Towards Emissions Trading: The Role of Environmental Management Systems in Voluntarily Disclosing Greenhouse Gas Emissions

Abstract

The Australian government ratified the Kyoto Protocol in 2007 signifying their commitment to address global warming and associated harmful climate change. Central to the Government's strategy is the proposed emissions trading scheme (AETS) now mooted to begin in 2011. Credible, transparent and efficient information is necessary to inform such a market, hence the *National Greenhouse and Energy Act 2007* requires annual mandatory corporate reporting of GHG emissions from 1 July 2008. This study examines GHG emissions disclosure practices of Australian companies as well as their motivations to voluntarily report emissions before mandatory reporting, from a legitimacy perspective. A logit regression is used to analyse the link between voluntary GHG emissions disclosure (VEmD) and: the existence of an environmental management system (EMS); presence of an environment committee; CEO membership of the environment committee; firm size and industry category of 271 ASX300 firms. The findings reveal that firms with an EMS in place are more likely to disclose discretionary GHG emissions data. Firms that have certified their EMS (ISO 14001) are more inclined to voluntarily disclose GHG emissions information than firms without a certified EMS. Energy and mining firms demonstrate a higher propensity to disclose GHG emissions information than other industries. Firm size was also positively related to VEmD. Findings of this study not only emphasise the importance of an EMS as a device to manage environmental impacts of a firm's operations, but it also shows the role of an EMS in bridging communication between firms and their relevant stakeholders.

JEL classification: M48; Q56

Keywords: Voluntary emissions disclosure, environmental management systems, legitimacy

1. Introduction

Increased scientific evidence of human induced global warming and associated harmful climate change has considerably challenged the global community's approach to dealing with harmful greenhouse gas (GHG) emissions (Stern, 2006; Garnaut, 2008). The Australian government ratified the United Nations' Kyoto Protocol (United Nations, 1998) in December 2007 signifying their commitment to reducing global warming with the aim of mitigating harmful climate change (Franklin, Ryan, Warren and Fitzpatrick, 2007). Central to the Australian Government's GHG reduction strategy is a proposed emissions trading scheme (AETS) (Garnaut, 2008; Wong, 2008), now mooted to begin in 2011 (Taylor, 2009). The proposed AETS is a market mechanism that encourages businesses to operate more efficiently, thus reducing GHG emissions through price signalling. Credible, transparent and efficient information is necessary to inform such a market (Garnaut, 2008) hence the *National Greenhouse and Energy Act 2007 (NGER Act 2007)* requires annual mandatory corporate reporting of GHG emissions from 1 July 2008.[1] The Act also provides a compliance assurance[2] framework which includes specific monitoring and enforcement measures which are available to the regulator, thus affecting the accounting profession (CPA Australia, 2008).

This study examines GHG emissions disclosure practices of Australian companies to voluntarily report emissions before mandatory reporting is implemented. To legitimise emissions reporting, companies must be equipped internally to measure and record levels of GHG emissions hence an environmental management system (EMS) provides systemic and credible support for external emissions reporting, especially if the EMS is accredited pursuant to ISO 14001. Malmborg (2002) argues that an EMS not only provides companies with an environmental management tool, but also facilitates the company's communication. The existence of a firm's EMS and its relationship to discretionary company GHG emissions disclosure is the primary focus of this study. We also investigate other factors that may influence voluntary company emissions disclosure such as board commitment (evidenced by the formation of an environmental committee), the role of the CEO on this committee, as well as firm size and industry membership. The factors of interest in this study are also part of the disclosure requirements of the Global Reporting Initiative[3] (2006, see A1 Governance structure and management systems).

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[1] It is expected that around 300 corporations will be reporting for the year 2008-09 (Australian Government: Department of Environment and Water Resources – Australian Greenhouse Office, 2007). Mandatory reporting on GHG emissions and energy use will expand to incorporate up to 700 companies in the 2010-11 reporting period (Australian Government: Department of Climate Change, 2008).

[2] Currently, annual emissions verification is not required (CPA Australia, 2008).

[3] Established in 1997, the Global Reporting Initiative is a joint initiative of the Coalition of Environmentally Responsible Economies (CERES) and the United Nations Environment Program (UNEP). Its aim is to provide a global and credible framework for sustainability reporting that can be used by all organisations (GRI, 2006).

We examine GHG emissions disclosures in 2007 annual reports, stand-alone environment or sustainability reports, and on company websites. Our sample of 271 Australian firms represents a broad cross-section of Australian industries in line with the forthcoming mandatory reporting requirements detailed in the *NGER Act 2007*. Results of logit regression tests provide support for our hypothesis that firms with an environmental management system are more likely to disclose GHG emission-related information to stakeholders. This result is stronger for firms which hold ISO14001 certification. Firms in the mining and energy industries, considered as 'emitters' (Burgess, 2007), also demonstrate a higher propensity to voluntarily report their GHG emissions.

This study adds to the limited research investigating voluntary company GHG emission disclosures prior to emissions trading. For example, Freedman and Jaggi (2004) examined voluntary GHG emissions information of electric utilities in the United States. Other research has reported on carbon trading practices in the UK and EU (eg. Roeser and Jackson, 2002; Okereke, 2007; Egenhofer, 2007) spurred on by implementation of the European Union's Emissions Trading Scheme[4] (EU ETS) on 1 January 2005.

As yet, no research has investigated the preparedness of Australian companies to report GHGs necessary for AETS. The general lack of knowledge about GHG emissions and specifically disclosure preparedness by Australian companies may be attributed to governments' wilful inaction over several decades. Pearse[5] (2009b, p.31) argues that…

> …fossil-energy producers and their biggest Australian customers--our carbon lobby in waiting--exerted a disproportionate political influence. As mostly foreign-owned, capital-intensive businesses, they often lacked electoral clout, so the only real ace in their pack was to threaten to take operations elsewhere. The best way to avoid regulation or to attract government support was to confuse the national interest with their own. That required strong relationships with both sides of politics, with bureaucracies, think-tanks, industry associations, scientific and economic agencies, and media commentators. The extent to which these industries succeeded over a period of decades is best reflected, as we've seen, in successive Australian governments' judgment that cheap coal is the centre-piece of national competitiveness. Thus, when climate change emerged as an issue, there was already a consensus among Australia's

[4] The proposed Australian scheme has been mooted to operate similarly to the EU ETS however the EU scheme covers only carbon dioxide emission trading, while the Australian scheme proposes to target several greenhouse gases as per *NGER Act 2007* (Garnaut, 2008). EU ETS is a cap-and-trade system where permits are allocated to companies that allow them to emit a certain quantity of greenhouse gases (the cap). When an enterprise emits less than its cap it is allowed to 'trade' its excess permits on the market. Conversely, if enterprises emit more GHGs than their targets, they can buy carbon credits (Europa, 2008).

[5] A former Liberal Party member, lobbyist and former Howard-government advisor, Guy Pearse exposes the rhetoric he once helped write. His writings make public the prior Australian governments' planned inaction to reduce Australia's emissions. He reveals politicians and bureaucrats willfully blind to Australia's real interests for several decades– who allowed climate change policy to be dictated by a small group of Australia's biggest polluters and their paid lobbyists.

business, political and media establishment that the quarry was sacrosanct, coal nonnegotiable. It had to be protected at all costs.

The impending AETS therefore is anticipated to have substantial structural and economic effects on government, business and Australian society generally as GHGs are priced for the first time into good and services, particularly energy (Garnaut, 2008; Pearse, 2009a). Hence this research will contribute to public policy development by providing a better understanding of the extent and determinants of company emissions disclosures. In particular the accounting profession has called for a regulatory framework to develop appropriate reporting and verification standards. Finally, business can benefit from understanding the extent to which their counterparts have embraced emissions measurement and disclosure, the role of environmental management systems in assisting this process, and the extent of board and management commitment necessary to meet impending government policy requirements.

The paper proceeds as follows. The next section discusses the limited research examining GHG emissions disclosure, the theoretical framework to be utilised in hypotheses development and hypotheses to be tested. Section 3 outlines the research design, data collection and variable measurement, while section 4 presents results of hypotheses testing. The final section presents some concluding comments and implications of the research.

2. Prior Research and Hypotheses Development

2.1 Disclosure of Carbon Emissions

While much research has examined voluntary environmental disclosure and its determinants (see for example, Patten, 1992; Roberts, 1992; Deegan and Rankin, 1996; Brown and Deegan, 1998; Deegan, Rankin and Tobin, 2000; Alciatore and Dee, 2006; Choe and Patten, 2007; Gibson and O'Donovan, 2007) limited research to date has investigated voluntary disclosure of company GHG emissions. Freedman and Jaggi (2005) documented the extent of global warming-related disclosures of 120 firms in 20 countries affected by the Kyoto Protocol. Firms from Protocol-ratifying countries were observed to provide more extensive pollution disclosures than those from non-Protocol ratifying jurisdictions. The authors also found firm size to be positively associated with the extent of pollution disclosure, but found no relation between operating performance and pollution disclosures.

Studies of carbon disclosures are only just emerging in Australia. Simnett and Nugent (2007) revealed that less than 10 percent of ASX listed companies disclosed carbon emissions in their 2005 annual reports. The authors argue that disclosing emissions within the annual report will be more credible where emissions' reporting is subject to the same level of assurance as any other aspect in

the annual report. Simnett and Nugent (2007) further suggest that reporting emission activities in unassured company stand-alone reports or websites may mislead.

A 2007 survey of ASX100 and NZ50 companies by the Carbon Disclosure Project (CDP5)[6] found a lack of consistency and transparency in the 64 respondent Australian companies' carbon disclosures. Sixty-five percent of the ASX100 firms presented sufficient emissions data, but only 10 percent of the sample externally-verified their emissions data. Moreover, CDP5 notes that "the level of (emissions) data was highly correlated with the type and level of exposure to carbon and other climate change risks" (Carbon Disclosure Project, 2007, p. 64).

PricewaterhouseCoopers (PwC) (2008) conducted one-on-one interviews with the CEOs and CFOs of 303 large Australian companies to determine their response to the emerging constrained emissions economy. The interviews focused on Australian companies' preparedness to engage in the carbon economy with respect to regulatory requirements, investor expectations and customer demand. Many of the interviewed business leaders were unsure about the potential business risks of climate change, and therefore had not yet implemented a strategic response. Evidence also suggested that the resources industry appears to be better-prepared than other sectors as most Australian resource companies have already formulated a strategic response, with 28 per cent allocating a budget to fund a strategic response to emissions-related risks. Results suggest that overall, Australian industry is unprepared for the forthcoming transformation to emissions trading. As Pearse (2009a; 2009b) argues, Australian governments avoided developing public policy or appropriate regulatory frameworks to deal with climate change risks even though sections of Australian business and broader public opinion consistently wanted action on this vital issue.

Consistent with a legitimation perspective, firms are likely to provide voluntary GHG emissions disclosures in an attempt to maintain their 'social contract' (Shocker and Sethi, 1973; 1974). A breach of the 'social contract' through a failure to meet societal expectations, will lead to a revocation of the firm's license to continuously operate in the community (Deegan and Rankin, 1996). The signing of the Kyoto Protocol by the Australian government in January 2008, as well as the release of the *NGER Act 2007*, is evidence of this change of the social contract at a national level. In addition, increased public pressure on governments to reduce climate-harming GHG emissions indicates a change in the terms of the 'social contract' between firms and society. Firms that do not respond to these changing social expectations are facing an increased legitimacy risk from stakeholders including investors who have concerns about the economic, financial and regulatory risks of climate change (Sethi, 1978; Carbon Disclosure Project, 2007). The current study is

[6] The CDP is a non-profit organisation of 385 institutional investors with assets under management of US$57 trillion in 2007, which are interested in assessing the impact of climate change on shareholder value.

undertaken in an uncertain regulatory setting prior to any mandatory reporting of emissions by Australian companies. In such a voluntary setting, Patten (1991, 1992) notes that firms may use disclosure either directly, to address public and/or legislative concerns, or indirectly, to signify that the firm is an environmentally aware organisation, thus maintaining legitimacy in terms of a changing social contract.

Little research has examined whether companies operating in the EU prior to the implementation of the EU ETS reduce their legitimacy risk, and address the revised terms of their 'social contract' through disclosure of carbon emissions. Okereke (2007), evaluated the propensity of UK FTSE 100 firms to join the voluntary UK ETS[7] and to provide associated disclosure. The author found that less than 10 firms joined the scheme while in existence, however more have since participated in the EU ETS. Okereke (2007) observed that the top UK companies began to disclose their actions to reduce GHG emissions as a result of increased pressure from powerful institutional investors such as the CDP, the Sustainable and Responsible Investment (SRI) Fund and the Institutional Investors Group on Climate Change (IIGCC) – evidence of the influence of stakeholders on legitimacy maintenance (Hybels, 1995).

2.2 Adoption of Environmental Management Systems (EMS) and Voluntary Disclosure

Thornton and Hsu (2001) contend that to tackle climate change, companies need to tailor their environmental management systems (EMS) to gain better control of GHG emissions. The United Nations (2001, p. 176) define an EMS as "systematic planning, implementation and control activities in order to achieve continual improvement of corporate environmental performance". Voluntary implementation of an EMS suggests a firm's commitment to better manage, measure and report environmental matters, including GHG emissions. Further, an EMS should assist enterprises in conducting cleaner production and better management of carbon emissions (Thornton and Hsu, 2001). Those firms with an EMS and associated cleaner production not only address the changing social contract regarding corporate impacts on global warming but also shape public perceptions, whereby these firms are more likely to be viewed as good corporate citizens.

A number of studies have investigated the link between EMS implementation and environmental performance (see for example Melynk, Sroufe and Calantone, 2003; Anandale, Morrison-Sanders and Bouoma, 2004; Khanna and Anton, 2002); however no study to date has examined the adoption of an EMS as a tool to enable measurement and disclosure of GHGs.

[7] The UK established an emissions trading scheme in April 2002. In addition to the aim of significantly reducing greenhouse gas emissions in accordance with the Kyoto Protocol, the UK ETS also aimed to prepare UK companies with practical experience in emissions trading ahead of the upcoming European trading scheme. This scheme was voluntary. The UK ETS was carried out over a five year period ending in December 2006 (Department for Environment, Food and Rural Affairs and the Forestry Commission, 2006).

While prior research found that the adoption of an EMS is primarily driven by external pressures faced by companies (Anandale et al, 2004; Khanna and Anton, 2002), Malmborg (2002) emphasises that the EMS is a tool not only important for an organisation's environmental management tasks, but also for communicative action and organisational learning. An essential communicative role of the EMS is to provide information regarding a company's environmental and sustainable development in response to community concerns (Malmborg, 2002). Therefore an EMS will serve both managerial and external reporting processes in response to both internal and societal environmental concerns.

Increased societal awareness about the pervasive harm and associated risks of GHG emissions is likely to encourage firms to adopt an EMS voluntarily. These early EMS adopters are able to collect their emissions-related information to better measure, manage and report their GHG emissions. Such firms with GHG emissions information are more likely to be in an advantageous position to communicate their efforts about GHG emissions' reduction to powerful stakeholders such as investor institutions (Anandale et al, 2004) and the public generally once the AETS is implemented. Hence, a firm's voluntary EMS implementation enables maintenance of legitimacy through the collection of vital data needed for voluntary GHG emissions disclosures. Accordingly, this study will test the following hypothesis:

H_{1a}: Firms with an environmental management system (EMS) are more likely to voluntarily disclose GHG emissions information than firms without an EMS.

2.3 Certified EMS and Voluntary Disclosure

In addition to implementing an EMS, firms can seek external certification through ISO 14001 to further demonstrate the quality of their management systems. Provision of a variety of institutionalised practices to lessen pollution, such as ISO 14001 certification, represent management's attempts to further legitimise the firm's environmental policies (Milne and Patten, 2002). ISO 14001 requires certifying companies to establish and maintain communication, both internally and externally. The external communication, which aims to manage a firm's relationship with external stakeholders, can be performed by providing disclosures in a number of different media, including the annual report, stand-alone sustainability report and internet (Whitelaw, 2004a; 2004b). This is acknowledged by Patten and Crampton (2004), who provide evidence that companies' involvement in ISO 14001 leads to a higher level of environmental disclosures. Another requirement of ISO 14001 is to continuously update an EMS to cover current environmental issues related to the adopted firm. Consequently, increased stakeholders' concerns on climate change and associated GHG emissions are more likely to be addressed by firms with a certified EMS in place

than an uncertified EMS. Having a certified EMS is also more likely to address risk concerns of stakeholders, thus ensuring firm legitimacy in the face of a changing social contract. This leads to the following hypothesis:

H_{1b}: Firms with an EMS that is also ISO 14001 certified are more likely to voluntarily disclose GHG emissions information than firms without a certified EMS.

2.4 Environment Committee and Voluntary Disclosure

The presence of a company environment committee signifies a firm's attempt to legitimate their commitment to sustainability (Milne and Patten, 2002). An environment committee suggests a firm's concern about managing GHG emissions to enhance and legitimize their environmental reputation (Neu et al, 1998) particularly in the eyes of powerful stakeholders (Anandale et al, 2004). One of the aims of an environment committee is to motivate a firm to implement policies and practices to measure and report on GHG emissions levels. The environment committee is likely to see the importance of this GHG reporting to their public, government and financial stakeholders, amongst others. As a legitimating strategy, firms with an environment committee are also more likely to publicly disclose their emissions levels in a voluntary disclosure regime to indicate their commitment to climate change (Lindblom 1994, cited in Gray, et al, 1995; Ashforth and Gibbs, 1990). Cowen, Ferreri and Parker (1987) provide evidence of specific committee-disclosure relationships, finding an association between the existence of a corporate social responsibility committee and human resource disclosure. We propose that:

H_2: Firms with an environment committee are more likely to voluntarily disclose GHG emissions information than firms without an environment committee.

2.5 CEO Membership of the Environment Committee and Voluntary Disclosure

Engaging the CEO as a member of the environment committee demonstrates the increased importance a company places on continually improving their environmental performance. Firms whose CEO represents the views of senior management on the environment committee will be more concerned about reducing GHG emissions, thus creating a more 'green' corporate image. Ashforth and Gibbs (1990) argue that a firm's commitment to deal with measuring and reporting GHG emissions needs to be communicated to the public to ensure that the legitimation action is successful. As emphasised by O'Donovan (2002, p. 348):

> "If senior management perceives that legitimacy is threatened, then legitimacy theory can now be described as: the greater the likelihood of adverse shifts in a corporation's conferring public perceptions of how socially responsible a corporation is, the greater the

desirability on the part of the corporation to attempt to manage these shifts in social perceptions."

Where the CEO is a member of the environment committee, the firm is more likely to want to indicate their strong commitment to reducing emissions and to the climate change agenda by disclosing GHG emissions data. Hence, we hypothesise that:

H_3: Firms engaging their Chief Executive Officer (CEO) as a member of their environment committee are more likely to voluntarily disclose GHG emissions information than firms without CEO membership on their environment committee.

2.6 Industry Category and Voluntary Disclosure

Some industries are more likely to generate greater public concern, particularly those industries whose business operations emit greater levels of harmful GHGs. The extractive and energy industries, for example, face greater legitimacy risk in this regard. Thus, the legitimacy gap is likely to vary across industries. Those industries with greater threats to their legitimacy as a result of GHG emissions are more likely to attempt to reduce this legitimacy risk by voluntarily disclosing their impacts from GHG emissions (Deirkes and Preston, 1977).

With regard to GHG emissions, industries can be classified into 'emitters' and 'non- emitters' (Burgess, 2007). The emitters with GHG emissions-heavy activities face higher legitimacy risks as they are more exposed to public scrutiny than non-emitters. In this study, consistent with Burgess (2007), the energy and extractive industry sectors are classified as the 'emitters'.

Patten (1991), Roberts (1992), Hackston and Milne (1996), and Patten and Crampton (2004) have all demonstrated an industry-disclosure association. We propose firms in emitting industries are more likely to voluntarily disclose their GHGs to enhance their legitimation:

H_4: Firms in emitting industries are more likely to voluntarily disclose GHG emissions' information than other industries.

2.7 Firm Size and Voluntary Disclosure

Larger companies are more likely to provide voluntary disclosures as they are likely to undertake more activities that affect the environment, thus attracting greater public concern. In addition, these large firms generally have more shareholders who may be interested in the firm's social and environmental activities (Cowen et al, 1987). Consequently, as larger firms attract greater scrutiny from stakeholders, indicating higher legitimacy exposures, we argue they are more likely to provide voluntary GHG emission disclosures to alleviate the potential legitimacy risks.

Prior research have demonstrated a positive association between firm size and disclosure (see for example Patten, 1991, 1992; Hackston and Milne, 1996; Patten and Crampton, 2004; Walden and Stagliano, 2004; Alciatore and Dee, 2006; Clarkson, Li, Richardson and Vasvari, 2007).

The current study proposes that larger firms are more likely to voluntarily disclose GHG emissions as these firms are more likely to be subject to legitimacy pressure from powerful stakeholders than smaller firms. Larger firms are more likely to attract more scrutiny from financial and other stakeholders with regards to riskiness of investment. Powerful stakeholders will be concerned about the effect of global warming on future operations and consequent resource flows (Hybels, 1995):

H_5: Firm size is positively related to the propensity to provide voluntary GHG emissions disclosures.

3. Research Design

3.1 Data and Sample

Data are collected from annual reports and stand-alone environment or sustainability reports and corporate websites for this archival study. Patten and Crampton (2004, p.31) note that "Corporate web pages appear to be adding at least some additional, non-redundant environmental information beyond what is provided in annual reports". Moreover, Frost, Jones, Loftus and Laan (2005) in their study of ASX500 environmental disclosures contend that annual reports provided less extensive information than discrete reports and websites. They further emphasised that the discrete reports provided the highest level of disclosures that tended to focus on environment information, whereas company websites provided a wider range of reporting. Accordingly, this study explores all three reporting channels to determine voluntary disclosure of GHG emissions for the year 2007.

The year 2007 is prior to mandatory reporting for Australian companies[8], hence represents a voluntary reporting context. The *NGER Act 2007* requires eligible Australian firms to report GHGs by 30 June 2009.

The sample includes a cross-section of Australian firms participating in the S&P ASX300 index, in line with the forthcoming mandatory reporting requirements detailed in the *NGER Act 2007*. The ASX300 represents around 81 percent of the Australian share market by market capitalisation

[8] The EU ETS commenced operation in 2005 (Europa, 2008), thus may impact on some Australian companies with subsidiaries or operations in the EU. In addition, during April 2006 the Australian government conducted a national stakeholder consultation as part of developing a nationally consistent framework for greenhouse and energy reporting by industry (The Parliament of the Commonwealth of Australia: Senate, 2007). These situations are more likely to raise awareness of Australian firms with regards to measuring their GHG emissions and collecting related data in preparation for the forthcoming mandatory reporting.

(Standard & Poor's, 2007). The initial sample consisted of the 295 firms[9] recorded in the ASX300 as at 26 August 2008. Four companies were removed as their official listing dates were after June 2006, and do not have sufficient data for all testing requirements. Another twenty firms were eliminated from the sample because they did not possess property, plant and equipment data for calculation of the NEW variable.[10] This resulted in a final sample of 271 companies.

Logit regression was used in hypotheses testing to examine the relative importance of explanatory variables in determining GHG emissions disclosure.

3.2 Measurement of Variables

3.2.1 Dependent Variable

Voluntary Emissions Disclosure (VEmD) refers to firm disclosures of their GHG emissions information. GHG emissions disclosures are not only presented as the numerical level of GHG emissions, but can be also presented in various other formats, such as a firm's GHGs related policy, reduction target, and initiatives. Data coding was performed to enable this information to be systematically analysed in the hypothesised model (Neuman, 2004). VEmD for the purposes of hypotheses testing, is a dummy variable which is coded one when the observed firm has provided GHG emissions disclosure and zero otherwise (Kennedy, 2008; Koop, 2006). The presence of voluntary GHG emissions disclosure was also categorised as either quantitative or qualitative, to capture more information for descriptive purposes.

Information on voluntary GHG emissions disclosure was manually collected from 2007 annual reports, 2007 stand-alone reports and 2008 firms' websites.[11] Some keywords were utilised for locating[12] emissions disclosure in these archival data sources. 'Carbon', 'emission' and 'greenhouse' are keywords used for locating Voluntary GHG Emissions Disclosure (VEmD). For consistency, a second researcher reviewed the collection of a sample of data. Inconsistencies were discussed and resolved prior to any further data collection. A random sample of all data was then further assessed for consistency.

[9] There were less than 300 stocks in the ASX300 because the S&P does not replace stocks removed from the list until the ASX300 index rebalancing process in March and September. The stock removal from ASX 300 between the rebalance dates may be due to firm takeover or merger cases (Standard & Poor's, 2008).

[10] These firms' main businesses are investments in nature, such as Babcock & Brown Japan Property Trust, Challenger Diversified Property Group, and Spark Infrastructure Group.

[11] Websites were examined in August 2008, the time of data collection.

[12] This study explored each firm's website in our sample to locate any further web-based GHG emissions disclosure (VEmD). Where websites had no search feature, the Google advanced keyword search function was employed to ensure more complete data collection.

3.2.2 Independent Variables

To test the first hypothesis EMS is a categorical variable where firms are classified into three groups: firms with no EMS; firms having a non-certified EMS; and firms having an ISO 14001-certified EMS.

To test hypotheses 2 and 3, both the presence of an environmental committee (ENV_COM) and CEO membership of the environmental committee (CEO_MEM) are measured as dichotomous variables.

Industry category, which comprises the 10 sectors of the Global Industry Classification Standard (GICS) utilised by the ASX for industry classification (Australian Securities Exchange, 2008a; 2008b) is used to test hypothesis 4. For analysis purposes to ensure each group contained a sufficient sample size, these ten industry sectors are classified into four industry groups based on similarities in the nature of the industry, as illustrated in Table 1.

[Table 1 about here]

Market capitalisation of sample firms is used to represent firm size when testing hypothesis 5. The raw market capitalisation values are utilised for descriptive statistics purposes, with a natural logarithmic transformation applied for statistical testing. This variable transformation is intended to alleviate the impact of outliers, particularly for skewed data (Tabachnick and Fidell, 2007). Industry categories and all financial data utilised in this study are collected from the Aspect Huntly FinAnalysis database.

3.2.3 Control Variables

Three control variables are utilised: return on assets (ROA), leverage (LEV) and newness (NEW). ROA is a proxy for firm financial performance (Clarkson et al, 2008) and is measured as the ratio of income before interest and tax at the end of the period to total assets at the beginning of the period. Lang and Lundholm (1993) note firms that have performed well are more likely to 'announce' their superior performance to the financial market. Consequently Clarkson et al (2008) conclude that profitable firms are more likely to provide environmental disclosures. Conversely, Neu et al (1998) find that unprofitable companies tend to utilise environmental disclosures for legitimacy purposes. However studies by Cowen et al (1987) and Patten (1991) find no such evidence of a relationship between profitability and corporate environmental disclosure.

LEV is included to control for the likelihood that high leverage firms provide greater levels of discretionary disclosures (Clarkson et al, 2008). Further, Roberts (1992) suggests that firms should manage creditors' impressions, as creditors are vital stakeholders. The more a firm relies on funding

from creditors, the more likely the firm is to address creditors' expectations regarding corporate responsibility activities by using voluntary disclosures. Alciatore and Dee (2006) also support the relationship between high leverage and higher levels of environmental disclosures. Leverage is measured as the ratio of total debt to total assets at the end of fiscal year 2007, (Clarkson et al, 2008).

Consistent with Clarkson et al (2008), NEW is a proxy for equipment age. An asset's newness is measured as net property, plant and equipment divided by gross property, plant and equipment at the end of fiscal year 2007. A higher NEW ratio is assumed to represent newer plant and equipment, which is likely to be associated with less polluting technologies. Clarkson et al (2008) contend that firms which possess cleaner technologies are more likely to disclose this information. However, in accordance with legitimacy theory, the current study argues that firms with less polluting technologies are less likely to voluntarily disclose. On the contrary, firms with older, more polluting technologies are likely to provide more disclosure than those with cleaner technologies, as their legitimacy risks are higher in relation to harming the environment.

3.3 The Model

The binary choice-logit model to test the hypotheses is as follows:

$$VEmD = \alpha + \beta EMS + \delta D_{ENV_COM} + \gamma D_{CEO_MEM} + \rho IND + \varphi SIZE + \tau ROA + \theta LEV + \omega NEW + \mu$$

Where:

VEmD	=	the probability that the firm presents voluntary GHG emissions disclosure
$\boldsymbol{\alpha}$	=	constant term
EMS	=	a vector of EMS category variables, which includes n = 3 categories: no EMS, having a non-certified EMS and having an EMS that is ISO 14001 certified
D_{ENV_COM}	=	dummy variable of environment committee which is = 1 if the firm has a specific environment committee, 0 otherwise
D_{CEO_MEM}	=	dummy variable of CEO membership which is = 1 if the firm's CEO is a member of the environment committee, 0 otherwise
IND	=	a vector of industrial category variables, which includes n = 4 categories: energy and mining, industrials, consumer and services
SIZE	=	natural logarithm of market capitalisation
ROA	=	return on assets, measured as the ratio of income before interest and tax at the end of fiscal year 2007 and total assets at the end of fiscal year 2006
LEV	=	leverage, measured as the ratio of total debt divided by total assets at the end of fiscal year 2007
NEW	=	asset newness, measured as a ratio of net properties, plant and equipment divided by the gross properties, plant and equipment at the end of fiscal year 2007
μ	=	error term

4. Results

4.1 Descriptive Statistics

4.1.1 Dependent Variable

Table 2 reveals summary details of the dependent variable employed in the current study. Panel A shows that 93 out of 271 sample firms (34.3%) have voluntarily disclosed GHG emissions information. This is a substantial increase from Simnett and Nugent's (2007) observations of 10% of firms disclosing emissions in 2005.

Disclosure media preferences are reported in Panel B. The most preferred medium to disclose GHG emissions is the annual report (89 firms or 95.7% of disclosing firms). Firms' websites were the second preferred medium (58 firms), which may be driven by the relatively low cost and the extent of scope offered by communication via the Internet. Considering the wide scope of the Internet, web disclosures indicate that firms tend to report their GHG emissions information to the wider community rather than using only annual reports that are more investor focused. Meanwhile, 35 firms provide GHGs emission disclosure in their discrete reports, primarily targeted at financial stakeholders.

[Table 2 about here]

Most firms used multiple media to disclose their GHGs information. The most preferred dual media are annual reports and the Internet (40 firms). A similar number of firms reported voluntary GHG emissions in both annual reports and stand-alone reports (24 firms), and stand-alone reports and websites (23 firms). Information disclosed in stand-alone reports is, for the most part, identical to that in annual reports. Seventeen firms voluntarily disclosed GHG emission information in all surveyed media.

Forty-one sample firms provided GHG emissions information in their annual reports only. Web-based disclosures and stand-alone reports were utilised as the only reporting medium by only 10 and 5 firms respectively, re-emphasising the perceived importance of annual reports as an important GHG emissions disclosing medium by Australian firms.

Of 93 firms that voluntarily disclosed GHG emissions, around 47 percent (44 firms) provided quantitative disclosures, while the rest (49 firms) presented qualitative information. The slightly larger portion of qualitative disclosures indicates some progress towards preparing for the forthcoming implementation of the *NGER Act 2007* in July 2008. The largest number of quantitative disclosure providers (20 firms) came from the more polluting energy and mining industries. The remaining industries disclosed a greater proportion of qualitative than quantitative information. This suggests that energy and mining industries are likely to be better-equipped to quantify GHGs

emissions than other industries. This is consistent with the report by PwC (2008). As an industry which has been claimed to have a large legitimacy gap, the energy and mining industry utilises disclosures as a means to lessen the extensive public scrutiny.

A large variability of type and extent of GHG emissions disclosure was observed. Disclosures ranged from merely discussing firm awareness of GHGs issues; through policy and plans to reduce GHGs emissions; to including quantitative information comprising the amount of GHGs emissions and GHGs reduction achievements compared to a predefined target. Consistent with surveys conducted by the Global Reporting Initiative (GRI) and KPMG's Global Sustainability Services (2007), we find that a number of the disclosing firms acknowledge the importance of the climate change issue. For example:

> A number of measures to combat climate change are already being undertaken by Caltex, some of which are specified in the company's climate change policy. These include producing cleaner and more energy efficient fuels, quantifying and reducing greenhouse emissions associated with Caltex refineries, terminals, service stations and related supply chain activities and identifying cost effective opportunities for improving energy efficiency (Caltex Australia Limited, 2007, p. 22).

Other firms reveal their commitment by establishing a specific committee to deal with the GHGs emission issue, for example:

> The Company also acknowledges its own operations and augments current strategies to enable it to reduce its own carbon footprint. In 2007, a team was formed to map the Company's carbon emissions and to investigate and implement strategies and programs to effectively reduce or offset greenhouse gas production (Macarthur Coal Limited, 2007, p. 15).

More advanced disclosures, present the amount of company GHGs emission information. For example, Billabong International Limited (2008) reported quantitative emissions information on its website:

> Billabong International Limited chooses to undertake voluntary reporting of its global greenhouse gas inventory. The organisational boundary includes all brands and company-owned operations globally, while the operational boundary includes all scope 1 and 2 activities, as well as scope 3 activities where reliable data such as air travel is available.
>
> The footprint is measured according to guidelines set out in the AGO Factors and Methods Workbook (December 2006) and the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (GHG Protocol). The footprint is then independently audited.
>
> The Group's carbon footprint for the 2006-07 financial year totaled 16,463 tonnes of CO2-e. The inventory is considered low for a company the size of Billabong but this is a function of the structure of the Group. The majority of the emissions relate to

electricity, car and air travel and waste. The Group continues to analyse the data to determine areas in which improvements can be achieved as the Company continues to grow (Billabong International Limited, 2008).

Some firms also compared their predefined target or previous year's performance in their GHGs emission disclosures. Such disclosures provide better information for users as they enable users to assess firm emission performance over a period of time. An example is provided in the AGL Concise Sustainability Report by AGL Energy Limited:

Greenhouse footprints (total annual emissions, Mt CO_2e)

	2006/2007	2005/2006	2004/2005	2003/2004
AGL Footprint	0.182	-0.10[a] (0.725)	N/A[b]	N/A
Australian Equity Footprint	6.892	(6.755)	(6.820)	(6.439)
Overseas Equity Footprint	0.498	0.274	-	-
Energy Supply Footprint	41.0	37.8[a]	38.2	36.0

(AGL Energy Limited, 2007, p. 4)

4.1.2 Independent Variables

Table 3 presents descriptive statistics for the independent variables, with the exception of industry - presented in Table 4. Nominal independent variables are reported in Panel A of Table 3. Of the 271 observed firms, a total of 103 have an EMS in place with 35 firm having ISO 14001 certification. Only 15.5% (42 firms) possess a specific environment committee to deal with environmental issues, of which 40.5% (17 firms) believe environmental issues are of sufficient importance to engage the CEO as a member of the committee.

[Table 3 about here]

Panel B of Table 3 presents descriptive statistics for continuous variables utilised in the analysis. The firms range in size from a market capitalisation of around $158 million to $203 billion, indicating a high variability in firm size, with a mean and standard deviation of $6 million and $19 million respectively. A similarly high variability was shown in the level of return on assets (ROA) and leverage (LEV). On average the sample firms booked 26.7% return on assets (ROA) in 2007. On average, 28.2% of the ASX300 assets were funded by debt (LEV). In terms of equipment age, the average firm recorded a 64% newness ratio (NEW).

SIZE, ROA, and LEV all indicated high levels of positive skewness in their distribution, whereas the NEW variable was negatively skewed. In addition, SIZE, ROA and LEV all recorded high and positive kurtosis. Waternaux (1976) and Tabachnick and Fidell (2007), however, note that

in a large sample involving 200 cases or more, deviations of skewness and kurtosis values from normality often do not cause an essential impact in analysis. The Kolmogorov-Smirnov[13] test shows significant values indicating a violation of the normality assumption, a common problem in a large sample but will not essentially affect the results (Tabachnick and Fidell, 2007). Moreover, Leech, Barrett and Morgan (2008) and Tabachnick and Fidell (2007) emphasise that this distributional assumption is not required for nonparametric procedures including logistic regression. Accordingly, non-normal distributions of predictor variables are not likely to affect the analysis.

Table 4 shows the industry composition. The energy and mining industry is the largest group represented in the sample (35.8%), followed by both the services and consumer industries, which account for 33.2% (90 firms) and 16.61% (45 firms), respectively. The industrials category is the smallest portion of the sample (14.39%).

[Table 4 about here]

4.2 Multivariate Analysis

Logit regression requires avoiding high intercorrelations among predictor variables (Leech et al, 2008; Pallant, 2007; Tabachnick and Fidell, 2007). Accordingly, a collinearity diagnosis was performed to meet the underlying assumption, which is presented in Table 5. The Table clearly shows that all the tolerance values (VIF) of independent variables are far more than 0.10 (less than 10), indicating no multicollinearity problem in the tested model.[14]

[Table 5 about here]

Table 6 presents multivariate analysis results using a logit regression to test the hypotheses. Goodness-of-fit tests were conducted by the Omnibus Test of Model Coefficients[15] and the Hosmer and Lemeshow Test[16]. The chi-square value of the Omnibus Test is 129.956, significant at p>0.000, suggesting that the Voluntary Emission Disclosure model with eight variables was able to distinguish those Australian firms that disclosed GHG emissions from those that did not. More than eighty percent of cases (81.5%) were correctly classified by the model. The chi-square Hosmer and Lemeshow value with a significance level larger than .05 indicates support for the model, suggesting

[13] The Kolmogorov-Smirnov one-sample test aims to check the normality of data, which is claimed to be superior to chi square when the main concern is the distributional shape of the continuous variable (Tabachnick and Fidell, 2007). Normality is indicated by "a non-significant result (Sig. value of more than .05)" (Pallant, 2007, p.62).

[14] Tolerance represents the variable proportion of a certain independent variable which is not explained by other variables in the model (Pallant, 2007), whereas VIF (Variance Inflation Factor) denotes "the inverse of the tolerance values (1 divided by tolerance)" (Pallant, 2007, p.156). A small tolerance value (less than .10) or a VIF value above 10 indicates the possibility of multicollinearity (Pallant, 2007).

[15] The Omnibus Test indicates how well the model performs over a model with none of the predictors entered (Pallant, 2007).

[16] This test is claimed to be the most reliable test of model fit (Pallant, 2007).

that the analysed model is worthwhile. Pseudo R^2 values show that the full model with eight variables was able to explain between 37.4% (Cox & Snell R Squared) and 51.7% (Nagelkerke R Squared) of the variance in the voluntary GHG emissions disclosing status of the sample firms.

[Table 6 about here]

When independent variables are tested using logit regression, the Voluntary Emissions Disclosure model offers evidence that there are only three significant variables of interest: EMS, energy and mining industry, and SIZE, consistent with the arguments presented in H_{1a}, H_{1b}, H_4 and H_5. The results indicate the likelihood of Voluntary Emissions Disclosure when firms have an EMS in place as stated in H_{1a}. The results also support H_{1b} that firms with an ISO 14001 certified EMS are more likely to voluntarily provide GHG emissions disclosure than those with either no EMS or an uncertified EMS. The odds ratio corresponds to "the change in odds of being in one of the categories of outcome when the value of a predictor increases by one unit" (Tabachnick and Fidell, 2007, p. 461). The odds ratio of 7.354 suggests that having a certified EMS is the strongest predictor of firm voluntary disclosure of GHG emissions. Firms having EMSs that are ISO 14001 certified were over seven times more likely to voluntarily disclose GHG emissions than other firms[17]. On the other hand, firms having an EMS with 4.839 odds ratio were recorded as the second strongest predictor. Australian firms that have implemented an EMS are over four times more likely to provide disclosure of GHG emissions than firms without an EMS. This offers support for H_1, which states that firms adopting an EMS are more likely to voluntarily disclose GHG emissions than firms without an EMS. Furthermore, the difference of the odds ratio between ISO 14001 certified EMS (7.354) and uncertified EMS (4.839) confirms H_{1b} which proposes that firms having their EMSs certified to ISO 14001 are more likely to provide discretionary GHG emissions disclosures than firms with an uncertified EMS.

Although not significant, a positive relationship[18] was found between voluntary GHG emissions disclosure and the presence of an environment committee (1.252 odds ratio) as well as CEO membership in the environment committee (2.197 odds ratio). While not supporting hypotheses 2 and 3, results are in the hypothesised direction.

The logit results also support H_4 that companies in 'emitting' industries, and specifically energy and mining firms, are more likely to voluntarily disclose GHG emissions than other industries. Results suggest that the industry category, overall, is not a significant determinant of disclosing discretionary GHG emissions. However, the energy and mining industry proves to be a

[17] assuming other factors in the model being constant

[18] A positive relationship is evidenced by the odds ratio which is more than 1, whereas a negative relationship is denoted by the odds ratio less than 1.

significant categorical variable which is different from others concerning the likelihood of GHG emissions disclosure. The odds ratio of 3.151 suggests that sample firms in the energy and mining industry are over three times more likely to present discretionary GHG emissions disclosures than firms in other industries. This result provides support for the legitimacy theory argument that the more polluting the industry, the more likely that industry is to voluntarily provide GHG emissions disclosure to mitigate the legitimacy gap. This result also provides evidence to support hypothesis 4 on the association between industry membership of a company and the probability of disclosing GHG emissions. Although the *NGER Act 2007* requiring Australian firms to report on GHG emissions is expected to apply to all industries that meet certain thresholds from 1 July 2008 and reporting 30 June 2009, the energy and mining industry has a greater propensity than other industries to voluntarily disclose the information ahead of this compulsory reporting.

Meanwhile, H_5 refers to the likelihood of greater Voluntary GHG Emissions Disclosure as firm size increases. EMS and SIZE were significant at $p < 0.000$. In terms of firm size, larger companies have proven to be over twice as likely to voluntarily release their carbon emissions to stakeholders with the odds ratio of 2.506. All else being equal, the larger firms are more likely to disclose its emissions. This finding is consistent with the argument that larger firms are more exposed to public scrutiny, thus encouraging voluntary disclosure of their GHG emissions as a means to mitigate public pressure and to enhance their legitimacy. Consequently, hypothesis 5, which states that larger firms are more likely to provide GHG emissions disclosure than smaller firms, is supported by the above findings.

Two control variables - ROA and LEV - were found to be insignificant predictors of GHG emissions disclosure in this sample of Australian firms. Finally, the coefficient on NEW, another control variable, is negative and significant, suggesting that companies with newer plant and equipment, which are assumed to operating with cleaner technology, are less likely to voluntarily disclose their emissions information to the public. Meanwhile, having older plant and machinery might mean that these firms operate their businesses with more polluting technology and use ‘green wash’ to legitimize their operations to the community. The GPT Group (2008) - one of Australia’s largest diversified listed property groups - stated on its environmental webpage disclosure that: “Whilst older assets pose challenges, we have achieved significant outcomes from projects and initiatives that we have previously reported … and continue to focus on areas to improve operating efficiencies and performance”. Such firms may voluntarily disclose emissions to manage their legitimacy risk without having to invest in newer plant and equipment until forced to do so through regulation or market mechanisms. Consistent with legitimacy theory firms whose environmental legitimacy is threatened are more likely to make claims about their commitment to the environment.

5. Summary and Conclusions

Increased community awareness of human-induced global warming and associated harmful climate change has changed societal expectations of firm behaviour in relation to their GHG emissions. Consequently, the current research provides evidence that Australian firms are increasingly likely to voluntarily provide GHG emissions disclosure prior to the obligatory reporting required by the *NGER Act 2007*, to manage their 'social contract'. Voluntary disclosure of GHGs has increased since the 2005 observations of Simnett and Nugent (2007), with almost 35% disclosing in 2007 when compared to only 10% in 2005 even though Australian governments have largely been inactive in regulating industry emissions (Pearse, 2009b).

One possible explanation for this increased disclosure could be that Simnett and Nugent (2007) examined disclosure in a period prior to the increased debate and legitimacy threat to Australian firms with regards to global warming and GHG emissions. Our evidence of increased disclosure could relate to the likelihood that management, observing a shift in the political agenda, and appreciating the lead time involved in developing an accurate emissions reporting system ahead of mandatory reporting, are actively developing their EMS and associated measurement and reporting systems. In particular, firms in the Australian mining and energy industries considered as 'emitters' (Burgess, 2007) have a higher propensity to voluntarily report their GHG emissions information than other industries suggesting the reporting may legitimize their operations in the public eye. Moreover, these firms often trade internationally, hence must deal with the higher environmental standards of the European Union and the EU ETS. At the same time this strategy reduces regulatory risk in Australia as governments here have been effectively captured by this powerful industry (Pearse, 2009b).

An environmental management system (EMS) proves to be significantly related to discretionary provision of GHG emissions disclosures. Firms with voluntary ISO 14001 certification of their EMS demonstrate more willingness to disclose their GHG emission-related information to their stakeholders. Larger firms and firms with older equipment are more likely to disclose GHG emissions information than firms without these characteristics.

The current study contributes to the academic literature by providing evidence that an EMS is an influential determinant in the provision of discretionary GHG emissions disclosure. This finding also highlights a firm's propensity to disclose environmental information in order to manage societal perceptions and maintain firm legitimacy. As such, the current research develops legitimacy theory by adding EMS as a determinant variable of discretionary GHGs emission disclosures aimed at maintaining or improving organizational legitimacy in the context of a changing 'social contract'.

PricewaterhouseCoopers (2008, p.19) recently reported that, "There is a high level of concern about imminent compliance obligations". Further, Climate Change Minister Penny Wong has emphasised that Australian businesses only have two years to adjust to emissions trading, which is claimed to be, "the most significant economic and structural reform undertaken in Australia since the trade liberalization of the 1980s" (PricewaterhouseCoopers, 2008, p.9). However, a majority of Australian business leaders have not discussed business risks and opportunities with stakeholders, nor have factored the impact of climate change in their annual reports. In terms of customers, a quarter of the business leaders acknowledge that 'green products' are of customer concern. Clearly, Australian firms at the time of this study are dealing with a changing social contract relating to global warming and GHG emissions particularly since the recently elected Labor government ratified the Kyoto Protocol in December 2007.

Findings of this study not only emphasise the importance of an EMS as a device to manage environmental aspects of a firm's operations, but also show the role of an EMS in bridging communication between firms and their relevant stakeholders. This may also motivate corporations to introduce an EMS in their business operations, in preparation for the proposed AETS in 2011. In addition, EMS adoption may assist Australian firms to comply with obligatory reporting requirements outlined in the *NGER Act 2007*, and effective from 1 July 2008.

A limitation of this study is the restricted scope of GHG emissions disclosures observed. This study only examined whether an Australian firm disclosed GHGs emissions information or not, and relates this to some observed firm characteristics. More details of information provided by the disclosing firms are not further categorised using a content analysis method. This may have affected the extent and complexity of voluntarily disclosed GHG information captured in the current research. In addition, this study initially attempted to incorporate a measure of assurance of GHG reporting. However, very few sampled firms[19] provided assured environmental reports, thereby limiting opportunities for this analysis.

Whilst this study examined the propensity of Australian companies to voluntary disclose their emissions, future research might investigate the relationship between the quality of company GHG emissions disclosure and the quality of EMS. Quality GHG emissions reporting should increase credibility, hence the more efficient operations of the proposed AETS and similar markets in other jurisdictions. Another line of research could examine the quality of regulation necessary for transparency and trust in GHG markets, in light of the regulatory weaknesses that precipitated the recent collapse of the international financial markets.

[19] In 2007, 14 of 271 ASX300 firms in this sample had assured environmental disclosures either in an annual report or in a stand-alone report. Hence the assurance variable was dropped from the model because of statistical issues.

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Table 1
Industry Group

Industry Group	GICS Code	Sector
1 : Energy and Mining	10 15	Energy Materials*
2: Industrials	20	Industrials
3: Consumer	25 30	Consumer Discretionary Consumer Staples
4: Services	35 40 50 55	Health Care Financials Telecommunication Services Utilities

* Under the Global Industry Classification Standard (GICS), the materials sector covers the metals and mining industry (Australian Securities Exchange, 2008a), represented by companies such as BHP Biliton Limited, BlueScope Steel Limited, OneSteel Limited, OceanaGold Limited, and Newmont Mining Corporation

Table 2
Characteristics of Dependent Variables

Panel A: Dependent Variable by Type of Disclosure		
	Disclosing Firms	**Non-Disclosing Firms**
Voluntary GHGs Emission Disclosure (VEmD):	93 (34.3%)	178 (65.7%)
Qualitative Disclosure	49 (52.7%)	
Quantitative Disclosure	44 (47.3%)	
Panel B: Dependent Variable by Reporting Media		
	Disclosing Firms	
VEmD in Annual Report	89	
VEmD on Websites	58	
VEmD in Stand-Alone Report	35	
VEmD in Annual Report only	41	
VEmD on Websites only	10	
VEmD in Stand-Alone Report only	5	
VEmD both in Annual Report and on Websites	40	
VEmD in both Annual Report and Stand-Alone Report	24	
VEmD both in Stand-Alone Report and on Websites	23	
VEmD in all Annual Report, on Websites and in Stand-Alone Report	17	

Note:
VEmD = the probability that a firm presents voluntary GHG emissions disclosure

Table 3
Characteristics of Independent Variables

Panel A: Independent Variables – Nominal Variables		
	Number	**Freq. (%)**
Environmental Management System (EMS):		
Not having EMS	168	62.0
Having an EMS	68	25.1
Having an ISO14001 Certified EMS	35	12.9
Total	271	100
Environment Committee:		
Not having an Environment Committee	229	84.5
Having an Environment Committee	42	15.5
Total	271	100
CEO Membership:		
No CEO membership in Environment Committee	25	59.5
CEO as a member in Environment Committee	17	40.5
Total	42	100

Panel B: Independent Variables - Continuous Variables				
	SIZE	**ROA**	**LEVERAGE**	**NEW**
Mean	6,297,921,394	0.267	0.282	0.633
Median	1,268,425,452	0.150	0.013	0.178
Standard Deviation	19,159,183,708	2.475	0.211	0.293
Minimum	157,808,912	-2.175	0.00	0.00
Maximum	202,610,017,000	40.506	1.272	1.00
Skewness	7.210	16.036	1.057	-.627
Kurtosis	62.442	261.683	1.699	-.460
Kolmogorov-Smirnov	.374	.412	.091	.105
Sig.	.000	.000	.000	.000
Observations	271	271	271	271

Table 4
Sample Selection and Industry Composition

GICS Code	**Sector**	**Total Sample**	
		Number	**Freq. (%)**
10	Energy	28	10.332
15	Materials*	69	25.461
Industry Group 1: Energy and Mining		**97**	**35.793**
20	Industrials	39	14.391
Industry Group 2: Industrials		**39**	**14.391**
25	Consumer Discretionary	31	11.439
30	Consumer Staples	14	5.166
Industry Group 3: Consumer		**45**	**16.605**
35	Health Care	13	4.797
40	Financials	51	18.819
45	Information Technology	9	3.321
50	Telecommunication Services	4	1.476
55	Utilities	13	4.797
Industry Group 4: Services		**90**	**33.210**
Total		**271**	**100**

* mining is included in the materials industry sector

Table 5
Collinearity Diagnosis

	Collinearity Statistic	
	Tolerance	**VIF**
EMS	.795	1.259
ENV_COM	.581	1.721
CEO_MEM	.631	1.585
IND	.856	1.168
SIZE	.988	1.012
ROA	.951	1.052
LEV	.941	1.062
NEW	.957	1.045

Note:

Dependent Variable: VEmD = the probability that a firm presents voluntary GHG emissions disclosure

EMS = a vector of EMS categorical, which includes n = 3 categories, namely no EMS, EMS in place, and ISO 14001 Certified EMS

ENV_COM = a dummy variable of environment committee, which is equal to 1 if the firm has a specific environment committee, 0 otherwise

CEO_MEM = a dummy variable of CEO membership, which is equal to 1 if the firm's CEO is a member of the environment committee, 0 otherwise

IND = a vector of industrial category variables, which includes n = 4 categories, namely services, energy and mining, industrials, and consumer and services

SIZE = natural logarithm of market capitalisation

ROA = return on assets, measured as the ratio of income before interest and tax at the end of fiscal year 2007 and total assets at the end of fiscal year 2006

LEV = leverage, measured as the ratio of total debt divided by total assets at the end of fiscal year 2007

NEW = asset newness, measured as a ratio of net properties, plant and equipment divided by the gross properties, plant and equipment at the end of fiscal year 2007

Table 6
Logistic Regression

	B	S.E.	Wald	df	Sig.	Odds Ratio
EMS variable			20.784	2	.000***	
EMS in place	1.577	.418	14.207	1	.000***	4.839
Certified EMS	1.995	.531	14.128	1	.000***	7.354
ENV_COM	.224	.606	.137	1	.711	1.252
CEO_MEM	.787	.916	.739	1	.390	2.197
INDustry variable			5.133	3	162	
IND_Services	.165	.529	.097	1	.755	.1179
IND_Energy&Mining	1.148	.565	4.125	1	.042*	3.151
IND_Industrials	.638	.622	1.051	1	.305	1.892
SIZE	.919	.146	39.365	1	.000***	2.506
ROA	.132	.148	.802	1	.370	1.141
LEV	.067	.835	.006	1	.936	1.070
NEW	-1.603	.610	6.907	1	.009**	.201
Constant	-20.816	3.239	41.292	1	.000	.000
Omnibus Tests of Model Coefficients Chi-Square						126.956 (.000)
Hosmer and Lemeshow Test Chi-Square (Sig.)						4.808 (.778)
Cox & Snell R Square						.374
Nagelkerke R Square						.517
Classification Table – Overall Percentage Correct						81.5
* p < .05, ** p < .01, *** p < .001						

Notes:
EMS = a vector of EMS categorical, which includes n = 3 categories, namely no EMS, uncertified EMS in place, and ISO 14001 Certified EMS
ENV_COM = a dummy variable of environment committee, which is equal to 1 if the firm has a specific environment committee, 0 otherwise
CEO_MEM = a dummy variable of CEO membership, which is equal to 1 if the firm's CEO is a member of the environment committee, 0 otherwise
IND = a vector of industrial category variables, which includes n = 4 categories, namely services, energy and mining, industrials, and consumer and services
SIZE = natural logarithm of market capitalisation
ROA = return on assets, measured as the ratio of income before interest and tax at the end of fiscal year 2007 and total assets at the end of fiscal year 2006
LEV = leverage, measured as the ratio of total debt divided by total assets at the end of fiscal year 2007
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