Centre for Energy and Environmental Markets

The NSW Greenhouse Gas Abatement Scheme:

An analysis of the NGAC Registry for the 2003 Compliance Period

Sources of registered NGACs,
Market Concentration,
Reporting Transparency, and
Additionality questions

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Robert Passey
Iain MacGill
Karel Nolles
Hugh Outhred

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UNSW
THE UNIVERSITY OF NEW SOUTH WALES
SYDNEY • AUSTRALIA

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About the CEEM and this paper:

The Centre for Energy & Environmental Markets was founded in 2004 to allow the University of New South Wales to provide interdisciplinary research and advice on the design, implementation and operation of energy and environmental markets.

The Centre formally brings together researchers from within the Faculty of Engineering, the Faculty of Commerce & Economics and the Australian Graduate School of Management. The CEEM also has active collaborations occurring across other faculties at the UNSW, and with a number of Universities and other organisations.

The CEEM has formal research partnerships with the Interdisciplinary Center for Economic Science at George Mason University and with the Power Sector Engineering Research Centre (PSerc) based at Cornell University.

This paper (DP_050405) presents some findings of a recent analysis of the NGAC Registry for the 2003 Compliance Period of the NSW Greenhouse Abatement Scheme.

A companion paper (DP_050408) considers some of the possible policy implications from the findings of this registry analysis.

This is an area of ongoing work for CEEM and we are actively seeking feedback and comments on the analysis methodology and findings outlined in this paper.

The corresponding author for this paper is:

Dr Robert Passey
r.passey@unsw.edu.au

www.ceem.unsw.edu.au

UNSW
THE UNIVERSITY OF NEW SOUTH WALES
SYDNEY • AUSTRALIA

Executive Summary

The NSW Greenhouse Gas Abatement Scheme (NGAS) aims to reduce the per-capita greenhouse gas emissions associated with electricity consumption in NSW from the benchmark 8.65 tonnes CO_2-e in 2003 to 7.27 tonnes CO_2-e by 2007, and continue this until 2012. This objective is implemented via mandatory benchmarks applied to electricity retailers, generators that supply directly to retail customers, and some major energy users.

The compliance instruments used to measure performance of covered entities are NSW Greenhouse Gas Abatement Certificates (NGACs). There is also a related instrument known as the Large User Abatement Certificates (LUACs). The NGACs and LUACs are recorded in a certificate registry operated on behalf of IPART, in their role as NGAS Administrator.

The NGAS has now been underway for over two years and NGACs registered from certified activities undertaken for the 2003 compliance year have all been recorded in the NGAC registry.

In this paper, a detailed analysis of the NGACs registered for the 2003 compliance period is used to assess the scheme's performance over this period. We identify all the activities that earned NGACs in that year, and consider possible issues of market concentration in terms of who registered these NGACs. In order to assess the scheme's effectiveness in reducing per capita emissions we focus particularly on the scheme's transparency and additionality: transparency is assessed in terms of public availability of data regarding how NGACs are created, and additionality is assessed in terms of whether the NGAS actually drives greenhouse abatement that would not have occurred otherwise. We then briefly consider the possible implications of this analysis for future performance of the scheme over its mandated life

This paper is focused on detailing the results of analysis of the data from the NGAC registry. A companion paper (DP_050411) from CEEM discusses some of the wider policy issues and implications of the findings in this paper.

The main findings of this analysis are as follows:

Most 2003 NGACs come from just a few types of projects

1. Waste coal mine gas and landfill gas projects were the main sources of NGACs for 2003, registering just over two thirds of the total between them. Together with natural gas-fired plant they made up just under 84% of the total, and these three with coal-fired plant made up just under 92% of the total.
2. Project accreditations for 2004 include more waste coal mine gas, landfill, DSA, bagasse and fossil-fuel power stations as well as two new activities – sequestration projects and creation of LUACs.
3. Just over 40% of the 2003 NGACs were from projects outside NSW.

There is evidence of market concentration

1. There is a high level of market concentration. A single participant, Integral Energy, created almost half (46%) the 2003 NGACs, and together with EDL (17%) and AGL (8.5%), created over 70%.
2. The Herfindahl-Hirschman Index (a metric used to quantify market concentration) for the supply side of the NGAS in 2003 is around 2,540. Indicatively, a market where the HHI exceeds approximately 1,800 may be considered highly concentrated, with the implication that the assumptions of a competitive market may be violated.

Reporting transparency is lacking

1. The lack of publicly available data often makes it difficult to assess both how a particular project created NGACs and the likelihood that the underlying emission reduction activity was additional.
2. The main problems relate to which method or equation was used, how baselines were calculated, and how compliance was achieved.

Additionality is not clear

1. Despite the lack of reporting transparency, on available evidence from the registry it appears the level of additionality (in terms of emission reduction activity) may be low.
2. This particularly applies to Category A fossil fuel plant, and to biogas plant that create NGACs through so-called avoided methane emissions for generation above their MRET baseline (such as landfill gas), which together account for over 75% of the 2003 NGACs.
3. NGACs created directly from mandated retailer RECs obligations reduce additionality further. They made up 28.5% of total NGACs surrendered in 2003.

Emissions are greater than implied by the scheme

1. A significant proportion of the low emission plant does not have to increase generation compared to their level of output before the scheme in order to create NGACs. Thus their activities that created NGACs won't necessarily have changed the emissions intensity of electricity sold in NSW.
2. Despite the NGACs being denominated in units of 1 tonnes CO_2-e abated, the average emissions displaced by each NGAC was less than 1 tonne CO_2-e because the emissions intensity of the plant actually displaced by NGAC-creating plant is likely less than that of the scheme's pool coefficient.

Implications for scheme performance to 2012

1. In addition to the current NGACs whose degree of additionality is low, NGACs created through RECs (created due to the Federal Government's Mandatory Renewable Energy Target) will reach around 2.5 million per year by 2012.
2. NGACs likely to be created through activities under other government programs and by new plant built to meet BAU demand growth could also significantly limit the need for additional NGACs from other activities.

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Introduction

The NSW Greenhouse Gas Abatement Scheme (NGAS) imposes mandatory greenhouse gas benchmark targets on all NSW electricity retailers and certain other parties for electricity consumed in NSW. A declining per-capita NSW state target for these emissions is compared to an 'imputed' estimate of actual NSW emissions from the electricity sector each year. 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 NSW Greenhouse Gas Abatement Certificates (NGACs), each representing an imputed one tonne of CO_2-e of 'avoided' GHG emissions. Alternatively, liable parties can pay a penalty of \$10.50/tCO_2-e in lieu of each NGAC that they are short of their target. NGACs can be created through certified low-emission generation, energy efficiency and sequestration activities. The scheme commenced on 1st January 2003.

The NGAS has now been underway for over two years, and all NGACs created from certified activities undertaken for the 2003 compliance year have been recorded in the NGAC registry. There is now an opportunity to assess how the scheme has actually performed in practice to date. The primary data source for this analysis is the NGAC Registry overseen by the scheme administrator, the NSW Independent Pricing and Regulatory Tribunal (IPART).

We conducted an independent search through the NGAC Registry, creating and analysing our own database of the registered NGACs for 2003. In this paper we first present some analysis of the certificates issued for 2003, identifying the different activities that earned NGACs in that year, and the major organisations involved. We then briefly assess these activities against one of the scheme's core policy objectives of reducing the greenhouse gas emissions associated with electricity consumed in NSW.

This analysis focuses particularly on questions of the scheme's transparency and additionality. Transparency is explored in terms of public availability of data regarding how NGACs are created, and additionality is considered in terms of whether the activities that created NGACs for 2003 would have occurred without the scheme.

We then briefly consider the possible implications of the issues raised above in the possible performance of the scheme over its mandated life to 2012.

Analysis of the NGAC registry

According to the scheme's Key Factors, in 2003 total state electricity demand was 63,178 GWh, and the assigned pool coefficient was 0.897, giving a total of 56,670,666 tonnes emissions of CO_2-e if we assume that all electricity sold came from the pool. The electricity sector 2003 benchmark was given as 57,768,160 tonnes CO_2-e, which after subtraction from the state total (increased to allow for transmission and distribution losses), gives the number of NGACs required to meet the NSW 2003 liability. This number is calculated by IPART.

NGACs can be created through:

- Low-emission generation of electricity (Generation) under the Relative Intensity or Efficiency Improvement approaches,
- Activities that result in reduced consumption of electricity (Demand Side Abatement),
- The capture of carbon from the atmosphere in forests (Carbon Sequestration), or
- Activities carried out by elective participants that reduce on-site emissions not directly related to electricity consumption (Large User Abatement).

Renewable Energy Certificates (RECs) from the Federal MRET scheme deemed to correspond to electricity sold in NSW can also be used to meet liable parties' benchmarks, where RECs are multiplied by the NSW pool coefficient to obtain the equivalent number of NGACs. Large electricity users can create Large User Abatement Certificates (LUACs) if they have elected to manage their own greenhouse gas benchmark and undertaken emission reduction activities that don't relate to electricity consumption. LUACs cannot be traded.

Sources of 2003 NGACs

Up to the end of June 2004, 6,662,994 NGACs were registered through Generation or DSA activities, and 1,167,392 NGACs were surrendered to meet 2003 liabilities. In addition, 544,518 RECs equivalent to 488,432 NGACs were also used to meet liabilities. No LUACs were registered.

IPART accredited 113 projects to create NGACs for 2003. Our analysis of the NGAC registry database allows categorisation of the types of projects as summarised in Table 1. This shows that waste coal mine gas and landfill gas projects were the main sources of NGACs for 2003, representing just over two thirds of the registered total between them. Together with natural gas-fired plant they made up slightly less than 84% of the total, and adding to these three the coal-fired plant creating NGACs accounts for slightly under 92% of the total.

Just over 40% of the 2003 NGACs were from projects outside NSW.

Table 1 Sources of 2003 NGACs by fuel type
(based on our analysis of the NGAC registry)

	NGACs registered for 2003	% of total registered for 2003 [a]	Cumulative % total
Waste Coal Mine gas	2,478,611	37.2	37.2
Landfill gas	1,979,899	29.7	66.9
Natural gas	1,117,472	16.8	83.7
Coal-fired plant	538,184	8.1	91.8
DSA - Generation	278,939	4.2	96.0
Hydro	132,869	2.0	98.0
Energy efficiency - DSA	66,744	1.0	99.0
Sewage gas	59,381	0.9	99.9
Bagasse	10,895	0.2	100.1[a]
Total	6,662,994	100	

(a) The total is greater than 100 because of rounding.

Major providers of 2003 NGACs

The five major providers of 2003 NGACs are identified in Table 2.

Table 2 Market share of major providers for 2003 NGACs
(based on our analysis of the NGAC registry)

	NGACs registered	% of total NGACs registered	Cumulative % total
Integral Energy	3,048,880	45.8	45.8
Energy Developments Ltd	1122260	16.8	62.6
AGL	542625	8.6	71.2
International Power	285002	4.3	75.5
International Power Hazelwood	251199	3.8	79.3

It can be seen that Integral Energy registered nearly half the total NGACs created for the 2003 compliance period. Integral Energy is an electricity retailer and distribution network operator based in Western Sydney. It is the second largest of the NSW State Owned electricity utilities.

Just under 17% of NGACs were created by EDL, and 8.2% were created by AGL. Together these three created over 70% of the NGACs for 2003. The largest 5 participants represent 79% of the NGACs created for 2003.

This represents a high level of market concentration. An indicative tool for quantifying market concentration is the Herfindahl-Hirschman Index (HHI)[1]. The HHI ranges from 0 (perfect competition with thousands of firms) to 10,000 (indicating a complete monopoly). As a general rule, a HHI of more than around 1,800 is considered a highly concentrated market place requiring particular regulatory consideration. Using the data extracted from the NGAC registry, the HHI on the supply side of the NGAC market for 2003 would be around 2540, suggesting a high level of concentration, and potential for the exercise of market power.

[1] The HHI is not a definitive measure, however it is used by both the U.S. Department of Justice and the Australian Competition and Consumer Commission as one indicative tool to quantify the likelihood of market power when evaluating mergers and the necessity of regulatory intervention. The HHI is defined as follows:
$HHI = s_1^2 + s_2^2 + s_3^2 + s_n^2$ (where s_n is the market share of the ith Firm as a percentage).

Assessing the Scheme

Table 2 (based on our analysis of the registry) sets out the various projects and the number of NGACs they created for the 2003 compliance year. This table as presented in Appendix 1 also includes the detailed project characteristics relevant to NGAC creation.

As discussed below, there is a lack of transparency in public reporting of these projects that makes assessment difficult. Nevertheless, with many of them it is not clear that additionality has been achieved even though they have created significant numbers of NGACs.

Table 2 2003 NGACs by Operator and Project
(Based on our analysis of the NGAC Registry)

Operator	Project	NGACs	% of total	Cumulative
Integral Energy	Tower and Appin collieries	2,468,419	37.05%	37.05%
	Smithfield natural gas cogen	580,461	8.70%	
		3,048,880	45.76%	45.76%
Tower and Appin (1996[2]) and Smithfield (1997) are eligible to create NGACs from all generation.				
Energy Developments	Landfill gas	1,122,260	16.84%	62.60%
Seven landfill gas plant commissioned from 1992 to 1995 are Category A and are eligible to create NGACs for avoided methane emissions from generation above their REC or PPA-derived baseline. Three landfill gas plant commissioned from 1998 to 2002 are eligible to create NGACs for avoided methane emissions from all their generation,				
AGL	Landfill gas	493,545	7.41%	
	Sewage and natural gas	75,837	1.14%	
		569,382	8.55%	71.15%
Four 1995 landfill gas plant create NGACs in the same way as the equivalent Category A EDL plant. West Nowra (2002) creates NGACs in the same way as the equivalent Category D EDL plant. Werribee (1997) can create NGACs for generation above the average annual net sent out generation from 1997 to 2001. Varnsdorf (~1994) and Coopers Brewery (2003) can create NGACs from all generation.				
International Power	Natural gas	285,002	4.28%	75.43%
Pelican Point (2001) can create NGACs above the average annual net sent out generation 1997-2001 if it uses the Relative Intensity rule.				
International Power Hazelwood	Coal-fired	251,199	3.77%	79.20%
Hazelwood (1964) created NGACs through actions taken under the GES.				
CS Energy	Natural gas[3]	228,718	3.43%	82.63%
Swanbank E (2002) can create NGACs from all generation.				
Energy Australia	Landfill gas	160,449	2.41%	
	Hydro and DSA	13,521	0.2%	
		173,970	2.61%	85.24%
Lucas Heights (1995) and Belrose (1995) create NGACs in the same way as the equivalent Category A EDL plant. Glenbawn (1995) can create NGACs for generation above either the PPA-derived baseline, or if no PPA then from all generation.				
Country Energy	Tahmoor (DSA & Gen)	120,943	1.81%	
	Hydro & Biomass	52,721	0.79%	
		173,664	2.61%	87.85%
Tahmoor (2001) can create NGACs from all generation if using the Relative Intensity approach, and also under the DSA rule. Three hydro plant from 1992 to 1996 can create NGACs for generation above their REC or PPA-derived baseline. Nymboida (1928) and Oaky (1950s) can create NGACs for generation above either the PPA-derived baseline, or if no PPA then from all generation. Broadwater (1996) can create NGACs for generation above their REC or PPA-derived baseline., and by reducing its emission intensity through cogeneration.				

[2] A year in brackets is a year of commissioning
[3] Is actually coal seam methane but is classified as natural gas on Swanbank E's NGACs.

Operator	Project	NGACs	% of total	Cumulative
TXU	Landfill gas	109,839	1.65%	
	Hydro	42,821	0.64%	
		152,660	2.29%	90.14%
Berwick (1992) can create NGACs in the same way as the equivalent Category A EDL plant above. Three hydro plant from 1994 can create NGACs from generation above their REC or PPA-derived baseline. Three hydro plant from 1989 to 1993 can create NGACs from generation above either the PPA-derived baseline, or if there is no PPA then from all generation.				
Eraring Energy	Coal-fired	129,086	1.94%	92.08%
Eraring (1984) created NGACs through actions taken under the GES.				
Visy Pulp & Paper	Biomass cogeneration	113,489	1.70%	93.78%
Tumut (2001) created NGACs under the DSA Rule most likely under the Generation Emissions Method.				
Delta Electricity	Coal-fired	94,537	1.42%	95.20%
Mt Piper (1992/93), Vales Point (1978/9) and Wallerawang (1957/80) created NGACs through actions taken under the GES.				
Energy Impact	Landfill gas	93,806	1.41%	96.61%
Molendinar (2002), Mornington (2002), Reedy Creek (2003), Stapylton (2002), Suntown (2002) and Wyndham (2003) create NGACs in the same way as the equivalent Category D EDL plant above.				
Macquarie Generation	Coal-fired	63,362	0.95%	97.56%
Liddell Power Station (1973) created NGACs through actions taken under the GES.				
Sydney Water	Sewage treatment plant	54.699	0.82%	98.38%
Malabar (1999) and Cronulla (2001) created NGACs under the DSA Rule most likely under the Generation Emissions Method.				
Origin Energy	Hydro & Natural gas	43,029	0.65%	99.03%
Yarrawonga (1993) created NGACs in the same way as the Country Energy hydro plant. Quarantine (2001/02) can create NGACs from all generation.				
Orica Australia	Botany Chlor-Alkali Plant	23,668	0.36%	99.39%
Orica's Botany Chlor-Alkali plant created NGACs under the DSA Rule using upgrades first commissioned in September 1998.				
Woolworths	Lighting Controls	15,517	0.23%	99.62%
Woolworths Supermarket After Hours Lighting Controls created NGACs through the DSA Rule.				
SEDA	Various projects	10,646	0.16%	99.78
SEDA created NGACs under the Residential Energy Efficiency Scheme.				
LESS	Project #1/2003	7,741	0.12%	99.90%
Low Energy Supplies and Services performed an unspecified project under the DSA Rule.				
Tomago Aluminium	Variable Speed Drives	6,386	0.10%	100.00%
Tomago Aluminium Fume Treatment Centre installed variable speed drives based on a feasibility study completed before 2000.				
Alinta DEBO	Natural gas	1,293	0.02%	100.02%[a]
Bairnsdale (2001) can create NGACs in the same way as Pelican Point.				

a: The total is greater than 100% because of rounding

Reporting transparency is lacking

The lack of publicly available data in the NGAC database often makes it difficult to assess how a particular project created NGACs. The main transparency issues for NGAC creation, along with the relevant projects to which they particularly apply, are as follows:

1. Which method was used to create NGACs under the Generation and DSA Rules?
   EXAMPLES: Pelican Point natural gas, Tahmoor waste coal mine gas plant, Tumut pulp and paper mill, Malabar and Cronulla sewage treatment plant, Alinta DEBO Bairnsdale natural gas
2. How are renewable energy plant baselines calculated? Were REC or PPA-derived baselines used? How were REC baselines calculated?
   EXAMPLES: All Category A and C renewable energy plant
3. How was compliance achieved under the Efficiency Improvement method? eg. did coal-fired plant go through operational changes or changes to either the plant design or fuel mix?
   EXAMPLES: Hazelwood brown coal, and Eraring, Mt Piper, Vales Point, Wallerawang and Liddell black coal
4. How many NGACs were created through avoided methane emissions?
   EXAMPLES: All landfill gas plant, Malabar and Cronulla sewage treatment plant
5. Which DSA-NGACs were deemed and are so from projects that should not contribute to further DSA-NGACs in the future?
   EXAMPLES: SEDA's Residential Energy Efficiency Scheme
6. Some plants were not properly identified.
   EXAMPLES: 'NSW', 'Qld', and 'ACT' landfill gas plant are specified only by their State not their name, and Lucas Heights does not specify whether unit 1 or 2

Additionality is not clear

Because of this lack of transparency, and since projects may create NGACs in a number of different ways under the NGAS Rules, the degree of additionality these certificates actually represent is difficult to determine. Nonetheless, it is clear from the available information that the additionality of many projects may be low. The reasons for this are outlined below along with the relevant plant and commissioning date. More detail for each project is provided in Appendix 1.

(i) Category A fossil fuel plant (3,058,743 NGACs, 45.9% of 2003 total)

Given these plant may have been commissioned at any time, and all generation is eligible to create NGACs:

a. To what degree did the existence of NGAS contribute to the decision to build the plant?
b. To what degree did the existence of NGAS contribute to the plant's final design and operation?
c. Has generation from these generators increased because of the NGAS?
d. Is the historical reason for all Category A generation being eligible justifiable in terms of the NGAS's primary aim to reduce GHG emissions?

Applies to Tower and Appin colliery waste coal mine gas plant (1996), Smithfield natural gas cogeneration plant (1997) and Varnsdorf natural gas plant (~1994).

(ii) Category C fossil fuel plant (286,295 NGACs, 4.3% of 2003 total)

For these plant where only generation above the average annual net sent-out generation from 1997 to 2001 is eligible to create NGACs;

a. To what degree is generation above the baseline due to the NGAS?

b. Do these generators surrender NGACs if their annual production is below their baseline?

Possibly applies to Pelican Point (2001) and Alinta DEBO Bairnsdale natural gas plant (2001).

(iii) Category D fossil fuel plant (351,604 NGACs, 5.3% of 2003 total)

Given these plant may have been commissioned on or after 1st July 1997 if 30 MW or less, or on or after 1st Jan 2002 if above 30 MW, and all generation is eligible to create NGACs;

a. To what degree did the existence of NGAS contribute to the plant being built?

b. To what degree did the existence of NGAS contribute to the plant's final design and operation?

c. Has generation increased because of the existence of NGAS?

d. Is classification of these plant as 'new' and so having a zero baseline justifiable in terms of the NGAS's primary aim to reduce GHG emissions?

Applies to natural gas plant at Coopers Brewery (2003), Swanbank E (2002) and Quarantine (2001/02), and Tahmoor waste coal mine gas plant (2001).

(iv) MRET baseline plant

Given that the MRET scheme was in operation several years before the NGAS, and the price of RECs is over three times that of NGACs, where NGAC creation is derived from generation above the REC baseline;

a. To what degree is generation above the REC baseline due to the NGAS? (1,945,561 NGACs, 29.2% of 2003 total)

Applies to landfill gas plant at Belrose (1995), Berwick (1992), Broadmeadows (1993), Brooklyn (2001), Clayton & Springvale (1995), Corio (1992), Eastern Creek (2002), Highbury Hill (1995), Lucas Heights 1 & 2 (1995, 1998), Molendinar (2002), Mornington (2002), Pedler Creek (1995), Reedy Creek (2003), Stapylton (2002), Suntown (2002), Tea Tree Gully (1995), West Nowra (2002), and Wingfield 1 & 2 (1994), and Wyndham (2003), and hydro plant at Burrendong (1996), Copeton (1996), Eildon Pondage (1994), Lake Glenmaggie (1994), Lake William Hovell (1994), Yarrawonga (1993) and Wyangala (1992), and Broadwater biomass cogeneration plant (1996).[4,5]

b. Do these generators surrender NGACs if their annual output is below the REC baseline in any year?

c. Is classification of renewable energy plant as 'new' with a zero baseline, as long as first commercial operation was on or after 1st Jan 1997, justifiable in terms of the NGAS's primary aim to reduce GHG emissions? (767,162 NGACs, 11.5% of 2003 total).

Applies to landfill gas plant at Brooklyn (2001), Eastern Creek (2002), Lucas Heights 2 (1998), West Nowra (2002), Molendinar (2002), Mornington (2002), Reedy Creek (2003), Stapylton (2002), Suntown (2002) and Wyndham (2003).

[4] If there exists a Power Purchase Agreement that includes a maximum amount of electricity expressed in MWh to which the Deemed Retailer is contractually entitled in a calendar year, the generator may choose to use the lower of this or the REC baseline. In this case, is generation above the PPA-baseline in order to create RECs?

[5] Some landfill gas plants were not named in the NGAC database, and may otherwise have been included here.

(v) Non-MRET-baseline plant (106,716 NGACs, 1.6% of 2003 total)

For these plant;

a. To what degree is generation above the baseline due to the NGAS?

b. Do these generators surrender NGACs if their annual output is below their baseline in any year?

Applies to Werribee sewage treatment plant (1997), and hydro plant at Glenbawn (1995), Nymboida (1928), Oaky (1950s), Blue Rock Dam (1991), Cardinia (1993) and Thomson Dam (1989).

(vi) Efficiency improvements under the Australian Government operated Generator Efficiency Standards program (538,184 NGACs, 8.1% of 2003 total)

Where NGACs were created through GES activities;

a. To what degree did the NGAS contribute to improvement beyond GES requirements?

b. To what degree did the NGAS result in the decision to undertake turbine upgrades?

c. To what extent are NGACs generated through routine annual fluctuations in emission intensity - where those worse than GES requirements do not 'pay back' NGACs?

d. Do these generators surrender NGACs if their efficiency falls below GES requirements?

Applies to coal-fired power stations at Hazelwood (1964)[6], Eraring (1984), Mt Piper (1992/93), Vales Point (1978/9), Wallerawang (1957/80)[7] and Liddell (1973).

(vii) Efficiency improvements outside the GES (286,295 NGACs, 4.3% of 2003 total)

For plant that created NGACs through efficiency improvements outside the GES;

a. To what degree is the improvement due to the NGAS?

b. **Do these generators surrender NGACs if their efficiency falls below their claimed enhanced efficiency?**

Possibly applies Pelican Point gas-fired plant (2001) and Alinta DEBO Bairnsdale natural gas plant (2001).

[6] Emission reduction for Hazelwood is part of an ongoing process initiated in 1997 with a commitment to reduce or offset annual emissions by 920,000 tCO_2-e per year by 2000, a commitment that saw them sign on to the GES in 2001. Between 1997 and 2002 the 'annual abatement' compared to 1996 reported by Hazelwood has ranged from 758,473 to negative 439,556 tonnes due to changes in emissions intensity. Reminiscent of the hydro baseline issue, if their 'abatement' again goes negative, they will not have to pay back the NGACs. Hazelwood's projected greenhouse emission index target for the period ending 2005 is approximately 1.53 tonnes CO_2-e/MWh sent out (IHP, 2003). This compares to the NSW Scheme pool coefficient of 0.913 for the same year. It is an unusual outcome (but one inherent in a baseline/credit scheme) that a plant that is 60% more emission intense than the NSW pool coefficient can gain "credits".

[7] For operational reasons, the emissions intensity of all four of Delta's plant varied over the last 4 years, sometimes above and sometimes below the lower GES band. Since NGACs would be created when below the lower band, but not lost when above, fluctuations that may on average be above, are still said to reduce emissions overall. In fact, the emissions intensity of three out of four plant increased from 2002/03 to 2003/04 and yet NGACs were created (Delta, 2004).

(viii) For NGACs created through Demand Side Abatement (DSA) activities (345,683 NGACs, 5.2% of 2003 total)

For abatement that occurred through one of a number of DSA activities

a. To what degree has the NGAS contributed to the relevant activities?

b. To what degree were these activities beyond standard practice or what would have occurred regardless?

Applies to Tahmoor waste coal mine gas plant (2001), Visy pulp and paper mill (2001), Malabar (1999) and Cronulla (2001) sewage treatment plant, Orica's Botany Chlor-Alkali plant, Woolworths Supermarket After Hours Lighting Controls, SEDA's Residential Energy Efficiency Scheme, Low Energy Supplies and Services projects, Tomago Aluminium Fume Treatment Centre and EnergyAustralia's power factor correction and energy efficiency pilot.

NGACs created directly through the MRET scheme reduce additionality

RECs created through the Australian Government's MRET scheme can be used to meet participants' liabilities under the NGAS. Because they are created using low emission generation that would occur regardless of the NGAS, they reduce its degree of additionality.

In 2003, 544,518 of the RECs generated for electricity sold in NSW were converted into 488,432 NGACs. They made up 28.5% of total NGACs surrendered in 2003 and reduced the scheme's additionality accordingly. As the MRET target increases, the number of REC-derived NGACs can also increase.

To what extent have 2003 NGACs actually reduced emissions?

According to IPART, all liable parties met their NGAC obligations under the scheme for 2003, and so "have reduced their emissions to their Benchmark levels" (IPART, 2004).

However, over 95% of 2003 NGACs were generated by plant that was commissioned before the start of the scheme. In addition, no operational changes are required for NGACs to be created by the plants that actually provided the great majority of the 2003 NGACs (eg. Category A fossil plant and 'new' renewable energy plant). This means their activities that created NGACs won't necessarily have changed the emissions intensity of electricity sold in NSW.

For example, consider a landfill gas plant that commenced commercial operation in 1997. Under NGAS, this would be classified as Category D, have a REC baseline of zero, and hence be able to create RECs from all its generation. Even if it operated at the same output from 1997 for each year through to 2004, as it passes from the 31st Dec 2002 to the 1st Jan 2003, its generation is suddenly eligible to create NGACs due to 'avoided' methane emissions from the landfill. Clearly, however, there would not actually be any physical change to greenhouse emissions between 2002 and 2003.

Further, the number of NGACs created by projects such as coal and natural gas plant is based on the difference between the emission intensity of the generator and the NSW pool coefficient, which in the NGAS is based on NSW Category B Generators eg. NSW owned generators (Delta, Macquarie, Eraring), Snowy hydro and Redbank 1. This rule design assumes the types of plant that create NGACs would displace Category B Generators. However, they are more likely to displace plant higher up the dispatch order, such as gas-peaking plant, which would have lower emission intensities. This means the emissions such plant actually displaced per NGAC is currently overestimated – that is, the "true" abatement is probably is less than 1 tonne CO_2-e per certificate.

Some possible implications for the future performance of NGAS

Over 95% of 2003 NGACs come from projects that appear able to continue to create NGACs over the mandated life of the scheme to 2012. Although some plant that created 2003 NGACs may produce less over time, other projects commissioned before the start of the scheme yet which didn't create NGACs in 2003 can be expected to do so from 2004 onwards.

These existing plants that aren't included in our 2003 registry analysis include a number of projects that may face similar additionality problems to those outlined above.

1. Two bagasse cogeneration projects that were commissioned before 2002, and are registered with ORER.
2. Teralba waste coal mine gas project received GGAP funding in May 2001, and it is expected abatement is 200,000 tonnes CO_2-e per year (AGO, 2005). Although projects that received GGAP funding after 1st Jan 2003 can create NGACS only in proportion to the funding provided by the generator, projects before this date have no such restriction.
3. Efficiency improvements of Stanwell coal-fired plant under the GES that involves upgrades of four turbines.
4. Tarong North 450MW supercritical coal-fired plant. Construction started in Jan 2000, and it will generate NGACs under the Relative Intensity rule. Assuming 860kg/MWh and a NSW pool coefficient of 930kg/MWh, generating 3.6 x 10^6 MWh/yr, about 250,000 NGACs would be created annually.

It therefore seems reasonable to expect that currently accredited projects that were operating before the scheme started might continue to produce more than six and a half million NGACs each year for the life of the scheme.

In addition to the current 2003 NGACs whose degree of additionality is unclear, NGACs will continue to be created from the growing MRET obligation of NSW retailers to 2010. If NSW's market share of total Australian electricity sales remains approximately the same to 2010, the total REC-derived NGACs will reach around 2.5 million per year by that time.

There would also appear to be considerable potential for NGACs to be created by activities undertaken over the next seven years under other government greenhouse policy programs such as GES and GGAP. Further, any load growth in the NEM to 2012 can be expected to drive investment in new plant that will be more efficient than the imputed NSW pool intensity and so will be able to create NGACs.

By way of comparison, some IPART projections of NGAC demand, that exclude any contribution from MRET-derived NGACs, suggest a scheme target of perhaps 20 million NGACs in 2012 (Drysdale, 2004).

Thus there are questions of what new abatement activity the scheme might actually drive over its lifetime. These issues are explored in the companion policy paper to this work.

Conclusion

The NGAS has been operational for over two years and although NGACs are created by a variety of projects, the majority are from existing waste coal mine gas and landfill gas plant, and just over 40% were from projects outside NSW. There is also a high level of market concentration suggesting significant potential for the exercise of market power.

The NGAC database lacks reporting transparency, with missing information including the method or equation that was used, how baselines were calculated, and how compliance was achieved.

It appears the level of additionality may be low. Emissions are also greater than implied by the scheme because a significant proportion of the low emission plant that created NGACs won't necessarily have changed the emissions intensity of electricity sold in NSW, and because the average emissions displaced by each NGAC was less than 1 tonne CO_2-e.

NGACs produced by existing plant, derived from RECs, and created under other government programs and by new plant built to meet BAU demand growth, could significantly limit the need for additional NGACs, and hence the effectiveness of the scheme.

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Appendix 1: Details of NGACs Created for 2003

Operator	Project	NGACs	% of total	Cumulative
Integral Energy	**Tower and Appin collieries**	**2,468,419**	**37.05%**	**37.05%**
	Smithfield natural gas cogen	**580,461**	**8.70%**	
		3,048,880	**45.76%**	**45.76%**

Both Tower and Appin use waste coal mine gas, and were commissioned in 1996. Smithfield was commissioned in 1997. All are Category A and so all generation is eligible to create NGACs through the Relative Intensity approach. All create additional NGACs by reducing their emission intensity - Tower and Appin through avoidance of emitted methane, and Smithfield through cogeneration.

Energy Developments	**Landfill gas**	**1,122,260**	**16.84%**	**62.60%**

All landfill gas plant that created NGACs did so under the Relative Intensity rule and are registered with the Office of the Renewable Energy Regulator (ORER) and so have a REC baseline. If RECs are created, NGACs can only be created because of avoided methane emissions, where the number of NGACs is equal to the number of RECs multiplied by an adjusted emissions intensity.

Berwick (1992), Broadmeadows (1993), Corio (1992), Pedler Creek (1995) and Wingfield 1 & 2 (1994) were commissioned before 1st Jan 1997, are Category A and have a REC baseline that is most probably the average of the three years generation prior to 1997. If they have a Power Purchase Agreement that includes a maximum amount of electricity expressed in MWh to which the Deemed Retailer is contractually entitled in a calendar year, the generator may choose to use the lower of this or the REC baseline as a baseline for creating NGACs.

Lucas Heights 1 (1995) was commissioned before 1st Jan 1997, is Category C and has a REC baseline that is most probably the average of the three years generation prior to 1997.

Brooklyn (2001), Eastern Creek (2002), Lucas Heights 2 (1998) were commissioned after 1st Jan 1997, are Category D, and have a REC baseline of zero.

Plant labeled as 'NSW', 'Qld', and the 'ACT' were not identified, and so their details are unknown.

AGL	**Landfill gas**	**493,545**	**7.41%**	
	Sewage gas	**59,381**	**0.89%**	
	Natural gas	**16,456**	**0.25%**	
		569,382	**8.55%**	**71.15%**

Landfill gas plant at Clayton & Springvale (1995), Highbury Hill (1995), Pedler Creek (1995) and Tea Tree Gully (1995) create NGACs in the same way as the equivalent Category A EDL plant above.

West Nowra (2002) create NGACs in the same way as the equivalent Category D EDL plant above

The sewage gas plant at Werribee was commissioned in 1997, is Category C and created NGACs under the Relative Intensity Rule and by avoiding methane release. It is not registered with the ORER and so its NSW production baseline is the average annual net sent-out generation from 1997 to 2001.

The natural gas plant are at Varnsdorf (~1994) and Coopers Brewery (2003) and are Category A and D respectively, and so all their generation can create NGACs.

International Power	**Natural gas**	**285,002**	**4.28%**	**75.43%**

Pelican Point was commissioned in 2001, and is Category C and so NGACs can be created through either the Relative Intensity or Efficiency Improvement Rule. If the former, only generation above the average annual net sent out generation from 1997 to 2001 is eligible.

International Hazelwood	**Power Coal-fired**	**251,199**	**3.77%**	**79.20%**

Hazelwood power station was commissioned in 1964, and created NGACs under the Efficiency Improvement Rule. IPH signed on to the Generator Efficiency Standards (GES) before 2001. Where the plant increases efficiency without changing the design or fuel mix, NGACs can only be created to the extent that the plant efficiency is improved to be lower that the calculated minimum greenhouse intensity (GI) value. Where significant changes are made to the design or fuel mix, all the redesign gain can be used to generate NGACs.

Operator	Project	NGACs	% of total	Cumulative
CS Energy	**Natural gas**[8]	**228,718**	**3.43%**	**82.63%**

Swanbank E began commercial operation in Nov 2002. Because it was commissioned after 1st Jan 2002 it is classified as a new plant (Category D) and so all its generation is eligible to create NGACs.

Energy Australia	**Landfill gas**	**160,449**	**2.41%**	
	Hydro	**10,735**	**0.16%**	
	Power factor correction	**2,140**	**0.03%**	
	Residential EE pilot	**646**	**0.01%**	
		173,970	**2.61%**	**85.24%**

Lucas Heights and Belrose landfill gas plant were both commissioned in 1995 (assuming is LH1, LH2 was commissioned in 1998), and create NGACs in the same way as the equivalent Category A EDL plant above.

Glenbawn hydro was commissioned in 1995, is classified as Category A, and is not registered with ORER. This means its baseline is the maximum amount of electricity to which the Deemed Retailer is contractually entitled in its PPA, or if there is no PPA then all generation is eligible to create NGACs.

The 'power factor correction' and 'energy efficiency' refit pilot NGACs were created under the DSA Rule.

Country Energy	**Tahmoor (DSA)**	**110,751**	**1.66%**	
	Tahmoor (Generation)	**10,192**	**0.15%**	
	Hydro	**41,826**	**0.63%**	
	Biomass cogeneration	**10,895**	**0.16%**	
		173,664	**2.61%**	**87.85%**

Tahmoor waste coal mine gas plant and was first commissioned in 2001. It created NGACs under the DSA Rule, most likely under the Generation Emissions Method. Tahmoor also created NGACs as a Category D generator where all generation could create NGACs under the Relative Intensity Rule.

Burrendong (1996), Copeton (1996) and Wyangala (1992) are classified as Category A, are registered with ORER, commenced operation before 1st Jan 1997, and so have a REC baseline that is most probably the average of the three years generation prior to 1997. If they have a Power Purchase Agreement that includes a maximum amount of electricity expressed in MWh to which the Deemed Retailer is contractually entitled in a calendar year, the generator may choose to use the lower of this or the REC baseline.

Nymboida (1928) and Oaky (1950s) are classified as Category A, and are not registered with ORER and so can create NGACs from generation above either the PPA-derived baseline, or if there is no PPA then from all generation.

Broadwater cogeneration plant was commissioned in 1996 and created NGACs under the Relative Intensity Rule. It is Category A, registered with ORER, and so can use either the REC or PPA baseline as above. It creates additional NGACs by reducing its emission intensity through cogeneration.

TXU	**Landfill gas**	**109,839**	**1.65%**	
	Hydro	**42,821**	**0.64%**	
		152,660	**2.29%**	**90.14%**

Berwick landfill gas plant was commissioned in 1992, and creates NGACs in the same way as the equivalent Category A EDL plant above.

Eildon Pondage (1994), Lake Glenmaggie (1994) and Lake William Hovell (1994) are classified as Category A and registered with ORER and so can create NGACs from generation above their REC or PPA-derived baseline.

Blue Rock Dam (1991), Cardinia (1993) and Thomson Dam (1989) are classified as Category A, and are not registered with ORER and so can create NGACs from generation above either the PPA-derived baseline, or if there is no PPA then from all generation.

Eraring Energy	**Coal-fired**	**129,086**	**1.94%**	**92.08%**

Eraring power station was commissioned in 1984 and created NGACs under the Efficiency Improvement Rule. Eraring Energy signed on to the GES in 2001.

Visy Pulp & Paper	**Biomass cogeneration**	**113,489**	**1.70%**	**93.78%**

Visy's pulp and paper mill at Tumut was commissioned in 2001 and created NGACs under the DSA Rule. It is registered with the ORER and so has a REC baseline of zero. NGACS were most likely created under the Generation Emissions Method.

[8] Is actually coal seam methane but is classified as natural gas on Swanbank E's NGACs.

Operator	Project	NGACs	% of total	Cumulative
Delta Electricity	**Coal-fired**	**94,537**	**1.42%**	**95.20%**
Mt Piper (1992/93), Vales Point (1978/9) and Wallerawang (1957/80) created NGACs under the Efficiency Improvement Rule. Delta signed on to the GES in 2000.				
Energy Impact	**Landfill gas**	**93,806**	**1.41%**	**96.61%**
Molendinar (2002), Mornington (2002), Reedy Creek (2003), Stapylton (2002), Suntown (2002) and Wyndham (2003) create NGACs in the same way as the equivalent Category D EDL plant above.				
Macquarie Generation	**Coal-fired**	**63,362**	**0.95%**	**97.56%**
Liddell Power Station (1973) created NGACs under the Efficiency Improvement Rule through turbine upgrades of units 1 to 4. Macquarie Generation signed on to the GES in 2002.				
Sydney Water	**Sewage treatment plant**	**54.699**	**0.82%**	**98.38%**
Malabar (1999) and Cronulla (2001) sewage treatment plant created NGACs under the Demand Side Abatement Rule. They are registered with the ORER and so have a REC baseline of zero. NGACs were most likely created under the Generation Emissions Method and through avoided methane emissions.				
Origin Energy	**Hydro**	**37,487**	**0.56%**	
	Natural gas	**5,542**	**0.09%**	
		43,029	**0.65%**	**99.03%**
Yarrawonga hydro power station was commissioned in 1993, is classified as Category A, is registered with ORER, and so has the same transparency and additionality problems as the equivalent Country Energy hydro plant. Quarantine natural gas power station was commissioned in Dec 2001/Jan 02, is classified as Category D and so all its generation is eligible to create NGACs.				
Orica Australia	**Botany Chlor-Alkali Plant**	**23,668**	**0.36%**	**99.39%**
Orica's Botany Chlor-Alkali plant created NGACs under the DSA Rule through replacement of Mercury Cell technology with more efficient Membrane Cell technology. Kvaerner were first commissioned in September 1998 to perform the replacement, which was first reported under the Commonwealth Greenhouse Challenge program in 2000.				
Woolworths	**Lighting Controls**	**15,517**	**0.23%**	**99.62%**
Woolworths Supermarket After Hours Lighting Controls created NGACs through the DSA Rule.				
SEDA	**Various projects**	**10,646**	**0.16%**	**99.78**
The NSW Sustainable Energy Development Authority (SEDA) created NGACs through 33 separate projects under the Residential Energy Efficiency Scheme in 2003, all of which also created NGACs for 2004. Almost all (32) of these generated less than 2000 NGACs and so were probably deemed (creating 7272 NGACs in 2003 and 4035 in 2004). One project generated 3,375 NGACs in 2003 and 2095 in 2004.				
LESS	**Project #1/2003**	**7,741**	**0.12%**	**99.90%**
Low Energy Supplies and Services performed an unspecified project under the DSA Rule.				
Tomago Aluminium	**Variable Speed Drives**	**6,386**	**0.10%**	**100.00%**
Tomago Aluminium Fume Treatment Centre installed variable speed drives based on a feasibility study completed before 2000 that indicated a pay-back period of about two years. Installation of the VSDs was reported under the Commonwealth Greenhouse Challenge program in 2002.				
Alinta DEBO	**Natural gas**	**1,293**	**0.02%**	**100.02%**[a]
Alinta DEBO Bairnsdale Power Station was commissioned in 2001 with an upgrade in 2002. It is categorised as Category C and so can create NGACs in the same way as Pelican Point.				

a: The total is greater than 100% because of rounding