tCERs) expire at the end of the commitment period following the one during which they were issued. Long-term CERs (lCERs) can be nominated as either fixed or renewable. If fixed, a period of up to 30 years is allowed, and if renewable, a period of up to 20 years is allowed, which can be renewed up to two times, that is, they will expire after at most 60 years depending on the approach selected (UNFCCC, 2006).

The NGACs issued for biosequestration activities through the GGAS require maintenance of carbon stocks for 100 years, after which the NGACs need not be renewed. Given the long time frames of climate change, maintenance for 100 years is no substitute for carbon storage in the form of fossil fuels. In addition, the ability to enforce maintenance of plantings for 100 years is clearly problematic—particularly when there are likely to be marked changes in temperature and rainfall over that time that impact the viability and carbon balance of such ecosystems (IPCC, 2007a).

The design flaws relating to time of project commencement, leakage and non-permanence may also apply to other baseline and credit schemes depending on the particular biosequestration rules they use to address these issues.

4.2.6. *Certificate liability is linked to population*

The annual requirement for certificates under GGAS is linked to the NSW population and so as the population increases, allowed emissions can also increase. While the GGAS has been in operation the NSW population has increased from 6,678,400 in 2003 to a projection of 6,896,800 for 2007, or 0.8% per annum (GGAS, 2007). By 2051 the population of NSW is projected to reach about 8.7 million people, an increase of about 2.0 million people (or 30%) since 2004 (ABS, 2006). Thus, even assuming all the GGAS certificates are entirely additional, the total emissions allowable under GGAS would increase to over 9% above 2003 levels. This design flaw is likely to apply to other baseline and credit schemes that link their target to population.

4.3. *Design features that limit the impact on NSW electricity sector emissions*

A key function of an emissions trading scheme is to drive the innovation and deployment of low-emission technologies and associated infrastructure likely to be required for longer-term reductions in emissions. The GGAS allows NGACs to be created by certified low-emission generation activities in States/Territories throughout the Australian National Electricity Market. It also

Table 3
NGACs created outside NSW

Year	NGACs created outside NSW
2003	33.2%
2004	31.6%
2005	34.4%
Total	33.2%

allows large numbers of NGACs to be created by projects that burn methane, such as landfill gas and waste coalmine gas plants. Both these design features potentially reduce the effectiveness of the GGAS in driving innovation in the NSW electricity sector.

According to IPART's Compliance and Operation Report for the 2005 liability period, 33.2% of the 2003/04/05 total NGACs were created by projects outside NSW—see Table 3 (IPART, 2006a).

Of the 2003/04/05 NGACs created by NSW projects, biosequestration made up 4.3%, landfill gas projects made up 14.8% and waste coalmine gas projects made up 44.5% of the 3-year total. Because of the methane multiplier applied to landfill gas and waste coalmine gas projects, more than 75% of NGACs created by coalmine gas plants and Category A landfill gas plants, and essentially all NGACs created by Category C & D landfill gas plants, are from methane avoidance.[8] These methane-derived NGACs make up at least 47% of the NSW-located total, and at least 31% of the overall total for 2003/04/05. Accounting for the NGACs created by projects outside NSW as well as the biosequestration and methane-derived NGACs, the final number of 2003/04/05 NGACs created by activities that directly affect the emissions from electricity generation in NSW is unlikely to be much greater than 30% of the 3-year total.

To the extent that GGAS drives real emissions reductions in other states' electricity industries, it may still support some long-term structural change in those states. However, unlike the CDM, where legal rights to abatement are recognised by participating jurisdictions (UNFCCC, 2006), there are no formal arrangements in place regarding NSW's legal right to claim any abatement that occurs outside its borders. In this case, NSW electricity users may support abatement claimed by others (for example in other government or voluntary schemes), reducing equity and possibly resulting in double counting.

The significant use of offsets such as biosequestration and methane avoidance certainly reduces the costs of abatement—although this does not necessarily translate across to liable parties, who by purchasing NGACs pay closer to the marginal abatement cost. It has been argued that the use of offsets establishes the cost of carbon abatement across a broader section of the economy (Macdonald, 2007). However, offsets are more likely to remove the 'lowest hanging fruit' in a number of sectors, leaving only the more expensive options available for the deeper cuts almost certain to be required at a later date. Strictly speaking, offsets establish a 'rule approval' price, i.e. the cost of getting a project through the rules that determine eligibility for certificates. While conversion of methane to carbon dioxide certainly has greenhouse benefits, an emissions trading scheme is not necessarily the most efficient way to drive this practice, for example, it may be more effective to simply legislate that methane at large point sources must be either utilised or flared, the practice in a number of countries, for example the United Kingdom (Rosevear, 2005) and the United States (MM, 2005).

[8] Based on current values for the emissions intensity adjustment factor, marginal loss factor and NSW pool coefficient.

5. Assessing the effectiveness, efficiency and equity of GGAS

It is instructive to assess government climate change policy against three key criteria of effectiveness (have emissions been reduced?), efficiency (has this occurred at least cost?) and equity (have costs and benefits been distributed as evenly as possible?). As discussed, and as summarised in Table 4, it is very likely that emissions have not been reduced nearly as much as is claimed, decreasing the scheme's effectiveness.

Low effectiveness results in low efficiency because if emissions are not reduced as much as is claimed then the cost per unit of real reduction increases. There is a significant impact on both dynamic efficiency (the development of new products, processes or capabilities) and static efficiency (the refinement of existing ones), when a large part of the scheme's cash flow is collected from electricity consumers and delivered to participants who are not actually undertaking genuine, non-BAU, abatement activities. Although the scheme's costs have been distributed amongst electricity consumers, the allocation of cash flow for creation of NGACs has been highly concentrated, and so equity is also low, especially where the abatement would have occurred anyway or has not occurred at all.

Placing a price on greenhouse emissions is an important function of any emissions trading scheme, and is necessary for building the capacity within industry and government that will be required for the transition to a less carbon-intensive economy. Unfortunately, it is doubtful that the GGAS is doing this. Rather, it is placing a price on NGACs, which actually represent the absence of imputed emissions with respect to an historical or projected baseline. Thus, although it has been claimed the GGAS "has minimised the cost of abatement to NSW consumers and industry, compared to other types of regulatory measures or Government programs" (DEUS, 2006), this would not be true if, as reported here, the actual abatement was much less than claimed and much of the 'abatement activity' would have occurred anyway, was already happening, has not decreased emissions or has actually increased emissions.

Table 4
Reasons for low effectiveness in the GGAS

Section	Reasons for low effectiveness
4.1	The Relative Intensity Rule assumes that a new generator displaces another generator with an emissions intensity equal to the NSW pool coefficient. However, new generators built to meet growth in demand will not displace existing generators, and if they are not incorporated into the pool coefficient calculation, will increase emissions.
4.2.1	Emissions from newly constructed generators that are not classified as Category B will not be fully incorporated into the calculation of the requirement for NGACs.
4.2.2	Some generators' NSW Production Baseline was set some years before the GGAS commenced, meaning that the generator can create NGACs without contributing any additional 'abatement' activity since the scheme began.
4.2.3	Using Method 1—GES Gain, the baseline that determines how many NGACs are created, can move, and so it is possible for NGACs to be created without any reduction in the generator's emissions intensity.
4.2.4	Projects can create credits when they go above their baselines but do not 'pay them back' when they go below them. Thus, it is possible for a project to oscillate around its baseline, with no net contribution to low emission generation, yet create abatement NGACs.
4.2.5.3	In the short term, there may be increased logging in other areas because the GGAS project area is no longer available for logging. In the longer term, the forested areas need only be maintained for 100 years, after which they may degrade, for example, because of fire or changes in temperature and rainfall.

6. Possible lessons for governance in the policy design process

The design and implementation of government policies targeting the reduction of greenhouse emissions is one of the most important and difficult challenges facing modern society. To date such policies have mostly focussed on fossil fuel use. Fossil fuel-based energy systems form the energy backbone of industrial society, and so changes to their use will have significant impacts. These impacts will not be evenly distributed amongst stakeholders, being more concentrated on incumbent and often powerful industry groups, and tending to occur in the short term. In contrast, the impacts of climate change occur over the longer term and over a wider range of stakeholders, many of whom live in a different country to the industry groups' operations, and most of whom are yet to be born. Thus, there are clear imbalances between the various stakeholders that may influence the decision-making process used to develop government policy. There is also uncertainty regarding both the impacts of climate change and the nature and cost of measures to reduce emissions (IPCC, 2007a, b). These issues combined with the generally short-term focus of the final arbiter (government), which makes decisions based on optimising a number of different outcomes, only one of which may be an effective emissions trading scheme, means the policy development process is fraught with difficulty.

As a result, the first operating version of a scheme is likely to require design revisions. Revisions will also be required as circumstances change, for example as targets are updated or new sectors are incorporated. This means that not only must a scheme be designed so that it can be revised, but some form of ongoing revision process must be formally incorporated into the scheme.

6.1. Policy path dependency

Prior to GGAS, the NSW Electricity Retailer Licence Conditions under the NSW Electricity Supply Act (1995) included annual per capita emissions reduction targets between 1996/97 and 2000/01. However, they had very limited impact because they lacked penalties for non-compliance. The current GGAS was intended to address this problem, as well as reset the targets. During the policy consultation process, observers including the authors (Nolles et al., 2002; Outhred et al., 2002), raised concerns about the scheme's likely performance because of:

- its complex design *abstractions* that effectively separate the stated policy objectives and defined targets (electricity-related greenhouse emissions per NSW resident) from actual physical emissions from the state's electricity sector,
- difficulties in ensuring that the scheme actually drives *additional* abatement,
- a lack of *transparency* in the reporting of the scheme's operation and in legislated assessments of its performance,
- *complex* operational requirements placed on participants, that seem likely to cause significant transaction costs and
- *trading arrangements* that may actually increase the costs of meeting the scheme's policy objectives, and unfairly impact on some parts of the community.

After the GGAS had been operating for over 2 years, the authors reported on the GGAS outcomes for the 2003 compliance period and confirmed that these problems were in fact affecting the GGAS's performance (Passey et al., 2005; MacGill et al., 2005). Although a number of changes have been made to the GGAS since it began operation, these have not addressed the problems identified above, but instead have been primarily directed at increasing the ease and opportunity for accreditation and the creation of NGACs.

The NSW Government's ongoing reluctance to address these issues may carry through to a national emissions trading scheme. The NSW Government is currently considering ways to compensate projects that will no longer be able to create NGACs once a national scheme is implemented and the GGAS expires (DWE, 2008). As discussed above, many of the projects that create NGACs are of dubious additionality. If compensation occurs through the national scheme (e.g. using free permits), this is likely to damage the national scheme's effectiveness, efficiency and equity.

This policy 'path dependency' highlights the importance of good governance because elements of poor scheme design may be very difficult to redress and may carry through to subsequent schemes.

6.2. Separation of powers

Schemes such as GGAS can be separated into design, operation and assessment components, where the scheme may be implemented through the following process: scheme design—initial scheme operation—scheme assessment—revised scheme design and implementation—further operation—scheme assessment—revised scheme design and implementation, etc. In this process, separation of powers between the 'designer', 'operator' and 'assessor' is important to reduce conflicts of interest, especially where the assessor is publicly reporting on outcomes that are relevant to public welfare and are important to informing revision of the scheme design. Managing this interface for complex schemes is very challenging, and the need for scheme revision must be balanced with the need for investor certainty and the reduction of sovereign risk.

The EU ETS illustrates the need for design revision, where in the first allocation phase a number of problems arose. These included over-allocation of permits, updating allocations between trading periods and free allocation of allowances coupled with their withdrawal from 'ceasing installations' (Betz and Sato, 2006). While the degree to which these issues are addressed during the EU ETS second allocation phase remains to be seen, the GGAS in its current form does not even provide this opportunity to correct design faults, as no formal revision requirement was incorporated into the design process.

Fig. 2 below illustrates one possible decision-making framework for schemes such as the GGAS. A scheme is designed at the Governance level, which for GGAS involved the NSW Department of Energy Utilities and Sustainability (DEUS),[9] and 'Regulator' corresponds to the assessor, which for GGAS is the IPART.[10] In practice, IPART also fills the role of 'Scheme Administrator' and so is responsible for operation of the scheme. Thus, IPART is responsible for both operating and assessing the scheme. Note that this assessment role includes only assessing compliance to the GGAS Rules, it does not extend to assessing the GGAS's overall effectiveness, efficiency and equity.

Fig. 2 also illustrates the importance of good governance. The NSW Government is responsible for scheme design and for establishing both the Regulator and Scheme Administrator, as well as assigning their responsibilities and overseeing their operation. While IPART is responsible for production of the annual Compliance and Operation Reports that have so far failed to identify the design problems described in this paper, IPART's reporting guidelines are assigned to them by the NSW Government.

[9] Now the Department of Water and Energy.

[10] The Independent Competition and Regulatory Commission in the ACT.

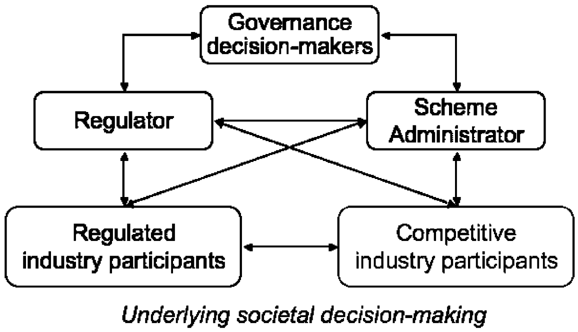

Fig. 2. Possible decision-making framework for an emission abatement scheme for a competitive electricity industry. *Note:* (1) Regulated industry participants include natural monopolies such as transmission and distribution network operators that are subject to direct regulation by government. Competitive industry participants include organisations such as energy retailers that are exposed to competition in the market. (2) All arrows are bidirectional to indicate the two-way flow of influence between the various participants.

7. Conclusions

There is no doubt that some projects that created NGACs represent additional abatement, and the scheme may drive some additional investment in activities that have lower emissions than would otherwise have been the case.

However, fundamental design features (which cannot be changed without creating an entirely new scheme) mean that a significant proportion of the NGACs are unlikely to correspond to the claimed emissions reductions. These design features are that:

(1) The number of NGACs created by most projects is calculated with respect to an imputed and rather abstract NSW pool coefficient. One consequence is that new low-emission projects built in response to demand growth, and whose emissions are not incorporated into the pool coefficient, will increase emissions while at the same time creating NGACs.
(2) Each NGAC corresponds to an absence of emissions, which cannot be measured but must be estimated with respect to a projection of what would have happened in the scheme's absence. This is inherently counterfactual and means that the scheme's outcomes (NGAC creation) are separated from the physical aim to reduce emissions.

Some design features could be altered to increase the scheme's effectiveness, efficiency and equity. However, to date, the NSW Government has not implemented such changes.

Because of these design problems, the GGAS is unlikely to be compatible with international schemes such as the EU ETS or the Kyoto Protocol. This may delay Australia's engagement with the international carbon market. The Australian Government has committed to implement a national emissions trading scheme starting in 2010. This will most likely result in the GGAS being phased out, and the NSW Government is currently considering ways to compensate projects that will no longer be able to create NGACs. If this occurs through the national emissions trading scheme, the effectiveness, efficiency and equity of the national emissions trading scheme may be reduced.

Some of the design flaws discussed here are likely to be peculiar to the NSW GGAS, while some could apply to other baseline and credit schemes depending on their rules of operation—see Table 5.

Table 5
Relevance of design flaws to other baseline and credit schemes

Section	Design flaw and applicability to other baseline and credit schemes
5.1	Relative Intensity Rule Will only apply to other baseline and credit schemes that reward low-emission generation with respect to an average scheme emission intensity that does not adjust for additional generation
5.1	Certificate corresponds to an absence of emissions Will apply to all baseline and credit schemes
5.2.1	NSW pool coefficient is determined by a subset of generators Will only apply to other baseline and credit schemes that do not increase the requirement for certificates as new generation is brought on-line
5.2.2	Determination of project baselines Will only apply to schemes that allow pre-scheme projects to have baselines lower than their level of activity at the time the scheme commenced
5.2.3	Moving NSW production baselines Similar problems could apply to other baseline and credit schemes that allow the use of moving baselines
5.2.4	Activities on only one side of some baselines are recognised Will apply to all other baseline and credit schemes that do not penalise activity below a project's baseline
5.2.5.1	Relationship to the Mandatory Renewable Energy Target Will apply to all other baseline and credit schemes that allow the credits from one scheme to count towards fulfilling the obligations of another
5.2.5.2	Relationship to the Greenhouse Gas Abatement Program Similar problems will apply to all other baseline and credit schemes that allow overlap between different government schemes
5.2.5.3	Time of project commencement, leakage and non-permanence Will apply to other baseline and credit schemes depending on the particular biosequestration rules they use to address these issues
5.2.6	Certificate liability is linked to population Is likely to apply to other schemes (either baseline and credit or cap and trade) that link their target to population

The issues discussed here are particularly relevant to the design of cap and trade emissions trading schemes, which are widely seen as a critical component of the response to climate change. One reason is that the GGAS serves to highlight the importance of good governance in any scheme design, and the need for separation of powers through a scheme development process that involves design, assessment and revision. Another reason is that offset schemes, which like GGAS, are baseline and credit schemes, are commonly seen as an adjunct to cap and trade schemes. For example, the Kyoto Protocol's CDM and Joint Implementation Flexibility Mechanisms, the EU ETS, the proposed Australian national emissions trading scheme and the various United States schemes all involve the use of offsets. 'White Certificate' baseline and credit schemes targeting uptake of energy efficiency are also becoming increasingly common, and also suffer similar additionality concerns (Fischer, 2005; Langniss and Praetorius, 2006; Bertoldi and Huld, 2006).

Poorly designed emissions trading schemes could delay meaningful action, not only because of the perception that emissions are being reduced more than they actually are, but also because firms that base their business plans on them are likely to either actively oppose any changes or require significant compensation. This could result in a degree of policy path dependency in climate policy, where improvements aiming to increase policy effectiveness, efficiency and equity become more and more difficult to achieve. Moreover, poorly designed, non-transparent schemes could undermine the development of the trust between national and international stakeholders that will be necessary to achieve an effective and equitable global response to climate change.

Given the poor performance to date of both the EU ETS and the NSW GGAS, and the increasingly urgent recognition of the need for effective mitigation policy, it is possible that poorly designed schemes could move the social consensus away from such market-based measures. Policy-makers must do far better or turn their attention towards alternative policy approaches, such as adopting a set of relatively narrow, targeted and transparent policies that have been demonstrated to work in other contexts, and are more likely to deliver robustly effective, efficient and equitable climate change outcomes.

Appendix A

The NSW pool coefficient

The NSW pool coefficient represents an average of the 5 previous years' annual pool values (APVs) lagged by 2 years. The APVs are estimated greenhouse emissions per MWh from the pool of major power stations in NSW (known as Category B generators) and from inter-state flows from generators in other states of the Australian National Electricity Market (NEM).

IPART estimates the emissions associated with electricity use in NSW by multiplying the NSW pool coefficient by the annual NSW electricity demand. The GGAS annual emissions targets are calculated by multiplying the NSW population with that year's per capita emissions benchmark. The annual NSW requirement for certificates is calculated by subtracting the annual emissions target from the estimated total NSW emissions (after allowing for transmission and distribution losses). See Table 6.

Appendix B

Definitions of categories of generators under GGAS

The following explains how the generator categories are defined, and Table 7 shows the NSW Production Baseline for the different generator categories.

Category A: includes only those generators that have a Power Purchase Agreement (PPA) with a retailer whereby this retailer (known as the 'deemed retailer') takes direct physical supply from the generator. This means generators that satisfied the criteria for 'Category A' in the previous voluntary benchmark scheme's Emission Workbook, provided that they continue to satisfy that criteria.

Category B: includes the NSW pool generators listed in Schedule B of the Generation Rule. This category comprises the existing large coal-fired and hydro generators located in NSW.

Category C: renewable generators that started commercial operation before 1 January 1997; fossil fuel generators with production capacity of 30 MW or less that started operation before 30 June 1997; and fossil fuel generators with production capacity of more than 30 MW that started operation before 1 January 2002.

Category D: includes all generating systems that commenced operation after 1 January 2002; fossil fuel plants with production capacity of 30 MW or less that started operation after 30 June 1997; and all renewable generation plants established after 1 January 1997.

Table 6
GGAS's key factors

Key factor	2003	2004	2005
NSW pool coefficient (tCO_2-e/MWh)	0.897	0.906	0.913
Electricity demand (GWh)	63,178	65,671	66,611
NSW population	6,678,400	6,752,100	6,812,300
Benchmark (tCO_2-e)	57,768,160	56,109,951	54,225,908
Liability[a] (tCO_2-e)	1,699,941	5,897,236	9,150,547

Data are from the NSW Greenhouse Gas Reduction Scheme website http://www.greenhousegas.nsw.gov.au/benchmark/key_factors.asp.
[a] The liability data are from IPART (2006).

Table 7
NSW production baseline for the different generator categories (IPART, 2006b)

Category	Fuel	NSW Production Baseline
A	Fossil fuel	The maximum output the deemed retailer is entitled to purchase under the power purchase agreement (PPA). If the maximum output is not defined then the generator's net sent out generation per annum is used.
	Renewable	Depends on whether the PPA specifies a maximum output and whether the generator has been assigned a REC baseline by ORER. For more details see (IPART, 2006b).
B	Fossil fuel	No NSW Production Baseline.
	Renewable	The generator's REC baseline assigned by ORER.
C	Fossil fuel	The generator's average net sent out generation from 1997 to 2001, with adjustments for periods of atypical output.
	Renewable	Either the generator's REC baseline assigned by ORER or, if it does not have a REC baseline then its average net sent out generation from 1997 to 2001, with adjustments for periods of atypical output.
D	Fossil fuel	Zero.
	Renewable	Zero.

The Office of the Renewable Energy Regulator (ORER) is responsible for administering the MRET scheme described in Section 4.2.5.1.

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