In Case Australia ForgETS:
On the Nature and Implications of Emissions Trading in Australia

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Joseph R. Hester
BS Environmental Science

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Institute of Sustainability and Technology Policy
Murdoch University

Declaration

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

Signature:

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Joseph R. Hester

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I would like to thank Martin Brueckner for his limitless patience, astute criticism, and informative guidance. Without his input this thesis would never have been written. I am also indebted to Sally Paulin for her consistent support and detailed feedback. Though they unknowingly assisted my writing, I would like to offer my gratitude to the peers that accompanied me through so many days of research and regularly offered me the opportunity to discuss my findings.

In memory of Joshua Douglas Cotton
You may not read this, but you helped me write it.

Abstract

This thesis explores the Carbon Pollution Reduction Scheme, Australia's proposed emissions trading regime. Following analysis of the international policy context which has led to climate mitigation scenarios both within Australia and abroad, the nature of Australia's iron and steel industry is examined, as is its dynamic trade relationship with Chinese steel makers. Since Chinese participation is a critical component of post-Kyoto climate change mitigation, I analyse the role of China thus far in international negotiations. Within the context of iron and steel trade flows, the operation of the Carbon Pollution Reduction Scheme and its likely effects on this industry's international competitiveness are discussed. Common critiques of the proposed emissions trading scheme (including but not limited to carbon leakage, emissions capture, and emissions-intensive, trade-exposed industry assistance thresholds) are identified and subsequently contextualised against the backdrop of iron ore mining and steel manufacture. I propose, in addition to emissions leakage addressed in the literature, that domestic, intra-industry *permit leakage* would appear to exist as a result of poorly designed assistance thresholds. There is potential for industries that receive no government assistance to export emissions onto industries that receive most permits free.

On the one hand, carbon leakage can act as a disincentive for net emissions reduction if trading partners are not forced to play by the same rules. On the other hand, inappropriate cost burdens could disadvantage Australian industries. If the Carbon Pollution Reduction Scheme is to be effective in the long run, it must address the tensions between comprehensive emissions control and administrative viability. If emissions capture is incomplete, mitigation efforts are notably ineffective. If certain industries beg concessions due to reduced competitiveness, then the cost burden on all other participating industries could reduce the scheme's economic efficiency. In either case, the justification behind these claims is analysed in depth. Based on the findings of this thesis, I have concluded that the focus of critics on the tradeoffs between environmental effectiveness and economic efficiency sacrifices the ability of the proposed scheme to achieve maximum buy-in from industry interests and ignores the foreign policy implications of early climate policy action by Australia.

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List of Acronyms

ABARE	Australian Bureau of Agricultural and Resource Economics
ABC	Australian Broadcasting Company
ABS	Australian Bureau of Statistics
BCA	Business Council of Australia
CDM	Clean Development Mechanism
COP	Conference of the Parties
CO_2-e	Carbon Dioxide Equivalent
CPRS	Carbon Pollution Reduction Scheme
DCC	Department of Climate Change
DFAT	Department of Foreign Affairs and Trade
DoIR	Department of Industry and Resources
EDR	Economic Demonstrated Resources
EIT	Economies in Transition
EITE	Emissions-Intensive, Trade-Exposed
ETS	Emissions Trading Scheme
GDP	Gross Domestic Product
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land-Use, Land-Use Change and Forestry
mmt	Million Metric Tonnes
NDRC	National Development and Reform Commission
NGERS	National Greenhouse and Energy Reporting Act
ppm	Parts Per Million
PRC	People’s Republic of China
SDPC	State Development Planning Commission
TEEII	Trade-Exposed, Emissions-Intensive Industries
UNFCCC	United Nations Framework Convention on Climate Change
WA	Western Australia
WRI	World Resources Institute
WTO	World Trade Organisation

Background

Having come to study in Perth, Western Australia in January of 2007, I unknowingly walked into a situation that incrementally shaped the perspective for this thesis. My bachelor's degree in Environmental Sciences gave me an unwavering commitment to an improved ecological relationship with our planet. Experience on a carbon dioxide emissions modelling project in 2004 and with air quality research in Washington, D.C. the same year gave me a framework from which I could peruse international climate change negotiations with interest. The Institute for Sustainability and Technology Policy at Murdoch University opened my eyes to the social science of sustainable development, and I rapidly came to terms with the fact that a robust combination of behavioural, economic, and policy reforms lie at the heart of true sustainability. Unprecedented prosperity in Perth from 2006 through to today due to historic economic growth in China, the end of John Howard's administration and the beginning of Kevin Rudd's, resultant radical changes in Australia's climate change policy stance, and not least the timing of my thesis research brought my carbon trading intrigue to a boiling point in early 2008.

Twelve thousand miles from home, I find myself in a hotbed for climate change research, and I have set out to qualify the impacts of what seems to be an inevitable carbon trading system in Australia. My almost 2 years in Western Australia have taught me much about the dynamics of a largely rural, resource-based national economy and the raw power of multinational corporations like BHP Billiton and Rio Tinto—they have so much at stake in the face of radical policy changes. The status of Australia's major trading players, not to mention their foreign partners, must weigh heavily in the debate over the short-term ramifications and long-term effectiveness of carbon trading in Australia.

Introduction

The Australian Labor Government, under Prime Minister Kevin Rudd, has begun crafting a cap and trade emissions reduction mechanism, called the Carbon Pollution Reduction Scheme (CPRS), which they hope to implement in early 2010. Australia has one of the highest per capita emissions signatures in the world, certainly more than all other developed nations (Turton 2004), and among its states and territories, Western Australia leads the pack. The largest mineral by value in Western Australia is iron ore (DoIR 2007c), and due to its high value for the Australian economy, it stands to make the largest case for transitional assistance if the scheme begins as proposed. Iron ore dynamics must be appreciated within the context of an internationally linked steel industry. The Business Council of Australia (2008) has noted that an emissions trading scheme (ETS) without assistance for vulnerable industries would cause "considerable economic pain" (p. 8).

Australian officials have made it clear that international market competitiveness and investment attractiveness (rather than climate change mitigation) are the driving forces behind support for, or antipathy toward, carbon pricing. This paper will therefore analyse ETS impacts as they pertain to the robust iron and steel industry of Australia.

Many recent industry submissions on carbon pollution reduction have noted supposed negative impacts of ETS compliance costs on international competitiveness (BHP Billiton 2008; BlueScope Steel 2007; BCA 2008; OneSteel 2008; Rio Tinto 2008), and thus far it has been relatively easy for business leaders to publicise the link between carbon costs and decreased profitability (entailing job losses, reduced investment, etc.). When political bodies create a carbon-based price signal in a domestic industry, they are forcing business operations to include the inevitable cost of pollution. Intended as a measure to reduce gross, countrywide carbon emissions, this price signal can lead to the leakage of emissions savings into countries where carbon has not been priced. If a climate change policy mechanism promotes this kind of carbon leakage, then such a mitigation tool is largely assumed to be ineffective and inappropriately costly.

I propose, in addition to emissions leakage, that domestic, intra-industry *permit leakage* would appear to exist as a result of poorly designed assistance thresholds. Where price signals translate into variable cost burdens in different industries, and where an industry emits carbon dioxide both directly and indirectly, there exists the potential for an industry that receives no assistance to export its emissions onto an industry that receives most of its permits for free. Both leakages present a conflict of interest for participating companies.

On the one hand, carbon leakage can act as a disincentive for net emissions reduction if trading partners are not forced to play by the same rules. On the other hand, inappropriate cost burdens could disadvantage Australian industries. If the CPRS is to be effective in the long run, it must address the tensions between comprehensive emissions control and administrative viability. If emissions capture is incomplete, mitigation efforts are notably ineffective. If certain industries beg concessions due to reduced competitiveness, then the cost burden on all other participating industries (Treasury of Australia 2008) could reduce the scheme’s economic efficiency. In either case, the justification behind these claims must be analysed in depth.

Research Aims

Given this context, three general points deserve attention. This thesis aims to:

1. Identify how the proposed Carbon Pollution Reduction Scheme is likely to impact the Australian economy; in addition, if an emissions trading scheme disproportionately affects trade-exposed domestic industries, how such changes could affect the trade relationship with Australia's biggest partner.
2. Examine how vulnerable the iron and steel industries are to carbon and permit leakage and identify significant flaws which may hinder the success of the Carbon Pollution Reduction Scheme.
3. All things considered, identify what issues must be addressed actively prior to the implementation of the Carbon Pollution Reduction Scheme and whether the proposed system should be initiated in 2010 or in 2012, after more definitive international negotiations have taken place.

Steel sector carbon leakage can only be tested based on a post hoc analysis of changes in net imports, which is obviously impossible before ETS inception. It is therefore critical to assess the likelihood of leakage in Australia's economy. Iron ore sector carbon leakage, ideally tested based on a post hoc analysis of changes in market share of the major ore producers, can only be estimated beforehand based on the comparative advantages of these producers as well as the likelihood that changes in international climate policy will disrupt the current competitive balance.

Methodology

This thesis reviews the available literature on not only international climate change policy but also on heavy industry and trade-exposure. For its primary debate it surveys the Labor Government's Green Paper, Ross Garnaut's Climate Change Review, and the Business Council of Australia's Emissions Trading critique. It draws from resource and trade statistics for information about the iron and steel industry, and it also sources extensive critical analyses from journals and international agencies in order to weigh the varying critiques of the Carbon Pollution Reduction Scheme.

Climate debates in Australia and the United States, especially in political and media circles, have consistently focused on scientific uncertainty as a source for caution with our fragile economy. This perspective reigns supreme for anyone not qualified enough to understand climatology (aren't most of us?). This thesis will focus on the indicators regularly recited by media and business interests. All data are publicly available, and most have been sourced from the internet. I did approach eight staff members from OneSteel, Rio Tinto, and

BHP Billiton, requesting site or company-specific carbon emissions profiles. I was unsuccessful in all cases due to the commercially-sensitive nature of such information. A copy of my written request is included in Appendix A. Thus, publicly available figures are utilised, and the reader should remain aware that although my opinions have been sufficiently informed, they are still opinions. In the end, however, policy makers are unlikely to have unlimited access to similarly sensitive data, so it is reasonable to assume that this same information is guiding policy decisions.

Composed in the language of economics, this thesis will serve largely as an exercise in logic and risk assessment. I intend to demystify the nature and implications of emissions trading in Australia, and for the sake of simplicity, I will focus on a single industry sector. Because this thesis does not rely on statistical significance or econometrics, I cannot state any of my conclusions with any sense of certainty. I do attempt, however, to highlight areas of concern which have either been insufficiently substantiated or are hotly contested in the debate. I will focus primarily on the costs of emissions reduction in Australia, and I will not address the costs of unmitigated climate change. However, this thesis is composed based on the assumption that disastrous climate scenarios, the costs of which are notably difficult to even estimate, should be avoided.

In Chapter 1, I will provide the background behind Australia's participation in international climate change negotiations and the development of the Carbon Pollution Reduction Scheme. It will also describe the domestic market environment in which it will be implemented. After briefly introducing the current status of the iron and steel sector, this chapter will conclude with an explanation of the intricacies of carbon emissions reporting and measurement within Australia.

In Chapter 2, I will address the Chinese market with which the Australian iron and steel industry has the most significant trade relationship. After discussing recent technological developments which have changed emissions intensities for the industry, it will outline the complex participation by China in international climate negotiations and the status of climate policy within that country. The chapter will finish by briefly introducing the spectrum of climate policy in the countries most clearly identified as Australia's competitors.

In Chapter 3, I will begin by identifying the two main critiques of the Carbon Pollution Reduction Scheme, namely the green and industry critiques. The green critique will be framed according to the various inconsistencies which are purported to undermine comprehensive emissions capture under the scheme. The industry critique will focus on the distorted market mechanisms which are purported to hinder Australia's economic growth. The validity of both critiques will be categorically weighed against the specific market relationships described in Chapters 1 and 2.

In Chapter 4, I will, building upon previous sections, outline the policy recommendations which seem most promising for Australia and analyse Australia's role in climate change mitigation both domestically and internationally.

Chapter 1: Climate Change & Australian Industry

As the most pressing crisis faced by the societies of the 21st century, climate change has served to highlight a manifest dysfunction (market failure) in the global free market, namely that capitalism has thus far been unable to adequately price pollution or provide sufficiently concrete incentives for environmentally benign behaviour. Augmentation of atmospheric greenhouse gases by industrial human activity over the past 200 years has resulted in an increasingly unstable global climate system (IPCC 2007b). Sources of greenhouse pollution are varied, and for the past few decades projections of impacts have been exceedingly difficult. Recently improved modelling and monitoring across all arenas of the international scientific community have helped a consensus emerge as to the prudence of risk management in carbon pollution control (IPCC 2007a). More and more abatement options are viewed in terms of their ability to promote competitive advantage in an increasingly ecologically constrained economy, and several notable developments, including the 2007 report produced by Sir Nicholas Stern, have instigated a momentous shift in government policy across the globe (Stern 2007). It is this shift in government policy in Australia which is the subject of discussion in this thesis. To contextualise this shift Australia's position will be placed in the international climate policy arena below. This chapter will also introduce the iron and steel sector of the Australian economy and describe recent carbon dioxide emission trends both nationally and within this industry.

1.1 Climate Change and the Kyoto Protocol

The United Nations Framework Convention on Climate Change (UNFCCC 1992) was signed at the 1992 Earth Summit in Rio de Janeiro, and the fruit of participating countries' labour was actualised in 1997 with the signing of the Kyoto Protocol (Kyoto 1997) at the third Conference of the Parties. This document, an unprecedented attempt at intergovernmental cooperation, emphasises the dire climactic situation that has been created and outlines important steps for mitigation. At Kyoto, binding carbon emissions limits were adopted for Annex I (developed) countries under the assumption that during the first commitment period (2008-2012), non-Annex I (developing) countries would be exempt from any obligatory constraint. Simultaneously, EIT (economies in transition) states, which are primarily located in the former Soviet Bloc, were granted allowances based on the volatile state of their economies. Developing country ratification took place with uncertainty surrounding future mandatory emission limits, and some countries were notably vocal in avoiding such limits. In fact, China remained adamant throughout negotiations that mandatory emissions limits for poorer countries were out of the question until Annex I countries had brought their own emissions under control (Cooper 1998).

Climate change encompasses a genuine global prisoner's dilemma (Rapoport, Chammah, and Orwant 1965), one in which every country stands to gain by free-riding on the sacrifices of others and defection generates the highest payoff ratio. Indeed, this is how international negotiations have proceeded since the debate's rise to prominence in the 1970s. Though the first acknowledgement of the potential for human-induced climate change came in 1896 (Arrhenius), international environmental negotiations focused on acute, local air pollution through to the mid 1980s. By the time ozone depletion attracted international attention, the 1988 Toronto Conference, 1989 Hague and Noordwijk Conferences, and 1990 Second World Climate Conference all attracted prominent government officials to the discussion (Luterbacher and Sprinz 2001). It was not until the early 1990s, however, that an international agreement could be formulated, and the United Nations Framework Convention on Climate Change was signed at the Earth Summit in Rio de Janeiro (United Nations 1992). Even though signatories to the Convention crafted the Kyoto Protocol in 1997 (United Nations 1997), it did not enter into force until its ratification by Russia in 2004. In 2001, the most energy-intensive nation (the United States) withdrew completely (Nordhaus 2006), and only in 2005 was the first binding emissions control mechanism officially implemented in the European Union (Ellerman and Buchner 2007).

Kyoto invokes the 'polluter pays principle', and the repeatedly referenced "common but differentiated responsibilities" rely heavily upon 'ability to pay' as the guiding force behind cost burden displacement (United Nations 1992). For this reason Annex I countries have been bound to the initial round of emission restrictions, largely based on the premise that most of the current atmospheric carbon dioxide concentration can be attributed to their emissions, as well as the fact that their technological infrastructure and financial capital increases their ability to shoulder the early burden (Cazorla and Toman 2000). This trend is far from ubiquitous, though, and irrespective of the two guiding principles, Australia has worked for years to avoid the implementation of a document perceived by some to pose significant risk to the world's largest economies. The Howard administration consistently warned of real wage cuts, GDP reductions, and job losses during its tenure (McDonald 2005).

Australia exited the 1997 Kyoto negotiations having secured an almost unparalleled advantage among Annex I countries, given not only the selection of 1990 as the benchmark reference year for carbon emissions reductions but also a generous acknowledgment that land-use changes could be included in emissions calculation for said reference year. Largely due to land clearing, Australia saw a dramatic spike in carbon dioxide (CO_2) emissions during 1990, after which emissions growth slowed considerably (DCC 2006a). As a result of these two provisions, Australia was allowed to increase its emissions by 8% until 2012, a generous allocation when compared to the reductions required by most other developed nations (only Iceland was allocated more "hot air"—a +10% allowance). Thus Australia would need to worry little about reaching its target, and business as usual could prevail—and indeed it has.

Lobbyists that had been the driving force behind acquiring the aforementioned concessions soon thereafter mobilised to prevent the ratification of Kyoto by then Australian Prime Minister John Howard and his Liberal government (Pearse 2007). Emissions growth has since been openly unconstrained, and the Australian government has been viewed as a pariah in the international climate debate. Kevin Rudd's election over Howard in late 2007 provided a very dramatic turning point for climate negotiations, and the newly elected government moved swiftly to ratify the Kyoto Protocol during its first week in office. Ironically, this action provided only a marginal push for climate science, as the ball had already begun rolling. Months earlier, Rudd, while opposition leader under Howard, had organised an Australian State and Territory collective to commission a report from economics Professor Ross Garnaut of the Australian National University. His report, widely acknowledged as the Australian counterpart to the UK's Stern Review (2007), set out to identify the economic ramifications of climate change and mitigation within Australia. That report notwithstanding, the Rudd Government made climate change a large part of its election platform, and for the sake of consistency, the Prime Minister and Climate Minister Penny Wong have pursued a national ETS aggressively since their first week in office.

Though debate raged for some years as to the comparative effectiveness of cap and trade versus carbon tax systems (see Chameides and Oppenheimer 2008; Mankiw 2007; Pelley 2008), it has become abundantly clear that the Australian government is wholly committed to the principles behind the introduction of a cap and trade control mechanism (DCC 2008). Antipathy toward strictly regulatory approaches, which have been shown to be restrictive and cost-ineffective (Tietenberg 1990), has helped Australian policymakers embrace the potential for an emissions trading scheme to keep transaction costs down while ensuring long-term prosperity in a low-carbon economy.

At the same time, some factions in government have warned against implementing a unilateral carbon trading scheme (see *ETS threatens WA's economic boom: Opposition* 2008). Without comparable efforts abroad, an ETS is said to "erode a country's international competitiveness" and export emissions into other countries, thus inhibiting the long-term effectiveness of carbon emissions reduction mechanisms and making international cooperation more difficult (Carmody 2008, p. 1). The Business Council of Australia (2008) noted that without sufficient industry assistance, a domestic ETS will result in the exporting of emissions, especially if comparable international action has not taken place. There is clearly a concern that industries will suffer disproportionately under the Labor Government's CPRS if they are forced to absorb carbon pricing alone.

Rudd and Wong have committed to 2010 as the beginning year for the Carbon Pollution Reduction Scheme, a full 2 years before the first commitment period expires under Kyoto—and presumably the next begins. Not only are there significant discrepancies among current Annex I commitments, but there also exists a persistent atmosphere of uncertainty around the past, present, and future behaviour of non-Annex I nations, aggravated by the recently unfolding turmoil across the world's financial markets. As Kyoto nears its expiration, the outcome of the 15^{th} Conference of the Parties to the Convention (COP-15) at Copenhagen, Denmark in 2009 is both predicated on and a determining factor for country-specific responses.

1.2 Policy Orientation

1.21 The Garnaut Climate Change Review

With endorsement from not only state and territory governments but also the recently elected Kevin Rudd, the new environment minister, Peter Garrett, the newly appointed climate change Minister Penny Wong, and the Commonwealth government, the Garnaut Climate Change Review has been thrust centre stage. Besides contextualising international climate change science in terms of the Australian continent and economy, the Garnaut Review completed innovative modelling of various mitigation scenarios, referenced against a business-as-usual course of action (Garnaut 2008d). Released on 30 September, 2008, it superseded previous discussion papers on emissions trading, targets, and trajectories. According to Garnaut's analysis, the current atmospheric concentration of all greenhouse gases (in carbon dioxide equivalent or CO_2-e) is around 455 parts per million (ppm), and despite the fact that the concentration of carbon dioxide alone remains at only around 382 ppm (Worldwatch Institute 2008), he believes the current state of international negotiations means that the 450 ppm CO_2-e target for emissions stabilisation popular among climate scientists is not immediately cost-effective or feasible (Garnaut 2008b). He proposes, instead, a 550 ppm stabilisation target, with further action toward 450 or 400 ppm contingent upon the outcome of COP-15.

In order to achieve a best-case scenario 450 ppm target, Australia's aggregate emissions must be reduced by 25% of 2000 levels before 2020 and 90% of 2000 levels before 2050. Per capita this translates into reductions of 40 and 95%, respectively. For a 550 ppm target, emissions must be reduced by 10% (30% per capita) of 2000 levels before 2020 and 80% (90% per capita) of 2000 levels before 2050. If no agreement can be achieved in Copenhagen in 2009, then a 5% reduction by 2020 has been recommended, which would reduce Australia's per capita emissions by 25% by the same year. Garnaut also makes recommendations as to the design features and operation of an emissions trading regime, but specifics will be identified individually as they apply to the context of this thesis and in later sections.

1.22 Department Of Climate Change Green Paper

Garnaut's Review (2008a; 2008b; 2008c; 2008d), the National Emissions Trading Taskforce (2006), John Howard's Task Group on Emissions Trading (2007), and climate officials in New Zealand were surveyed by the new Australian Department of Climate Change under Penny Wong. The Department's policy recommendations culminated in July, 2008, with the release of the Carbon Pollution Reduction Scheme (CPRS) Green Paper. This document outlined the Labor Government's preferred position on and proposed design for a cap and trade scheme, specifically addressing a timeline, trade dynamics, permit coverage, allocation standards, and transitional assistance. In December of this year, and after the specified public comment period, the Government is scheduled to release a revised White Paper, which will incorporate public input as well as the findings of Ross Garnaut's recent Final Report. It is this paper that will specify the Government's preferred medium-term trajectories and permit allocations, likely covering the period until 2020 (DCC 2008).

According to the CPRS, the entire Australian economy will be carbon-constrained, but the ETS aims to address the 75% of Australia's greenhouse gas emissions which are produced by the largest corporate facilities, an estimated 1,000 companies (DCC 2008, p. 13). All six greenhouse gases included in the Kyoto Protocol framework will be accounted for in the Australian ETS according to their carbon dioxide equivalent value (CO_2-e). Any facility emitting more than 25 kt CO_2-e will be required to purchase a permit for every tonne of greenhouse gases they emit (p. 12). This threshold has been selected for the sake of consistency with the National Greenhouse and Energy Reporting Act (NGERS) of 2007. Annual permit quantity will be restricted to the yearly carbon budget specified according to the long-term reduction trajectory adopted by the government, and this number of permits will be auctioned to industry. The marginal abatement cost of these permits will dictate whether a firm thinks it more efficient to buy and surrender them or to reduce their carbon emissions in order to avoid doing so (DCC 2008).

CPRS transitional assistance will manifest either in the industrial sector in the form of free permit allocation for emissions-intensive, trade-exposed (EITE) industries or in the private sector in the form of household assistance for families most impacted by the redistributed cost burden (DCC 2008). For industries whose emissions intensity surpasses 2,000 tonnes of CO_2-e per A$ million in revenue, 90% of their permits will be provided free of cost. For industries that emit between 1,500 tonnes and 2,000 tonnes of CO_2-e per A$ million in revenue, 60% of their permits will be so provided (DCC 2008, p. 44). This type of assistance, called 'shielding', protects these industries from the burdens of a carbon price, though no more than 30% of each year's permits would be available for this kind of assistance. In order to offset the cost of fuel, likely to increase due to the requirement of carbon permits for fuel suppliers, the Australian government plans to cut fuel taxes on a cent-for-cent basis (DCC 2008, p. 16). As well, all permit revenue earned under the CPRS will be aimed at alleviating costs for the Australian public.

The overall goal of the CPRS is to reduce the greenhouse gas emissions of the Australian economy by 60% from 2000 levels between now and 2050 through a series of trajectories and gateways that will incrementally tighten the constraints on carbon pollution (DCC 2008, p. 37). It should also be noted that although these standards have been stated explicitly, they have not become law and thus remain debatable until their approval by Parliament. The Labor Government has, however, made very clear its preferred positions. Garnaut's trajectory modelling will be used to formulate a very specific and 'ratcheting down' long-term reduction regime, and the final proposition is scheduled to be released in December 2008 with the Climate Department's Carbon Pollution Reduction Scheme White Paper.

Under the current proposal, the CPRS will commence in 2010 (DCC 2008, p. v). Recent media attention highlights the dichotomy of opinion that has emerged not only in the public but also in high-level government as to the impacts of such an early timeline, given that for the next 3 years developing countries and regional trade partners will not be required to carbon-constrain their economies. A recent ABC (2008) program hosted a panel of individuals with varying viewpoints and critiques. According to scientist Tim Flannery, responsibility for implementing the scheme so soon stems from Australia's lengthy inaction on the climate front during the previous administration; others agree with businesswoman Catherine Harris and see first-mover advantage as a way to position Australia for increased competitiveness in a world where carbon pollution incurs escalating costs; still others, including Penny Wong, warn against inaction, fearing the escalating impacts of weak commitment (ABC 2008). Opposing perspectives from Opposition Leader Malcolm Turnbull and Tim Wilson from the Institute of Public Affairs highlight the dire potential for inconsistency, given the status of developing countries until 2012, the uncertainty surrounding post-Kyoto agreement, and the immense costs likely to be borne by Australian industries and subsequently the Australian people (ABC 2008). It is in response to the latter viewpoints that this thesis is composed, and it will operate henceforth under the assumption that the call for action on climate change is justified. The scientific consensus surrounding the need to reduce carbon pollution is taken as given.

1.3 Western Australia's industry and growth

Western Australia provides an appropriate starting point for a critical analysis of emissions trading in Australia, given that it is the largest and most resource-rich state with the highest carbon intensity. Largely due to the unprecedented growth of the Chinese economy, Western Australia has witnessed a dramatic influx of wealth over the past 3 years (Reserve Bank of Australia 2008). As a result of its rural lifestyle, agriculture, transport design, and minerals industry, WA has the highest per capita greenhouse gas emissions (~33 t CO_2-e) of any state or territory in Australia (EPA 2007). Since Australia as a whole has the highest emissions (~27.2 t CO_2-e) of any Annex I country (Turton 2004), Western Australia thus has one of the largest carbon footprints in the world.

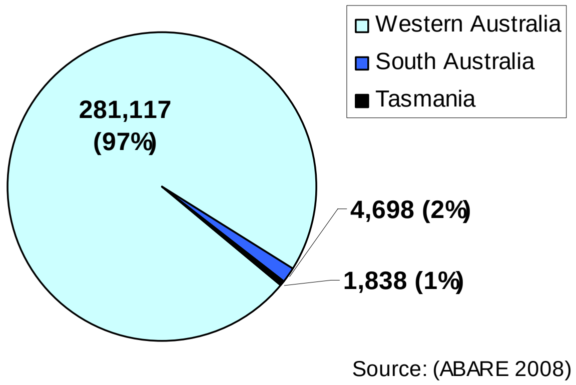
Though these figures are several years old, recent trends have been much more dramatic. Western Australia's Gross State Product grew by 6.3% during the 2006-07 financial year and only 4.8% during the previous year. For comparison, the overall Australian GDP grew by only 3.3 and 3.0%, respectively during these same years (ABS 2008). In the second quarter of 2008, and in the midst of an Australian GDP growth rate of 0.3%, the Western Australian economy grew by 2.4% (Greber 2008). Importantly, Western Australia can attribute its recent prosperity largely to trade relations with China (Lague 2007). WA's largest export, iron ore, fuels the Chinese steel market whose production and consumption rates are the highest in the world (WorldSteel Association 2008). Ironically, the state's robust resource sector has significantly buffered the country from the crippling effects of the most recent global economic downturn (Greber 2008). In fact, Western Australia's most recent economic growth rate has more closely resembled Chinese GDP growth rates (7% as forecasted until 2010 by Zhou 2006) than the rest of Australia's.

Unprecedented iron ore production in Western Australia is fuelling not only Australian but also international steel companies, and if state officials hope to sustain this level of growth until and beyond 2012, it is critical to explore the way such an industry might fit into an emissions trading regime. Many people worry that a poorly designed ETS could have detrimental effects on this industry, and subsequently the Australian economy, but first the relationship between iron ore and steel must be appreciated fully.

1.31 Iron ore mining and steel manufacture

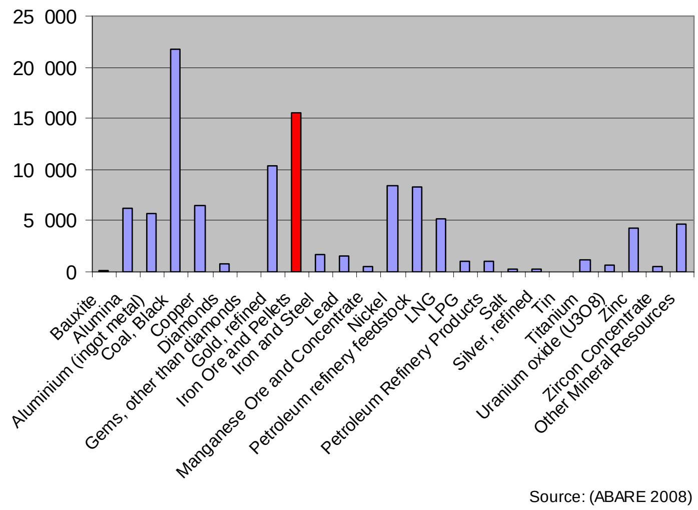
Australia sits on approximately 13% of the world's economic demonstrated resources (EDR) of iron ore, ranking it 4th internationally. Furthermore, it holds 15% of global EDR of contained iron, ranking third behind only China and Russia (Geoscience Australia 2008). More than 97% of the country's iron ore is produced in Western Australia [Figure 1], and most of these reserves are concentrated in the Pilbara Region about 800 kilometres north of Perth (ABS 2008; Geoscience Australia 2008). The Climate Department's Green Paper (2008) notes that 2006-07 mineral exports accounted for 3.8% of Australian GDP, and figures show that iron ore bolstered the largest value of Australia's minerals industry, accruing approximately 30% of the total minerals output last year (DoIR 2007b). In 2006-07, Western Australia produced 281 million metric tonnes (mmt) of iron ore, compared to 6 million produced in the rest of the country (ABARE 2008).

Figure 1: 2006-2007 Iron Ore and Concentrate Production (in kt)



According to Department of Industry and Resources (2007b) data, petroleum and minerals mining made up 86% [A$52.7 billion] of Western Australia's export income in 2007, with over A$15 billion attributed to iron ore alone (Figure 2).

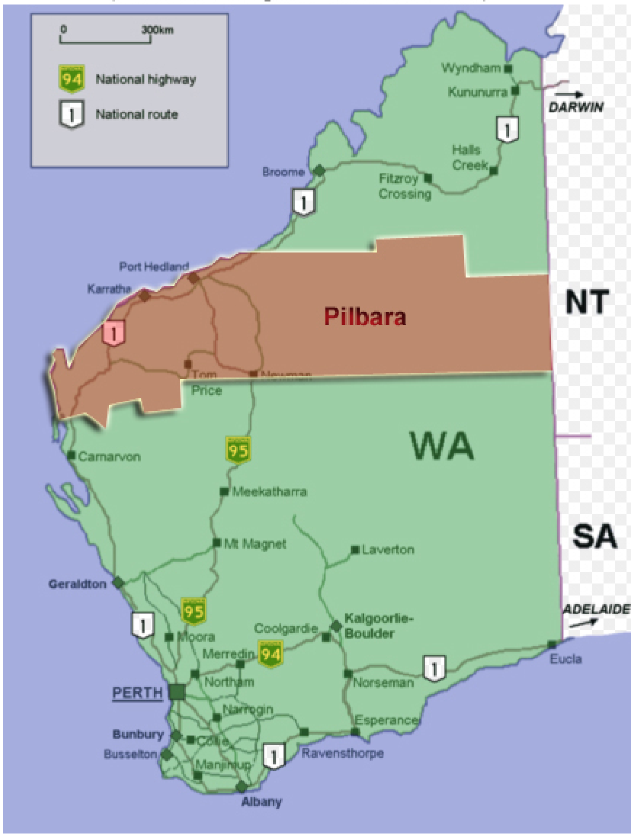
Figure 2: 2006-2007 Australian Mineral Exports (in A$million)



More than 20% of BHP Billiton's total assets lie in WA (DoIR 2007c), and the company operates ten mines in that state. Rio Tinto, based in London, operates nine WA mines through its subsidiary Pilbara Iron, which controls Hamersley Iron Pty. Ltd. Rio Tinto also maintains part ownership of four other mine sites. Clearly, the spoils of a robust iron ore trading relationship with China are disproportionately enjoyed by a few WA mining companies.

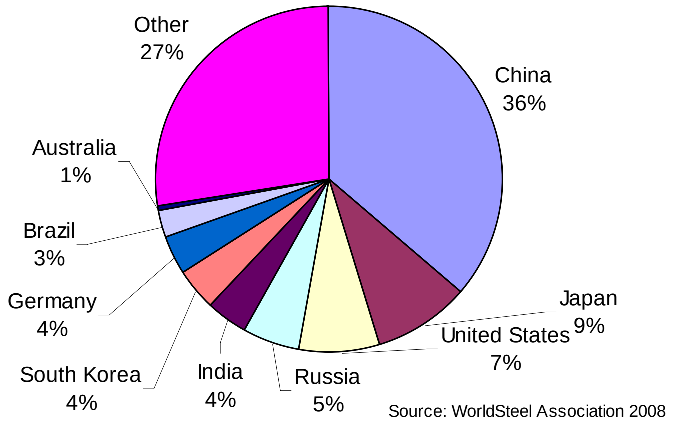
The steel picture, however, is quite different. While almost all iron ore is mined in the Pilbara (Figure 3), almost all domestic steel production occurs elsewhere. Compared to the mining and export of ore, production of steel is relegated to very few facilities within the country. For example, OneSteel operates a 1.2 million metric tonne (mmt) steel mill in Whyalla, South Australia, while BlueScope Steel, Australia's largest producer, operates the Western Port and Port Kembla Steelworks in New South Wales, which manufactures an estimated 5.1 mmt of steel per annum. The only steel facility within Western Australia is the HIsmelt facility in Kwinana, which operates new technology that bypasses cokemaking blast furnaces and sinter plants in iron production (*HIsmelt Operations* 2006). This and other recent technology developments will be addressed in Section 2.3.

Figure 3: Map of Western Australia
(Pilbara Region is indicated)



Kwinana's HIsmelt steel mill has an annual output of 115,000 tonnes of pig iron. Data from the International Iron and Steel Institute (2007) estimated Australia's domestic supply of scrap steel, which is used for secondary steelmaking in place of raw iron, to be 3.9 mmt in 2005, and the country consumed 6.5 mmt of pig iron, predominantly sourced domestically, during 2005-06. For international context, Australia-leading BlueScope Steel produced 6.8 mmt of crude steel in 2006 (IISI 2007), only 0.5% of the world total. The entire Australian economy produced 7.9 mmt of steel (with only 1.1 mmt attributed to all other steel producers in the country) in 2006 (Figure 4), which ranked it behind countries such as Belgium, Poland, and Iran in absolute output (IISI 2007). In addition, steel exports represent less than 1% of the total export market of Australia (ABS 2008).

Figure 4: 2007 Crude Steel Production (in million metric tonnes)



Mining investment has trebled in Western Australia since 2004 (ABS, cited by DoIR 2007b). According to ABARE (2008) investment data, there are eight advanced iron ore mining projects in Western Australia with capital expenditures from A$100 million to over A$1 billion. The same data show 25 less advanced projects in WA and three in South Australia, and they are expected to accrue a combined capital expenditure of A$28 billion. The data also indicate one advanced iron and steel manufacturing project in New South Wales (in Port Kembla, with a capital expenditure of between A$500 million and A$1 billion) and one less advanced project in Queensland with an expected capital expenditure of A$536 million. Department of Industry and Resources (2007b) data show 16 iron ore investment projects in WA, which will serve only to expand an already immense in-state mining industry.

The Department of Industry and Resources 2006-2007 annual report noted that Western Australian "iron ore investments should lead to increased output volumes in coming years" (DoIR 2007a, p. 40). They repeated this assertion in the 2007 Western Australian Mineral and Petroleum Statistics Digest by noting "it is expected that [the iron ore] sector will continue its record-breaking run well beyond 2007-08" (DoIR 2007b, p. 4).

1.32 Industry vulnerabilities

Traded minerals are clearly a pivotal part of the Australian economy, and trade-exposure is a very real possibility. Many recent industry submissions to the Garnaut Review have noted the negative impacts of ETS compliance costs on international competitiveness (see BHP Billiton 2008; BlueScope Steel 2007; OneSteel 2008; Rio Tinto 2008), and thus far it has been relatively easy for business leaders to publicise the link between carbon costs and distorted competition (see BCA 2008). This position has been eagerly embraced by pro-industry politicians, despite the efforts of authors like Garnaut to emphasise the risk associated with insufficiently aggressive responses to climate change. As abatement costs increase, production costs increase, and raw commodities are at risk of losing their competitive edge. Not only do high export prices risk eliminating trade partners, they risk trickling back into the domestic market via increased import prices, especially when a raw export (iron ore) is refined overseas and returned for import (steel).

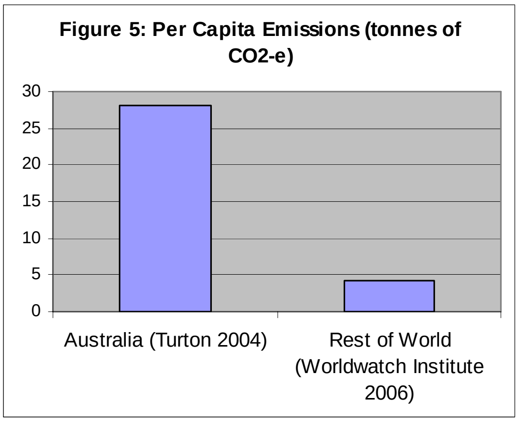
Emissions-intensive, trade-exposed (EITE) industries typically are more vulnerable to carbon permitting than others. These industries have production processes that depend heavily on direct consumption of fossil fuels, and international markets by and large dictate commodity prices. Mining facilities that produce metal ores for export are assumed by this thesis to be both trade-exposed and emissions-intensive. Mills that manufacture coke, pig iron, crude and refined steel are emissions-intensive (more so than iron ore mines) and all claim to be trade-exposed (see BlueScope Steel 2007; OneSteel 2008). Neither facility can pass carbon prices onto their consumers (BCA 2008). There is, however, no objective test for trade-exposure (Mazouz and Knapp 2008), and this thesis will base its conclusions on the assumption that these entities qualify for EITE assistance under the CPRS and are therefore the industries about which decision makers are most worried. The iron and steel industry has been referred to as "one of the most energy-intensive industrial sub-sectors" (Kim and Worrell 2002, p. 827) and "the largest energy consuming industry in the world" (Hidalgo et al. 2005, p. 584), and thus it will be assumed to represent one of the most vulnerable industries in Australia.

The vulnerability of iron and steel is a critical component of the vulnerability of Australia overall, and the impact of a CPRS on iron ore clearly must be appreciated alongside the impact of carbon pricing on both foreign and domestic steel mills. By selecting such a large industry I am attempting to analyse what is assumed to be a representative indicator for the Western Australian economy. This analysis will, in turn, help explain the different factors involved in the trade-exposure of the entire Australian economy, and eventually it will help qualify the concerns of CPRS critics. This in no way implies that the lessons learned in this case study can be applied unfailingly across all sectors. Indeed, other industries exhibit highly variable market profiles. They are, however, good estimates and will be further discussed in Chapter 2 of this thesis, which focuses on the current status of the international market for iron and steel.

In order to understand the way this industry fits into the Carbon Pollution Reduction Scheme, however, first the carbon dioxide emissions of Australia and its iron and steel industry need to be addressed.

1.4 Emissions signatures in Australia

As an Annex I country, Australia enjoys the energy-intensive lifestyle of Western nations, which means the carbon footprint of its citizens is considerably larger than that of citizens of many other countries. In contrast, its relatively small population emits only a very small proportion of annual global emissions, 1.5% as reported in Garnaut's Draft Report (Garnaut 2008d, p. 99). Australia's Climate Change Department (2006a) reports that in 2006 and according to Kyoto Protocol accounting standards, national emissions reached a net level of 576 million tonnes (Mt). In contrast, Australians emitted 28.1 tonnes CO_2-e per person that same year (DCC 2006a), one of the highest rates in the world (Turton 2004). The global emissions average is 4.2 tonnes CO_2-e per person, approximately 15% of Australia's (Worldwatch Institute 2008) (Figure 5).



It remains unclear whether nations will continue in the future to use aggregate emissions measurements. In Australia, absolute emissions vary dramatically from emissions weighed against the country's population—the former trivialises Australian contributions, while the latter emphasises world-worst emissions intensity (Garnaut 2008b). The two standards depict dramatically different scenarios, and in the context of emissions reductions, both lead to fundamentally different reductions or are implicated by fundamentally different incentives.

Worldwide, aggregate emissions reductions can, if inappropriately contextualised, punish low emitters by placing inappropriate burdens on countries with high populations and low emissions—especially in the case where two nations with radically different population levels emit roughly the same aggregate amount of carbon dioxide. Per capita emissions reductions, instead, can be said to reward countries for being less carbon-intensive per person—which would seem to be the most logical alternative were it not for the fact that carbon-intensive countries with low populations had more direct influence during policy formulation in Kyoto.

It is a worldwide per capita allocation that the Garnaut Review recommends, albeit not immediately (Garnaut 2008d). Contraction and convergence based on a per capita measurement, which Garnaut suggests as a long-term goal beginning in 2050, will serve to avoid the perverse incentive associated with an illogical pairing of means (reductions) and ends (distribution). It is also a more direct linking of climate change and sustainable development, which depends explicitly on increased international equity.

According to the National Emissions Inventory, stationary energy was the largest greenhouse emitting sector in 2006, producing 401 Mt CO_2-e (DCC 2006a). It was followed by agriculture, industrial processes, and waste, which produced 90, 28, and 17 Mt CO_2-e, respectively. In contrast, land-use, land-use change and forestry (LULUCF) produced 40 Mt CO_2-e that same year (6.9% of the Australian total), slightly less than industrial processes and waste combined (7.8%) (DCC 2006a), which suggests that forestry and land-clearing may be an underappreciated factor in Australia's emissions profile. This phenomenon will be more clearly addressed in Section 1.41.

Iron and steel production was attributed 1.25% (or 7.2 Mt CO_2-e) of Australia's 2006 emissions, which includes the usual by-products of the iron and steel industry, namely CO_2, NH_4 (methane), and NO_x (nitrous oxide). Emissions intensity in this sector has decreased since 1990 due not only to steel plant modernisation but also to the closure of a steel manufacturing facility in Newcastle in 2000 and the Boodarie Iron hot briquetted iron plant in WA in 2005 (DCC 2006a).

For reference, if the entire iron and steel industry were responsible for covering all of their 2006 emissions under the proposed ETS regulations, they would be required to surrender 7.2 million carbon permits at year's end. With Garnaut's proposed A$20 per tonne initial permit price, the industry would be responsible for covering A$144 million worth of emissions at ETS inception, with subsequent prices increasing compliance costs. This burden will be borne by more than one facility, but it serves to quantify the kinds of abatement costs players are likely to face.

1.41 Emissions uncertainty

Publicly available, aggregate greenhouse gas emissions include the contentious value associated with land-use, land-use change and forestry which has generated so much discussion over the past few years—in Australia's case about 40 Mt CO_2-e (DCC 2006a). Australia's history of dramatic, government-sponsored land clearing episodes highlights an important dynamic of the carbon cycle which cannot be ignored. Attention given to the degree to which cleared forests and disturbed agricultural soils leech carbon dioxide from the decomposition of soil organic matter (see Paustian et al. 2000; Saddler and King 2008) should serve to remind officials of the importance of these measurements in an industry where large amounts of earth and rock are not only cleared of their vegetation and organic matter but also pulverised and stripped of most of their mineral content, leaving a fraction of the sequestering capacity which existed in the undisturbed ecosystem. However, little attention has been paid to this point to date, and the CPRS does not include land-clearing (Saddler and King 2008).

The monitoring of emissions associated with the land-use changes induced by mining enterprises does not occur, and though the IPCC (2001b) defines ‘good practice’ to include the calculation of biomass lost when forest land is converted for human infrastructure (which includes mine sites), this monitoring requirement exists neither in the National Greenhouse and Energy Reporting Guidelines (NGERS) of 2007 nor in their revised 2008 version. Land-use change is defined in the National Emissions Inventory as “the conversion of forests to grassland and cropland” (DCC 2006a, p. 16). Environment Australia’s National Pollutant Inventory (1999) as well as the official IPCC guidelines for industrial process emission inventories (IPCC 2001b) outline iron and steel industry emissions beginning with the production of crude iron from raw ore, thereby excluding all vegetation removal and soil disturbance (not to mention machinery operation between mine and mill—though ETS regulations will likely capture these emissions at the fuel production point in the supply chain).

A recent study has emphasised that the traditional drivers of deforestation (i.e. poverty, agriculture) are weakening in comparison to new, industrial threats, namely timber harvesting, large-scale farming, and mining—specifically of oil and gas (Butler and Laurance 2008). Though oil and gas, not iron and steel, companies stimulate most of the deforestation, this reported trend cannot be ignored, as a rapidly growing, resource-hungry world is unlikely to reduce its pressure on fragile bushland. Despite considerable attention given to the role of *re*-forestation in establishing carbon sinks, there is yet no avenue for the quantification of carbon emissions associated with land-clearing on new mine sites, nor with soil reactivity and carbon release. It is therefore possible that significant emissions are being overlooked.

At the same time, Australian lawmakers have programmed into the NGERS Act a certain degree of ambiguity, as reporting thresholds in the legislation are quoted at 25 kt CO_2-e per facility, with a graded scale for entire companies. Those thresholds, as well as their *required data* are specified in the tables below:

Table 1: National Greenhouse and Energy Reporting Thresholds

Year	1	2	3
Per facility:	25 kt CO_2-e (and subsequent)		
Per company:	125 kt CO_2-e	87.5 kt CO_2-e	50 kt CO_2-e (and subsequent)

Source: (National Greenhouse and Energy Reporting Bill: Revised Explanatory Memorandum 2007)

Table 2: National Greenhouse and Energy Required Data

Public (mandatory)
- Sum of total gross scope 1 (direct) and scope 2 (indirect) greenhouse gas emissions
- Total energy produced
- Total energy consumed
Public (voluntary)
- Gross scope 1 (direct), scope 2 (indirect), and scope 3 (indirect) greenhouse gas emissions
- Total greenhouse gas emissions offsets
- Net greenhouse gas emissions, calculated by subtracting offsets from gross emissions
- Information explaining the company's greenhouse gas emission and energy profile and actions being taken or planned to reduce emissions and increase energy efficiency
Non-Public
- Data needed to calculate above quantities (i.e. emissions factors, output quantity, electricity consumed, fuel combusted, fuel type, equipment used, etc.)

Source: (National Greenhouse and Energy Reporting Bill: Revised Explanatory Memorandum 2007, pp. 8-9)

If a company can identify that it is "likely" to surpass the reporting threshold by "referring to published tables" that estimate greenhouse gas emissions, then it is required to register under this legislation (NGERS: Revised EM 2008). Compliance is defined according to the accuracy of *required data*, not as it pertains to participation, and independent verification is utilised for a random sample of company reports (i.e. *required data*) identified as having a high risk of non-compliance (i.e. inaccuracy). They are required, post hoc, to calculate *required data* according to recommended methodologies. They are not required, a priori, to calculate specifically the *required data*, and as such may have an incentive, indeed an opportunity, to blur the delineations of their own emissions inventory, especially with respect to direct/indirect emissions. Companies do not release emissions profiles in annual Sustainability Reports, and requests made by me to BHP, Rio Tinto, OneSteel, and BlueScope Steel for site-specific emissions inventories were respectfully declined. This thesis is, therefore, required to use publicly available data which may or may not provide the specificity against which generalisable conclusions can be drawn.

As such, the Australian public has little avenue for identifying the extent to which a company is "likely" to be a *reporting entity* according to NGERS. With an ETS expected to cover the 1000 largest emitters, I find it difficult to imagine that the administrator of the National Greenhouse and Energy Reporting Bill will have the resources for identifying with much accuracy the entities which fall into this category if they choose not to make themselves known. This will only become harder as sectoral coverage grows over time. It seems that the task will be simple only when the facility/company falls well below or well above the *reporting threshold*. Special vulnerability stems from three factors:

a) When an ETS begins, *reporting entities* will acquire a significant cost burden for the information they choose to report

b) There may be particular ambiguity as to facilities that produce emissions very close to the reporting threshold or who have grown into this category aware of a potential ETS and therefore unwilling to register

c) The system seems predicated on the transparency of non-public, commercially-sensitive information.

Streamlined reporting guidelines backed with robust legislation may increase the cross-jurisdictional reliability of greenhouse gas/energy reports, as has been explicitly noted in the legislation (p. 12-18), but the fact that "the companies with the highest emissions are often *caught by*" such programmes speaks volumes (NGERS Act: Revised EM 2008, p. 12). At the very least this poses an immediate threat to the emissions effectiveness of the CPRS whose "profundity" is "on par with…[the] deregulation of the financial system" (DCC 2008, p. 13).

A tenuous dichotomy exists between direct (scope 1) and indirect (scope 2) emissions, and as the BCA eloquently noted, "scope 1 emissions will cost permits, scope 2 emissions will cost cash" (2008, p. 25). Direct emissions in a steelmaking plant or iron ore mine site can be thought of as those produced by the combustion of liquid and solid fuels in on-site vehicles and machinery. Indirect emissions are those produced at the electricity generation facility which supplies a mine site or steel mill with its power. Though not physically produced by the steel mill, they are nevertheless attributed to its activity 'indirectly', since its demand can be said to have induced their production. Vagaries arise when one considers the implications of unused baseload power during off-peak periods, but such a problem lies outside the scope of this thesis. It does deserve note, however, that similar emissions dichotomies exist where some steel plants produce their own electricity via off-product, natural gases from coke ovens (BlueScope Steel 2006). Given that these gases are sequestered and used to power other production processes, they are what the National Emissions Trading Taskforce has recommended classifying as zero-emissions rated (2006).

Even if NGERS inconsistencies were limited, it should be noted that the potential for underreporting can only be exacerbated in situations where power generation is decentralised and site-specific. Reporting threshold enforcement may be difficult where sources do not obviously fall well above or below. Resource loops that have been closed based on variably emissions-intensive inputs, utilised in varying intensities on a low-scale, and applied in different manners for each facility may provide yet another immediate disincentive for NGERS compliance—and thereby ETS participation. It appears that even before ETS implementation, emissions are inadequately captured by current policies.

1.5 Iron and steel emissions

Though I attempt to provide an accurate portrayal of iron and steel emissions signatures, the reader should be aware that an appropriate figure must be gleaned from publicly available data, which rarely delineates in such a specific manner and always fails to incorporate the few intricacies previously mentioned.

The National Greenhouse Gas Inventory produces direct emissions figures per entire economic sector, and 2006 figures show that all mining in Australia accounted directly for 52.1 Mt CO_2-e, whose 1990-2006 increase (62.5%) is the most dramatic rise in emissions of any sector in the Australian economy (DCC 2006a). Most of said increase occurred after 2004 (DCC 2006b) and was likely spurred by increased output in response to high demand from China. Non-energy mining, which excludes coal and oil, directly produced 8.5 Mt CO_2-e, while metal manufacturing (including steel) directly produced 31.8 Mt CO_2-e. Western Australian mining, which includes all of Australia's iron ore mine sites, directly emitted 13.5 Mt CO_2-e in 2006. Responsibility for emissions on a mine site is, however, difficult to ascertain (BCA 2008). Department of Climate Change figures attribute 7.2 Mt of Australia's emissions to iron and steel, which this thesis assumes to be the closest estimate for emissions produced at iron ore mine sites and in steel mills. Iron ore transport emissions are captured in another sector, and thus are not attributed to the iron-steel industry and so do not require carbon permits. The reported 7.2 Mt CO_2-e include some combination of the 31.8 Mt CO_2-e produced by Australian metals processing and the 13.5 Mt CO_2-e produced by WA mining, though the figure is obviously not a summation. For this reason 7.2 Mt is quoted cautiously.

Steelmaking can exhibit varying emissions intensities based on the milling process utilised. Emissions are higher when iron ore is processed by an integrated steel mill than when scrap steel is processed by a minimill, since scrap steel has already bypassed its embodied emissions (Bode et al. 2001). In any case, it is clear that gleaning an appropriately specific figure for iron ore mines and steel mills in Australia presents an adventure in and of itself. One can assume, however, that taken together, ore mining and steel production boast dramatically different direct emissions-intensities and therefore fit differently into the EITE assistance scheme.

Indirect emissions are attributed to each sector in the National Greenhouse Gas Inventory based upon electricity usage statistics. The mining sector of the Australian economy consumed 4.7% of the country's primary energy in 2005-06, more than the entire residential sector (Syed et al. 2007). According to reported figures (DCC 2006a), the entire Australian mining industry consumed enough electricity to produce 12.9 Mt CO_2-e in 2006, again with the percentage increase (68.6%) representing the largest gain by any sector since 1990. Of this amount, 2.8 Mt CO_2-e were attributed to the generation of purchased electricity for mining enterprises in Western Australia, which ranks third only behind Queensland (4.9 Mt) and New South Wales (3.2 Mt), both coal-producing states. At the same time, 5.9 Mt CO_2-e were produced by the generation of electricity consumed at metals production facilities in New South Wales (DCC 2006a), which includes Port Kembla steel production.

Statewide, Western Australia produced 70.4 Mt CO_2-e in 2006, which represented 12.2% of Australia's total greenhouse gas emissions. Industrial processes in WA produced 6.2 Mt CO_2-e in 2006[1], which amounted to 22% of the state's total emissions that year (DCC 2006a). It is apparent that the state's highest earning industry represents a significant proportion of its carbon footprint, even though a facility-specific figure cannot be obtained.

By industry sector, neither mining nor industrial processes occupies the largest proportion of Australian or Western Australian carbon emissions (DCC 2006a) . This honour falls upon the stationary energy and transport sectors, and though prudence recommends that the impacts of an ETS on stationary energy and transport be specifically addressed, that does not fall within the scope of this thesis. There is little doubt that the impacts on stationary energy and transport serve to disproportionately affect the cost of living within Australia in the form of economy-wide increased commodity prices for families and individuals. However, the Australian government—with the help of the United States—has responded with hostile fervour in the past few decades to any threat to Australia's economic interests, highlighting the potential for carbon restrictions in some countries to disproportionately advantage countries with none (McDonald 2005), or to result in an environment antithetic to emissions reduction (Buchner and Carraro 2003).

The resounding complaint has been that any climate treaty that fails to include binding emissions limits for developing nations is ineffective and therefore should be considered null and void (Buchner and Carraro 2003; Cooper 1998). This claim is specious because in reality, no politician would attempt to justify the position that because X treaty would not result in sufficiently aggressive *reductions*, a wiser alternative is the abandonment of X in favour of limited emissions *increases*, which has been the popular option thus far

(Garnaut 2008b, p. 291). The conclusion follows logically from the premise only when the real-world implications of an incomplete treaty are premised as well, and only when the conclusion is accompanied with a simultaneous proposal for comprehensive action. Even the Asia-Pacific Partnership on Clean Development and Climate, a heralded climate directive proposed by the United States and launched in 2006, fails this logical test, as it is based on voluntary individual commitments (i.e. *no* binding emissions controls) in only six member nations, thus failing to capture half of the world's emissions (Zhang and Zheng 2007). For that reason, in this thesis I will base my conclusions on the assumption that the motivating factor behind stalled climate negotiations is fear of a distorted international market. In this context, officials have made it clear that international market competitiveness and investment attractiveness (and not climate mitigation) are the driving forces behind support for, or antipathy toward, a carbon reduction mechanism (Carmody 2008; Australia House of Representatives 2002). In terms of real worth to the Australian economy, and in light of international sensitivity, the iron and steel industry seems poised to make the biggest case for EITE assistance. If assistance thresholds compromise ETS economic efficiency and/or emissions effectiveness, there could be dramatic ramifications for the Australian economy. Cost inconsistencies could disproportionately burden firms that do not qualify for EITE assistance, with a potential ripple effect from the exemption of the largest of the estimated 1,000 emitters covered under the CPRS.

In a heavily traded sector such as iron and steel, it is critical not only to assess the nature of the domestic operations, it is also important to outline the status of competitor producers and major trading partners, in this case China.

Chapter 2: China

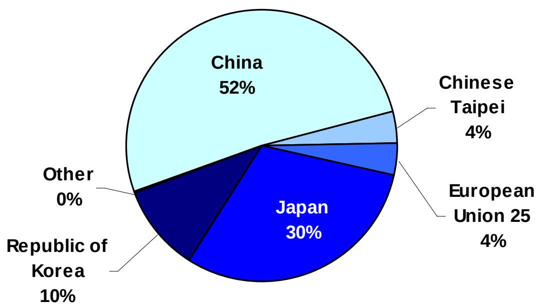
To effectively mitigate against disastrous climate change, China, the world's biggest emitter must participate in the international agreement process. At the same time, Australia has recently benefited significantly from the rapid Chinese growth that many in the world fear may hinder emissions control. In terms of post-Kyoto negotiations and international market sensitivity, the role of China cannot be understated. This chapter will introduce the country's trade relationship with Australian iron ore producers, its current and potential mitigation efforts, and the status of China and competitor developing countries in current and future international climate change policymaking.

2.1 Steelmaking

> It is expected the strong demand for Western Australia's commodities by the state's trading partners will continue beyond 2008 due to the prominence of China as a major export destination and its continuing economic prosperity. (DoIR 2007b)

By far, China is the fastest growing country in the world, and even Garnaut (2008d, p. 100) suggests that its GDP growth rate will approach 9.0% per annum over the next 10 years, thereafter slowing only moderately to 6.8% until 2025. China is Australia's biggest trade partner, with almost 13% of import-export share in the March quarter of 2008 (ABS 2008; DFAT 2008). Behind coal—most of which is mined in Queensland (black coal) and Victoria (brown coal)—iron ore is Australia's largest mineral export, with revenue of A$4.7 billion in the March quarter of 2008. The International Herald Tribune reported in 2007 that as much as 40% of Chinese iron ore imports were sourced in Western Australia, and the state accounted for nearly 60% of Australia's total export revenue (Lague 2007, citing ABS data). Last year, China accounted for 55.6% of the Australian iron ore market—DoIR reports 54% (2007b), ABARE reports 52% (Figure 6)—and these exports made A$9 billion (DFAT 2007; 2008).

Figure 6: Australian Iron Ore Exports by Destination (in kt)



Source: (ABARE 2008)

In the first six months of 2008, Australian metal ore exports were sold for more than A$17 billion, and China alone accounted for A$9.5 billion of Western Australia's total export revenue, as compared to A$14.5 billion from the previous 12 months (ABS 2008). Chinese imports of WA iron ore in 2006-07 amounted to 258 mmt, a figure that exceeded multiple forecasts for that year (EAAU 1995; Wu 2000) and even a forecast for 2010 (SAMI 1999) (Table 3). The growth of this industry has exceeded most expectations, and for eight consecutive years iron ore sales have broken records (DoIR 2007c).

Table 3: Chinese iron ore import forecasts (in million metric tonnes)

Source	**Years**		
	2005	2006-07	2010
EEAU (1995)	90		
SAMI (1999)			120-128
Wu (2000)	87		
Actual value		*258*-281***	

*Source: (DoIR 2007c)

**Source: (ABARE 2008)

China became the world's largest producer and consumer of steel in the mid 1990s (Price, Worrell, and Phylipsen 1999). In 2006 the country produced 422.7 mmt of crude steel (34% of global production), with the next highest producer being Japan with 116.2 mmt (IISI 2007). In the same year, China consumed 30.9% of the world's steel (IISI 2007), up from 26% the year before (Worldwatch Institute 2008).

As a result of recent trade liberalisation and domestic economic reform, China has emerged as the most rapidly growing economy in the world. Neither is their growth tenuous nor anything new. From 1972 until 1992, Chinese steel consumption increased by more than 300% at the same time that European Union and North American steel consumption actually *decreased* by 15 and 23%, respectively (Labson 1997). The latter regions acquired dominance in international steel production largely as a result of significant domestic iron ore sourcing, whereas East Asian production has evolved and grown based mostly on imported iron ore. Iron ore markets in Australia and Brazil responded to steel consumption changes over this time period, and by 1992 the two countries were responsible for an estimated 60% of the international iron ore market—both became world leaders in production by 1997 (Labson).

The Chinese steel industry was borne out of significant government efforts to devote vast human and resource capital to economic output (Price et al. 2002). The most recent growth in Chinese steel production and consumption can be attributed to the dramatic privatisation of formerly state-run steel facilities since the 1970s (Wu 2000; Worldwatch Institute 2006). Over the past few decades, mandatory state takeovers of processing facilities have declined, and public listing has increased, not least due to the transition of government activity from communist-era, iron-fist control to a more passive, market-oriented regulatory position. Bureaucratic influence is exercised most frequently via merger orchestration in a country where the sheer number of decentralised factory interests has reduced economies of scale and inhibited progress in the face of limited resources (Wu 2000).

When rumors began swirling in late 2007 of a possible BHP-Rio Tinto merger, Chinese officials baulked at the possibility of unchecked leverage over iron ore pricing by the new company. As a result, they have made a dramatic push recently to consolidate China's fragmented steel industry (Zhu 2008). A June International Herald Tribune headline captured this essence most eloquently when it noted, “Chinese steel companies create world's 5th-largest producer in government-led merger” (The Associated Press 2008). This move created Hebei Iron and Steel Group Co., which has replaced Baosteel as the largest steel producer in China (Roxborough 2008). An interesting dichotomy appears to be surfacing, in that a consolidated Australian iron ore industry and consolidated Chinese steel industry seem to be pulling in exactly opposite directions.

China boasts relatively plentiful iron ore resources, but in contrast to Australia, Europe and North America, their supplies are of poorer quality (with an estimated 50% of the per unit iron content of Australian supplies) and cannot be relied upon to produce sufficiently high quality steel at competitive cost (Labson, Gooday, and Manson 1995; Wu 2000). It is cheaper for China to import high grade iron ore than to utilise its own resources. As a result, the Chinese import of Australian iron ore increased by almost 2,700% from 86 kilotons in 1973 to 23,129 kilotons in 1996 (Tcha and Wright 1999). This trade is substantial and expected to increase, but Labson (1997) cautions that increased flow of raw materials will depend heavily on low trade barriers and liberal policies which encourage transmission of technology and investment. While a carbon price can act as a trade barrier, much like a tariff, international agreement will likely enhance investment and technological diffusion. In addition, Mai et al. (2005) has suggested that in this situation trade relationships could be enhanced with an appropriate bilateral free trade agreement.

Chinese government officials have planned to double 2005 GDP figures by 2015, with a subsequent planned doubling by 2025 (Zhou and Dai 2003). This change has been quoted as depending on growth rates of at least 7.2% per annum for the next 20 years. The resulting energy and construction demands are likely to bolster an already world-leading steel consumption rate (Zhou 2006).

Steel consumption has a very clear dependence on the import of iron ore resources, especially in China. With multiple alternative global sources (namely Brazil and India), it would be expected that any fluctuation resulting from an unfavourable trade environment in Australia may hinder its competitive edge and enable other producers to usurp its market. However, Tcha and Wright (1999) note a prominent inelasticity of iron ore demand with respect to price, and because iron ore amounts to approximately 5% of the total cost of steel production, ore prices may increase without dramatically affecting the price per unit of steel output. Indeed, China's own increasing demand inflates import costs, thus reinforcing the independence of demand against price (Trench 2004).

Australian ore purity is unrivalled by Chinese reserves, and market proximity keeps shipping costs lower for Australian producers than for Brazilian producers. Therefore the claim that "virtually all [EITEs are] unable to pass on additional carbon costs" (BCA 2008, p. 19) is misleading. In the past, ore competitiveness depended partly on the inability of Chinese ports to accommodate ocean-going carriers with very large capacity and on the comparatively high cost of Chinese ore processing (Labson, Gooday, and Manson 1995). More recently, however, Reinaud (2008a) has noted that massive ore demand has resulted in severely congested Chinese ports that have forced vessels to queue for up to six weeks. Current labour shortages in Western Australia inhibit output rates, and it appears that China truly cannot import necessary raw commodities fast enough.

2.2 Electrification

Before the turn of the millennium, Chinese steel mills were modernised partly in response to concerns over air pollution. Decreased reliance on coal and more frequent technology upgrades could be seen not only to limit particulate matter and other surface emissions, but it also made a great deal of business sense (Zhou 2006). China's shift from open hearth furnaces to basic oxygen furnaces was not the only one of its kind in the world. In the late 1990s, Costanza and Ruth (1998) noted that the United States iron and steel industry experienced a dramatic shift away from blast furnaces (crude steelmaking furnaces whose input is pig iron) to a combination of imported pig iron and electric arc furnaces (secondary steelmaking furnaces whose input is imported crude steel, scrap, and electricity). Retired facilities included several closed resource loops, in which waste products from early processes could be used to fuel later stages of iron production or steel refinement. Subsequent opening of these loops increased the energy demand of facilities, but this demand was largely displaced onto the electricity generation sector (Costanza and Ruth 1998).

Other research shows that during the 1980s and early 1990s, China's iron and steel industry overtook US iron and steel in absolute carbon dioxide emissions, having almost doubled the latter by 1996 largely due to continued dependence on coal inputs (Kim and Worrell 2002). At the time, China was still operating fewer electric arc furnaces than the rest of the world and had yet to modernise most of its facilities (Wu 2000). From 1990 until 2000, the emissions intensity of Chinese steel production was dramatically reduced largely due to the replacement of all open hearth furnaces with more modern basic oxygen furnaces for crude steel production (Hidalgo et al. 2005), which have energy intensities of 3.9 - 5.0 GJ/tonne and 0.7 - 1.0 GJ/tonne respectively (WEC 1995; Price et al. 2002). Price et al. (2002) found that Chinese steelmaking plants could have reduced their energy demand and emissions output by 45% as of 2002 with 'best available technology', so there is reason to expect that the Chinese market is not only poised for a dramatic increase in output and consumption, but that it is also primed for dramatic modernisation and technological improvement.

In recent years, and like China, Australian steel facilities have shown a marked tendency toward electrification, with 19.2% of its steel produced by electric arc furnaces in 2007—up from 18.3% the previous year (IISI 2007; WorldSteel Association 2008) A shift from emissions-intensive technology to electrified equipment and imported raw materials results in low direct emissions but high embodied emissions. Studies have shown that the environmental impacts associated with mine site machinery operation can be attributed primarily to those associated with electricity usage (Landfield and Karra 2000). Thus the iron-steel carbon burden in both countries has been gradually shifted onto the stationary energy sector. This means that China's improved efficiency potential is probably understated.

2.3 Technology developments

There are several important new processes which have modernised steel mills for the companies willing to invest in such innovation. Emerging technologies include the patented Corex and HIsmelt processes, and their potential for carbon emission reduction warrants a brief mention, especially within the context of technology diffusion. The sharing of innovative technology is an important aspect of the effectiveness of a global carbon reduction scheme, and the principle of 'common but differentiated responsibilities' provides a significant impetus for the relatively minor transaction costs of developed nations to facilitate the modernisation of global industries.

'Corex' facilities bypass blast furnace cokemaking (and the associated carbon emissions) and produce steel using cheap fine coal as opposed to more expensive coking coal (Ramstad 2008). Baosteel, China's second largest steel producer, is currently building the second of its Corex furnaces and plans for it to begin operating in 2010. A South Korean company, Posco, has recently invested heavily in 'Finex', which uses cheaper coal and iron ore inputs. It operates a facility within South Korea and has plans to expand into the Vietnamese and Indian steel markets (Ramstad 2008). All Western Australian steel is produced using ‘HIsmelt’, a counterpart to Corex, and the prevalence of these processes has changed the nature of the international steel industry.

In light of the scope of this thesis and due to time and resource constraints, the effects of these technologies are acknowledged only briefly. The competitiveness of Australian high-grade iron ore is assumed to have remained consistent over recent years, despite modernisation. There is clearly a need, however, for an updated cost analysis of Chinese and Australian reserves. It is evident that the global steel industry has begun modernising independent of carbon pricing. Nowhere is this more obvious than in China. If Corex and Finex enable China to capitalise on its vast, low-grade domestic iron ore reserves, then any ETS impact on the Australian export market must not be confused with counterfactual market trends. Temporal correlation can obscure causality, and much more research is needed.

2.4 China’s tactical participation in climate negotiations

Considerable attention has been paid to the current and future potential for a multilateral international agreement designed to tackle climate change, and most of the debate surrounds the necessary inclusion of China for such an effort to be successful. It bodes well that the Chinese economy has recently invested very heavily in renewable energies, indeed more heavily than many of the high-income countries of the world (Heggelund 2007). In terms of climate change mitigation, it comes as welcome news that Chinese per capita emissions remain low, less than a fifth of those in the US (Worldwatch Institute 2008, p. 47). It is, however, unfortunate that it remains so, as the disconnect between economic growth and per capita emissions growth is a clear indication of considerable inequity within the Chinese economy (Heggelund 2007). The country has successfully lifted millions of people out of poverty, but wealth accumulation appears to be staggered, and production capacity suffers due to a very large income gap. As well, mainstream climate science has frequently highlighted the potential for climate change to disproportionately impact poor parts of the world (IPCC 2001).

Per capita emissions notwithstanding, China’s growth has made it the largest carbon dioxide emitter in the world, and many warn that ineffective climate mitigation has the potential to further exacerbate already dramatic inequity. However, Chinese officials expect that strong growth can systematically alleviate income disparity (Heggelund 2007), and thus the primary goal of the country is production-at-all-costs. It appears, then, that both binding carbon limits *and* their absence could threaten economic prosperity in China, either via growth inhibition or climate destabilisation. In terms of post-Kyoto agreement, both situations are particularly problematic. Chinese officials ratified the Kyoto Protocol in 2002, but the absence of binding emissions restrictions meant that ratification had almost zero domestic ramifications. Still, news outlets reported the development as a significant step in the right direction for international climate policy (ABC Online 2002). COP-15 will occur in Copenhagen, Denmark in 2009, and developed country policymakers should hope that recent Chinese renewable energy investment is a more indicative trend than their incessant demand for economic growth.

2.41 Kyoto context

The ratification of Kyoto was not an unconditional vote of support by the Chinese government. As has already been noted, economic growth is very important both to the nation and to its people. China has experienced an unprecedented transition into the global free market since the 1970s, and its late entry means that it has not been afforded the gradual learning curve that saw the Western world come to terms with the realities of climate change. In fact, the confluence of its rise to economic supremacy and the confronting realities of environmental degradation mean that it is growing up in an entirely different world than the one in which earlier empires found themselves.

By 1990, climate change surfaced in the international dialogue, and sufficient warning by climatologists prompted the creation of a National Climate Change Co-ordination Group in China (Tangen, Heggelund, and Buen 2001). This group subsequently completed impact assessments and expert reviews of the proposed United Nations Framework Convention on Climate Change, and in 1992 China became its fifth signee (Tangen, Heggelund, and Buen 2001). In response to the influence exerted through the UNFCCC of developed nations, China banded together with 76 other developing nations in the Group of 77 (G-77). This organisation allowed them to collectively influence policy decisions at the conferences of parties. Though Chinese decision makers were willing to attach China's credibility to G-77 statements, they often made extra effort to clarify their country's unique position in the debate (Tangen, Heggelund, and Buen 2001), which suggests these officials were keenly aware of the extent to which China could be considered neither truly 'developing' (especially in coastal area megacities), nor truly 'developed' (primarily in inland, rural villages) (Bettelli et al. 1997). Fortunately for them, the preamble of the UNFCCC places the lion's share of responsibility for greenhouse gas emissions on developed nations (United Nations 1992), and initially G-77 had little reason to exert much influence in demanding concessions from developed nations, as concessions had been built into the document from its inception. Indeed, authors have noted that the UNFCCC, let alone the Kyoto Protocol, incorporates almost exclusively the responsibilities of Annex I nations, allowing but not requiring participation by China (Cooper 1998).

Developing nations, though, are required to submit national greenhouse gas inventories under the convention. For this reason Chinese officials established the China Council for International Cooperation on Environment and Development, whose expert members acted in an advisory role for the government (Cooper 1998). Significant domestic efforts aside (China submitted the first of its emissions inventories in 2004), China remained quick to remind Annex I countries of their obligation to fix the climate change problem for which they had been entirely responsible (IOSC 1996). At the same time, China's relatively low GDP per capita allowed it to justify devoting its resources toward growth of its economy and alleviation of poverty, rather than toward expensive emissions controls and technology upgrades (Tangen, Heggelund, and Buen 2001; Heggelund 2007). If the generally accepted 30-year lag time applies to Chinese carbon dioxide emissions, then the explosive nature of their recent emissions growth will not be realised for several decades, long after developed nations should have begun reducing their per capita emissions. Garnaut's emissions trading analysis has repeatedly hinged on the idea of contraction and convergence of per capita emissions across the international stage, and China's adamancy regarding the dichotomy between the "luxury emissions" of Annex I nations and "survival emissions" of developing nations has remained steadfast throughout negotiations (Bettelli et al. 1997; Heggelund 2007).

Thus far in climate policy, little has been done to set an appropriate stage for developing country participation. Participating countries used Kyoto to decide on an aggregate definition of emissions per nation, selecting an absolute total rather than a figure delineated per population size. This decision, as has been noted Section 1.4, plays in the favour of nations with currently high net emissions like Australia and the US, providing them with more flexibility and less demanding reduction standards (Najam, Huq, and Sokona 2003). At present, an absolute emissions standard acts as a punishing disincentive for countries like China, since worldwide emissions reductions burden them with most of the responsibility (Agarwal and Narain 1991; Najam and Sagar 1998).

2.5 Chinese carbon

The extent to which the Communist government's legitimacy relies upon its delivery of economic growth to its people (Worldwatch Institute 2006) provides an interesting motivation not only for promoting growth as its fundamental priority but also for overstating domestic economic figures (see Maddison 1997; Rouen 1997). It begs investigation as to whether or not emissions control can be seen as a threat to the stability of the current regime and economy, though it is possible that this tension is counterbalanced by several checking forces.

Climate destabilisation is a direct threat to long-term economic prosperity (Zhou 2006), and China is acknowledged as particularly susceptible to damaging climate change (Heggelund 2007; PRC 2004), but emissions limits are expected to derail the growth directly attributable to vast Chinese coal reserves. In addition, a carbon constrained international market can exclude China for any number of reasons, not the least of which is lack of cooperation, especially if the rest of the world has developed a unified coalition and fluid system of emissions trading. International loans are increasingly contingent on emissions control (Hon 1998), but it is widely acknowledged that an international mitigation system's legitimacy is directly tied to the inclusion of the Chinese economy.

This, of course, must be contextualised against the state-run nature of the planned Chinese economy. The country has very deliberately hybridised the centralised, top-down control reminiscent of the Soviet Bloc with the prosperity-enhancing dynamics of international markets, with the most glaring example of this occurrence being China's membership in the World Trade Organisation (WTO). As we saw in Section 2.1, their steel industry is no stranger to government ownership and/or takeover, and state officials are keen to run a successful economy with a very specific recipe for growth. Primary responsibility for climate change policies and negotiations in China (as well as energy and economic policy) lies with the State Development Planning Commission (renamed NDRC in 2003), which reinforces the interconnectedness of environmental and economic priorities (Tangen, Heggelund, and Buen 2001; Zhang and Zheng 2007).

The NDRC has, since 2003, represented Chinese interests at each Conference of the Parties, but the Ministry of Foreign Affairs acts as an intermediary for all final decisions, and such decisions are often presided over by foreign policy experts, rather than climatologists or economists. Scientists and economists accompany the Chinese delegation at COPs, but it is clear that scientific uncertainty has thus far paved the way for the perception of climate change as trade-based foreign policy (Heggelund 2007).

China's early antipathy toward the Kyoto flexibility mechanisms, as well as emissions trading can be attributed to their efforts to avoid any practice which may usurp government control over market forces, as the "commercialisation of international system[s]" is generally avoided in favour of bilateral government agreements and official development assistance (Tangen, Heggelund, and Buen 2001, p. 246; Heggelund 2007); whether Chinese officials consider absolute control over carbon permit allocation a sufficient union of the two remains to be seen. They are treading into free market terrain with relatively little experience, and repeated efforts to buy time for decisions can be seen to reinforce their inexperience. Heggelund (2007), however, notes a marked transition away from a planned economy, and China's recent enthusiasm for Clean Development Mechanism (CDM) projects (Heggelund 2007; Wara 2007; Zhang and Zheng 2007) may bode well for their flexibility at COP-15. The CDM involves the practice by which developed nations can invest in emissions offsets and technology improvements in developing nations in order to achieve their own emissions targets.

Relative to other environmental concerns in China, though, climate change is an ephemeral and distantly looming threat. Air and water pollution, water scarcity, and other acute ecological stresses are addressed with an immediacy which climate change has yet to garner (Tangen, Heggelund, and Buen 2001; Zhou 2006). Frequent literature reference to a 1997 World Bank paper reinforces the immediacy of Chinese air pollution, as it is estimated to cost the country 7% of GDP per annum (World Bank 1997). A government push away from coal (usage of which peaked in 1990) and toward oil-based energy this decade offered a temporary reprieve for emissions-intensity (Zhang and Zheng 2007; Zhou 2006). Pro-oil developments, however, were a response to acute air pollution and had little to do with the possibility of catastrophic climate change, as has been the case with other policies (Heggelund 2007). It is clear, then, that China's complete aversion to binding emission limits stems primarily from the assumption that such commitments will negatively affect economic growth. Ironically, high oil prices are expected to shift the energy burden back toward coal (Zhou 2006)—indeed, China used 957 million tonnes of coal (in oil equivalent) in 2004, 393 million tonnes more than the world's second largest consumer (Worldwatch Institute 2008). The rapidly growing, fossil fuel-driven economy will make emissions reductions exceedingly difficult (Zhang and Zheng 2007; Heggelund 2007).

Revealing research appeared in 2006 that clarified developing country participation in environmental treaties, whereby "no matter how important a nation is ecologically nor how vulnerable it currently is, other factors tend to drive treaty adoption" (Parks and Roberts 2006a, p. 14). In this case, it should come as no surprise that the threat of climate change to long-term Chinese prosperity has yet to weigh very heavily in this debate. Negotiators have consistently baulked at the concept of binding emissions limits, and the fear that the macro-economic effect of such limits could be resoundingly negative has trumped all other considerations.

Still, despite the expected consequences of carbon constraints, some degree of climate change mitigation seems to be in the interest of not only Chinese public health, it also serves to reinforce the bottom line. Though fossil-fuel intensity can be seen to dissuade China from attempting anything which may stifle economic growth, it is widely recognised that heavy dependence on coal entails large capacity for efficiency improvement (Heggelund 2007). Currently, government officials have committed to improving China's energy efficiency by 20% before 2010 while they aim for a twofold increase in renewable energy usage before 2020 (Zhang and Zheng 2007). It appears that China has not only retained the moral high ground in demanding accountability for past emissions, but they have stood behind their rejection of mandatory limits and embraced voluntary reductions above and beyond any in the world. It is estimated that these measures have, even without specifically addressing carbon intensity, reduced emissions growth by 250 million tonnes per year, and because of these same policies, a reduction of 800 million tonnes is entirely possible by 2030 (Chandler et al. 2002). This is, of course, entirely contingent upon commitment to and achievement of these targets.

Perhaps one of the more telling determinants of Chinese participation involves the widely-publicised expectation of leadership from industrialised countries, including Australia. The Norwegian researchers Tangen, Heggelund and Buen (2001) attended Conferences of the Parties to the UNFCCC from 1997 until 2000, at which point they interviewed Chinese decision makers during a 7-month period to obtain valuable insight into the motivations of the country. According to their analysis, the inclusion of non-Annex I countries, and specifically China, after the expiration of the Kyoto Protocol, is contingent upon the fulfillment of obligations under the Protocol itself of Annex I nations. In other words, China has made it explicit since signing the UNFCCC that they will not consider adopting post-Kyoto, binding emissions limits unless Annex I countries meet their targets, establish significant avenues of funding for international cooperation, and promote sufficient technology transfer. According to Heggelund (2007), officials in Beijing are as committed now to this Annex I burden of responsibility as they were at the inception of the UNFCCC.

During the early years of Kyoto, this demand posed a kind of cat-and-mouse threat to progress, with the United States and Australia on one side and China on the other. Each expected the other to surrender to its demands first. China refused commitments without progress by Annex I, which depended upon actions by the United States, who refused commitments without the same by China, who refused commitments, and so on ad nauseum. There is reason to suspect that despite considerable progress on the European front since 1997, China is paying very close attention to current developments in Australia and the United States. The “irresponsible” withdrawal of the US from Kyoto in 2001 adds considerable desperation to the success of post-2012 negotiations (PRC Ministry of Foreign Affairs, as quoted by Heggelund 2007, p. 177), but Australia should be wary of passing up the small window of opportunity it seems to have left for establishing good rapport. China sees climate change primarily as a foreign policy issue, and thus Australia should at least acknowledge an ETS as a good foreign policy move, one that will serve only to enhance the possibility of bringing China into the debate and potentially staving off catastrophic climate change.

2.6 How can Australia lose?

Ultimately, given the dependence of Western Australia on iron ore exports, China's ability to shift to alternative sources for its iron needs will weigh heavily into the debate over the trade-exposure of the industry. India and Brazil are Australia's main competitors, given that 22.9% of China's 2006 iron ore imports originated in India (DoIR 2007c), and Brazilian reserves (which are smaller in absolute terms than Australia's) boast higher iron content. Australia's proximity to Chinese ports gives it a competitive advantage over Brazil, and the expected rapid growth of India's economy—along with India's recent "full-scale infrastructure investment"— is likely to increase its own steel consumption rates to the tune of continually expanding demand for iron ore (DoIR 2007c, p. 22). If, however, internalised carbon pollution prices increase production costs associated with iron ore export, a number of effects may follow.

First, Chinese domestic, low-iron ore supplies may regain competitive advantage, and it may become cost-effective for China to reduce its import volume. However, earlier analysis highlighted China's largely uncompromising commitment to economic growth and increased output as well as the degree to which China's already poor infrastructure limits import volumes. For this reason it is expected that Chinese officials have already maximised imports from Australia, India, and Brazil and would more than likely absorb increased import costs for the sake of continued steel output.

Secondly, China may seek to manipulate the cost balance of its aggregate iron ore imports via increased reliance on Brazil, India, and possibly Russia (who has a larger reserve base than Australia). This, however, is heavily contingent on the fact that Australia is the only country forced to internalise the price of carbon and that production cost increases are not ubiquitous across the international market. If India, Brazil, and Russia can be incorporated into the international agreement process and are willing to accept binding emissions limits, then the playing field might be levelled and the Australian iron and steel industry will avoid trade-exposure. In this case, Indian, Brazilian, and Russian participation in Kyoto negotiations has as much to do with the impacts of an Australian ETS as does that of China.

2.61 India, Brazil, and Russia

India began to rapidly decouple GDP from energy in the 1950s, and due to its heavy reliance on coal-fired electricity, it has a large efficiency upgrade potential. In 2000, progressive energy policies helped curb emissions growth by 18 million tonnes, and coal subsidy reductions have brought domestic coal prices down near world levels. Energy intensity reduction rates hover at around 1.5% per annum (Chandler et al. 2002). There is a stark lack of literature addressing the complexities of India's climate policy stance. That said, India is poised for economic growth on par with that of China, and its rapidly growing economy is assumed to rely heavily on its own resource base in the coming years, suggesting increased reliance on domestic iron ore. India ratified the Kyoto Protocol in 2002 without a binding emissions limit, and the nation is assumed to rely primarily on proximity in order to foster an iron ore trade relationship with China. Though the likelihood of participation in a post-Kyoto regime is unknown, the country does not seem to pose a significant threat to the stability of the Western Australia-China trade regime, if for no other reason than the fact that its reserve base is much smaller than Australia's.

Elsewhere in the world, Brazil has also ratified the Kyoto Protocol without having to accept a binding emissions limit. It does not, however, seem to be poised for dramatic resistance in Copenhagen. The nation has set a 10% renewable energy target for 2022 and is a world leader in ethanol usage and production, the implementation of which has saved an estimated 10 million tons of CO_2-e (Chandler et al. 2002). Brazilian ethanol can be sourced from extensive domestic sugar cane resources which yield more litres of biofuel per hectare than any other crop in the world. In addition, sugar cane ethanol has the smallest carbon signature of all the world's biofuels (Worldwatch Institute 2008), thus insulating it from carbon price sensitivity and suggesting lower barriers to the internalisation of such a price signal. It is estimated that as much as 40% of Brazilian vehicles are currently suited for ethanol technology (WRI 2008), and officials have clearly embraced the constrained future of carbon emissions. High Brazilian deforestation rates indicate a vested interest in proactive international agreement, as the country could see windfall gains from selling offset credits (Fearnside 2005). In addition, Brazilian ports can never rival the proximity of Australia's, and as such will probably never see the same trade relationship with China that Western Australia enjoys today.

Identified as a country in transition to a market economy by the Kyoto Protocol, Russia was allocated a binding 100% emissions limit, though its status earned it a "certain degree of flexibility" in achieving emissions targets (United Nations 1997, p. 4). On paper Russia left the third Conference of the Parties significantly less advantaged than Australia—who gained 8% of "hot air" allowances. After the break-up of the Soviet Bloc in 1989-1990, however, Russia experienced an industrial collapse, and its emissions fell well below 1990 levels, thus giving it a vested interest in emissions credit trading, since it stood poised for windfall gains from the selling of carbon reduction permits (Buchner and Dall'Olio 2005; Henry and Sundstrom 2007; Korppoo and Moe 2007). When the United States officially withdrew from the Kyoto process, Russia's ratification vote became necessary in order for the Protocol to become legally binding and incorporative of at least 55% of industrialised carbon dioxide emissions from 1990. Aided by offers of a smooth entry into the WTO, Russian officials were sure to use their bargaining power to their greatest advantage in a time where the rest of the Annex I countries had grown increasingly desperate (Buchner and Dall'Olio 2005; Korppoo, Karas, and Grubb 2006).

Kyoto entered into force when Russian officials ratified on the 4th of November, 2004, but they did so only after a prolonged period of ambiguity on their intentions (Buchner and Dall'Olio 2005). Repeated assessments have confirmed the potential for Russian ratification to act as a magnet for investment and economic development opportunities, which is a particularly potent incentive given the fact that the Russian public views international action on climate change as a mechanism for redistributing wealth (Korppoo and Moe 2007; Henry and Sundstrom 2007). Like China, Russia can be said to have been sceptical of investment mechanisms that might undermine government control over market affairs, and, as a consequence, much uncertainty still surrounds its future involvement. It has, however, "initiated talks on future voluntary targets" (Korppoo and Moe 2007, p. 7). While studies have noted that public opinion could have thus far stalled participation (Korppoo and Moe 2007), others cite recent surveys that show the Russian public has grown more aware of the problems posed by climate change at the same time that leaders have begun touting Russia's environmental credentials (Henry and Sundstrom 2007).

2.7 Concluding remarks

The balance of competitive interests clearly hinges on the development of climate policy in China, and if secure trade channels cannot be protected, then the Carbon Pollution Reduction Scheme risks alienating the business interests whose participation will be so fundamental to its successful operation. Unfortunately, Australian mineral commodities are competing primarily with nations who have largely taken a back seat in previous climate negotiations, and the future is uncertain. Against the backdrop of the aforementioned trade environment, it is critical to analyse thoroughly the operational requirements of the CPRS and any areas where the scheme and Australia's economic and ecological interests may come into conflict.

Chapter 3: CPRS flaws re-visited

Increasingly vocal critics of the Labor Government's CPRS proposal have tended to split into two fairly partisan groups. In one camp there appears to be significant concern that reduction trajectories are insufficiently aggressive and that climate change mitigation has been sacrificed out of concern for the profits of the country's largest emitters (ACF Online 2008; Rogers 2008). Another camp is worried that the kind of sweeping change likely to result from CPRS introduction could, if not accompanied by sufficiently rigorous internal legislation and a suitable international trade environment, destabilise Australia's terms of trade and hinder, rather than enhance, the country's progress (Orchison 2008; Shanahan 2008). What is clear is that the current proposal, crafted within the political sphere as one party's preferred position, includes several notable inconsistencies and procedural flaws, flaws which if left unchecked could serve not only to harm the Australian economy, and thus its consumers, but also to undermine the long-term effectiveness of climate change mitigation. While these flaws have been hinted at in earlier sections, this chapter will reiterate them here in order to assess the validity of common CPRS critiques.

3.1 Emissions capture: the green critique

Environmentalists are quick to highlight the shortcomings of CPRS emissions coverage, and a considerable degree of attention has been paid to the perceived ambition associated with end-goal stabilisation targets of 450 or 550 ppm of CO_2-e. Most climate scientists associate a 450 ppm scenario with increased risk of catastrophic climate changes, while it is generally assumed that 550 ppm is associated with high risk of such changes (IPCC 2007b; Meinshausen 2006). Though a great deal of uncertainty still surrounds these values and their expected consequences, the disdain expressed by environmentally-minded individuals at the selection of 550 ppm as Garnaut's recommended trajectory goal (Rogers 2008) shows that dramatic emissions reductions are a very high priority in many circles. Because of this, the green critique must be contextualised against not only the weaknesses of the CPRS proposal, but also against the relative contribution of the sectors in question to the global greenhouse gas problem.

3.11 An ephemeral gas

The most fundamental problem associated with iron and steel industry emissions capture stems almost directly from the difficulty associated with measuring as ephemeral a pollutant as carbon dioxide. Where emissions proxies are available, they attempt to capture a representative estimate of the greenhouse gas emissions associated with a standard unit of a particular type of solid or liquid fuel (Chomitz 1998). They are usually cost-effective to administer, as they require very little labour capital, but these are, however, best-guess approximations. Where proxies are not available, end-of-pipe monitoring devices can be used to measure greenhouse gas output through a concentrated source such as a smoke stack. Slightly more cost-prohibitive, these mechanisms require upkeep, monitoring, and labour hours in order to produce reliable measurements.

If our complex ecosystem has taught us anything, however, it is that the carbon cycle is dynamic and interconnected. Fossil fuel combustion is not the only source of emissions, and land-use change has been a notable debate trinket since the early stages of climate negotiations. As we have already seen, mining is evolving into one of the primary drivers of deforestation, especially in such a resource-hungry world. As of yet, Australian measurement standards fail to capture land-clearing on new mine sites, which can be attributed in part to the lack of confident measuring techniques as well as the labour-intensive process of quantifying such a comprehensive figure. Though land-clearing usually happens only once, and despite comprehensive regulations which require substantial re-vegetation on closed mine sites, in terms of ecological effectiveness, the concept of additionality must be addressed where catastrophic climate tipping points linger on the horizon. There remains significant uncertainty surrounding an accurate assessment of carbon signatures for an industry as large and diverse as iron and steel, and though resolute conclusions will no doubt be costly, much more data is needed.

3.12 Point of obligation

Though the CPRS does not recommend specific points of obligation for emissions coverage, haphazard obligation delineation risks either failing to capture large ‘bubbles’ of emissions or ‘double counting’ emissions by holding two entities liable for the same carbon dioxide.

The most immediate problem stems from China. In the case where China refuses to take on binding emissions limits in Copenhagen, then Australia’s options are bleak. Production-based obligation captures the emissions at domestic mine sites or steel mills, but embodied import emissions are excluded and therefore unconstrained. This would seem to not be a problem in a country where so much iron ore is domestically sourced, but the fact remains that iron ore sites displace most of their emissions onto the transport and stationary energy sectors, and as such scope 1 emissions are difficult to ascertain (see Section 2.2).

Consumption-based obligation captures emissions embodied in steel imports, but because iron ore is not imported and is refined only in limited capacity within Australia, embodied carbon in exported iron ore remains unconstrained. In both cases Australia can continue to export a bubble of carbon emissions into the Chinese market via iron ore, thus increasing the overall uncertainty associated with coverage of this sector in the first place.

In the event that China adopts binding emissions limits in Copenhagen, then it appears that no matter what point of obligation is chosen, its carbon controls will reflect the emissions that have not been captured by the Australian CPRS. Consumption-based points of obligation in China will force the country to incorporate the emissions associated with iron ore imported from Australia. Production-based obligation can account for the emissions produced by steel manufacturing processes, but there will incidentally be no mechanism for capturing emissions embodied in imported iron ore. Since China manufactures vastly more steel than Australia, however, these embodied emissions are translated into direct emissions and are captured regardless. This is why Garnaut has noted that “harmonised” international points of obligation are unnecessary (2008b, p. 327). In the absence of international agreement, however, this flaw sacrifices the ability of the CPRS to capture, and therefore reduce, carbon dioxide emissions for iron ore producers.

International harmonisation may not be necessary, but domestic emissions capture lies at the heart of the CPRS, and even the Labor Government has noted that maximum coverage best serves everyone’s interests (DCC 2008). Emissions accountability will be difficult to assess where on-site electricity is utilised at various points during steel production processes. Stationary energy will likely find itself under a production-based point of obligation, but the iron and steel industry is more complex. Production-based obligation can hold mining companies and steel manufacturers accountable for operating (scope 1) emissions but not indirect (scope 2) emissions which stem from and are estimated according to electricity usage. Where waste products are used at intermediate production steps and by-product gases contribute to electricity generation, energy usage becomes inextricably linked to the exact technology recipe used at each operating facility. In this case it will be costly to calculate and apply a different standard for every emitter in the industry, which would seem to be the most environmentally-sensitive alternative.

Consumption-based obligation will hold consumers accountable for the emissions associated with the mining of iron ore and the manufacturing of steel, but such a standard is also cost-ineffective, as it will be prohibitively difficult to determine even an approximation of the carbon emissions associated with a unit of steel (Reinaud 2008a), especially given the variable state of industry technological developments (see Section 2.3) as well as aforementioned energy complexities. In the end, though, consumption-based points of obligation ignore the fact that Australian GDP is primarily consumption-driven (Cunningham 2005), which lends credence to the argument that such a practice would, even if cost-efficient to administer, disproportionately stifle economy growth and drown out concerns about reduced competitiveness.

In these cases it appears that incomplete emissions coverage can be attributed more to administrative obstacles than to the perceived sacrificing of environmental priorities.

3.13 National Greenhouse and Energy Reporting Act (NGERS)

Previous sections have noted the ambiguities inherent in the NGERS, which serves as the foundational accounting basis for greenhouse gas monitoring and reporting, but they deserve specific mention here. Methodologies are subject to inconsistencies early in the reporting process, as emissions measurement standards and reporting guidelines seem to make registry enforcement difficult. Only after having identified itself as a reporting party is a company or facility responsible for adhering strictly to mandated methodologies. Thresholds seem arbitrarily defined except for companies likely to obviously surpass them. Registration is mandated for companies or facilities that emit above these reporting thresholds, but enforcement will be difficult and costly, even for an independent regulatory authority whose responsibility it will be to oversee the permit market. This is probably why the CPRS proposal is designed only to account for the 1,000 largest emitters in Australia, but the perverse incentive to underreport grows with mounting attention paid to the likely costs of emissions reduction. It must therefore be acknowledged that maximum emissions capture will not be an easy task for the Australian economy. Aside from the obvious costs borne by the economy as a result of carbon prices, it is unclear if and how these shortcomings could be corrected cheaply.

It appears that there is also ambiguity surrounding carbon emission responsibility. Where industry sectors are often interrelated, the lines between the operation of one facility and another, even one company and another, tend to blur to the extent that standards applied to one *or* the other fail to capture emissions in both. Even the Business Council of Australia has noted significant confusion over the exact delineation of and responsibility for emissions on a mine site, noting a “potential disconnect between emissions reporting and permit acquittal” (BCA 2008, p. 152). Previously mentioned difficulty associated with NGERS (under)reporting combined with the fact that even the business leaders are unsure as to who is responsible for particular emissions means that emissions capture is probably sub-optimal. This is probably due as well to the difficulty of emissions obligation determination, but at the moment it is safe to assign a fair degree of uncertainty to the 7.2 Mt CO_2-e attributed to the iron and steel industry in the 2006 National Greenhouse Gas Inventory, and it is likely that this figure is an underestimate.

3.14 Competitiveness-driven carbon leakage

Repeated critiques warn of significant carbon leakage inherent in the CPRS proposal. The most widely acknowledged form of carbon leakage in the literature involves the transition of emitting companies to what are sometimes referred to as pollution havens (Eskeland and Harrison 1997). Well-intentioned price signals in one country can exacerbate emissions rates elsewhere[1], and many authors have identified this as a very fundamental weakness of an emissions trading scheme that fails to capture the entire global market.

Australia's energy intensity makes the iron and steel industry particularly vulnerable to the shock of electricity price increases which are likely to result from the pass-through of CO_2 permit prices. This effect may be exacerbated when there is an incentive to capitalise on EITE assistance by increasing the ratio of scope 2/scope 1 emissions (see Section 2.2). However, any concern that steel production will move overseas in order to satisfy Australia's consumption seems misplaced. Statistical analysis indicates no effect on the trade balance of aluminium exports/imports in Europe since the inception of their ETS in 2005 (Reinaud 2008a), which seems to suggest very little discernible carbon leakage in what is assumed to be a market with a significantly higher emissions-intensity.

For investors, a carbon price signal acts like a risk premium, the cost of which is imposed above and beyond operational costs. Where fluctuating currencies enhance or detract from terms of trade, this risk can be particularly adverse.[2] If this risk premium is of questionable credibility and generates unexpected cost transfers, then it may instil a certain degree of pessimism in potential investors. In this case, higher returns would be necessary to cover the risk associated with an unfavourable industry environment and unpredictable regulatory framework (DCC 2008). This would seem to make overseas investments more attractive and instigate a kind of *ad hoc* carbon leakage. If supported by legitimate government legislation and a transparent, predictable emissions trading regime, however, this risk premium can actually drive investor choice and force subjective investment decisions to take into account the risks associated with carbon-intensive industries (Mazouz and Knapp 2008). Essentially, a carbon price acts as an appropriate price signal only when backed by informed government impetus.

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[1] It should be noted that Eskeland and Harrison (1997) found no evidence of this kind of investment mobility as a result of environmental costs. Indeed, they found that domestic abatement costs had no discernible effect on foreign investment and that foreign facilities tended to be more efficient than their domestic counterparts. The former was, however, based on an overly simplistic model and the latter on empirical evidence.

[2] Exchange rate volatility compounds cost burden displacement (Reinaud 2008a). Steel investment will likely suffer from the recently reduced value of Australia's dollar, as costs are domestically shouldered. At the same time, though, iron ore is priced and traded in US$, and the direct costs to the iron ore industry will likely come in the form of higher Australian electricity prices. With the Australian dollar rapidly losing value compared to the US dollar, CPRS costs for iron ore are already significantly discounted when compared to trade value. However, the steel industry is reciprocally vulnerable to these price shocks, and as such causality between carbon prices and investment changes can be increasingly difficult to discern.

As can be expected, risk premiums act as deterrents as they grow larger—the Business Council of Australia noted very significant impacts at carbon prices of A$50-100/tonne CO_2-e (BCA 2008). It is unlikely that the Australian permit price will grow large enough to deter investment in the absence of an equally high global carbon price. In fact, Garnaut has mentioned repeatedly that there are more concerns about the carbon price being too low than too high (2008b, p. 350). If that were not sufficiently convincing, most of the harsh criticism Garnaut's own reports have received since the release of his 'Targets and Trajectories' discussion paper have suggested that a 10% reduction by 2020—perceived to be too weak—eliminates the scarcity value and risks the same value crash that the European Union saw when it overestimated actual emissions during the trial phase of its ETS and a surplus of permits flooded the market (Ellerman and Buchner 2007). In addition, increased uncertainty surrounding post-Kyoto commitments will likely cause domestic permits to lose a great deal of value, thus exacerbating the potential for a value crash. The risk of low carbon prices is quite high, and this point is markedly absent in the BCA analysis.

Garnaut (2008b) recommends that if comprehensive agreement cannot be achieved, a 5% reduction in emissions before 2020 is the most prudent alternative. The fact that his reduction recommendations increase within the context of similar carbon price signals abroad means that he is acutely aware of the aforementioned risk. More aggressive conditional trajectories could potentially drive carbon prices quite high, but these prices only become a factor when sufficient international agreement has been achieved, after which point leakage becomes a non-factor. This trend notwithstanding, Saddler, Diesendorf and Denniss (2007, p. 1245) have noted that "existing technologies with small improvements" can reduce Australia's 2001 stationary energy emissions by 50% before 2040, a far cry from articles that suggest "emissions control may cost billions…47 times the entire Australian economy's annual worth…by 2050" (Orchison 2008, p. 1).

Where investment has already taken place and pre-existing facilities are forced to incorporate a carbon price signal into the cost of doing business, the CPRS risks 'carbon leakage' when industries choose to relocate and increase their emissions elsewhere. Despite the seeming simplicity of such a transition, there are significant "sunk fixed costs" associated with pre-existing businesses which act as a deterrent for plant mobility (Mazouz and Knapp 2008, p. 13). Iron ore reserves cannot leave the country, and steel mills are, after all, not tents. It is true that at very high carbon prices, steel mills may be at an increasing risk of relocating. It is unlikely, however, that carbon prices will get high enough for this to occur in the absence of international agreement when the global price approaches similar levels (Mazouz and Knapp 2008). When the global price is similarly high, leakage is no longer a possibility.

Though not technically ‘carbon leakage’, the impact of a carbon price signal on the competitiveness of Western Australian iron ore reserves could be dire. If Chinese low-grade reserves regain competitive advantage and the Chinese fail to take on binding emissions limits in Copenhagen, then the resulting shift to alternative sources of ore can be said to increase emissions, thus instigating a kind of leakage that could be very damaging to the WA economy. The Chinese government’s decision to consolidate its steel industry in response to a rumoured merger between Rio Tinto and BHP Billiton clearly indicates their desire to increase bargaining power and influence ore prices, the development of which could potentially threaten the competitive edge of Australian ore reserves. In the absence of international agreement, the production cost increases imposed on iron ore mines must be applied sensitively, and this justifies serious consideration for industry assistance under the CPRS. As will be seen in the Section 3.21, however, the acceptable threshold of this assistance is highly contentious.

Reinaud (2008a) shows that ETS-driven production cost increases in the European aluminium industry have not necessarily led to carbon leakage. Investment has transitioned overseas, but this most likely stems from a confluence of other market factors (e.g. high energy prices, labour costs, or tariffs), and despite the difficulty in determining causality (via the separation of the counterfactual influences which would have changed the trade environment anyway), little impact seems attributable to the ETS. It is important, therefore, to acknowledge external factors and trade dynamics which may affect the cost of Australian raw commodities independent of ETS operation.

3.2 Economic pain: the industry critique

Specifically powerful players, including the Business Council of Australia (BCA), which can be said to represent the interests of the largest corporate interests in the Australian economy, have noted that acting unilaterally can do very significant damage to Australia’s status in the global market. News outlets have specifically highlighted “petrol price rises, higher electricity costs, and the threat to jobs” (Shanahan 2008, p. 22). Because businesses will be forced to, for the first time, include the price of carbon in the cost of doing business, many voices have called for comprehensive industry assistance. This stems partly from the acknowledgement that such a policy tool creates an inordinately punitive environment for a particular set of industries—on which Australia’s comparative advantage is said to depend—and also from the view that the government has a responsibility to protect against carbon leakage if it is serious about combating climate change.

3.21 Emissions-intensive, trade-exposed (EITE) industry assistance

By far the most vehement critique of the CPRS proposal has been focused on the specifics of its preferred EITE assistance scheme, whereby 30% of each year's issued permits (initially) would be issued free of cost and outside the normal auction process to business entities that emit more than 2,000 tonnes CO_2-e per A$ million of revenue (90% of required permits for free) and between 1,500 and 2,000 tonnes CO_2-e per A$ million of revenue (60% of required permits for free). Critics have been many and varied, and their qualms have focused on a few major problems that could spell trouble for both the Australian economy and the CPRS itself.

First, the reported threshold for assistance hinges primarily on emissions-intensity. There appears to be no incorporated measure of the trade-exposure of a facility, and thus abatement incentives are either misplaced or poorly directed. By offering more financial assistance to businesses that emit more carbon dioxide, the CPRS not only punishes low emitters, it offers a perverse incentive to emit more in order to qualify for assistance (BCA 2008; Garnaut 2008b; Mazouz and Knapp 2008). The BCA has noted that "businesses whose emissions are just below each threshold may find it economically rational to increase emissions to qualify for compensation" (2008, p. 90). The absence of dynamics which account, instead, for the difference between the cost burden of the CPRS alone and the cost burden under comprehensive international agreement—which seems to be the reason for the debate—removes the technological abatement incentive which is expected to drive a low-carbon economy. It thus does little to encourage good behaviour. The BCA (2008) recommendation of value add per carbon emissions, though seemingly aimed at the businesses who provide more value to the Australian economy, seems poised to do little more than insulate the profits of the nation's largest companies. Ross Garnaut's (2008b) recommended threshold, based on the difference in imposed cost between set prices and the expected future price of carbon, relies not only on the complex modelling of future carbon prices but also on very uncertain assessments of the degree to which countries like China will take on absolute emissions *reductions*, rather than emissions *growth* limitations. In either case it appears that the CPRS recommended threshold of emissions intensity is proposed because it can be administered both cheaply and quickly.

Second, it is uncertain to what actual value EITE assistance will amount in subsequent operating years of the CPRS (BCA 2008). A percentage compensation threshold can change in an unconstrained market where the price of carbon fluctuates wildly. Since Garnaut (2008b) has recommended three different trajectories for Australia, then the trajectory of EITE assistance could follow similarly variable paths. Thus there is no method for investors to accurately quantify the assistance they can expect to receive in long-term financial forecasts. This creates an atmosphere of uncertainty and reduces the attractiveness of Australian investments. Labor's CPRS proposal assumed a A$20 per tonne carbon price throughout, and both the BCA (2008) and Garnaut (2008b) have recommended constraining the price at A$20 per tonne CO_2-e. It is unclear whether this would provide the certainty for which the BCA has called.

Third, where mitigation is expected to impose significant costs on the economy as a whole, it appears that the insulation of Australia's top 1,000 emitters will transfer the bulk of the burden to the rest of the economy. If companies with the highest emissions-intensities can avoid altogether the cost of 90% of their carbon emissions, this means all other participating industries will be forced to internalise the costs associated with their emissions reductions, as "shielding redistributes costs from shielded to unshielded sectors" (Treasury of Australia 2008, p. 15). The intended minimising of costs on the Australian public should be compared against the likely subsuming of emissions costs by the rest of the Australian economy. It is the largest EITE industries that appear most capable of dispersing cost burdens over large consumer bases, whereas other participating industries are much less able to do so. The benefit of buffering transaction costs for iron ore producers would seem to insulate Australian steel imports from incurring too heavy a carbon price burden, as steel occupies more than 2% of the total import market in Australia (ABS 2008), but this justification ignores the fact that the cost of iron ore is a mere 5% of the cost of steel manufacture (Tcha and Wright 1999). Since 2005, the price of iron ore has increased by 123%, and since 2004 Chinese demand for iron ore has doubled (DoIR 2007c). The recent tendency toward supply contracts between China and iron ore producers[3] suggests that the Chinese are more concerned with securing a long-term supply than with short-term capitalisation of Australia's currently favourable terms of trade. In any case, this problem seems to support arguments for less, not more EITE assistance.

Fourth, the amount of assistance proposed is not negligible. At A$20 per tonne of CO_2-e, EITE assistance would likely accrue to around A$3 billion per annum (Mazouz and Knapp 2008). In an unconstrained market (of which the BCA (2008) is most wary), this figure could exceed A$6 billion. This is A$3-6 billion of foregone government revenue not only in a time where consumer spending is responding negatively to the global financial crisis (thereby reducing tax revenue), but also in a time where state and local governments are at very significant risk of suffering disproportionately under the CPRS (see Richardson 2008; also Richardson and Denniss 2008). All revenue is proposed to be directed to households, and fuel excises will be cut incrementally, but as such A$3-6 billion of assistance would be available neither for households nor for state and local governments. EITE assistance is not the first of its kind. De Moor (2001) estimates that the world's energy sector receives public subsidies to the tune of US$240 billion (US$151 billion to fossil fuels)

[3] In 2006, Baosteel, China's then largest steel producer, entered into such a contract with Western Australia that saw the price of iron ore increase by 9.5% from April of 2007 until April of 2008.

per year. Riedy and Diesendorf (2003) have more recently estimated the Australian figure to be approximately A$6.54 billion per annum for fossil fuels. Despite the fact that there is no way for this thesis to determine the exact subsidies on which iron and steel depend, it is important nonetheless to consider the extent to which the industry's competitive edge has thus far been artificially supported by government assistance. If competitiveness concerns stem from the fear of distorted competition, do they also acknowledge the distorting effect of these subsidies?

Fifth, compensation instigates what I propose to be *permit leakage*. If coal-fired electricity generators (assumed to be among the first to qualify for EITE assistance) receive 90% of their carbon permits free of charge, then there will be an incentive for industry sectors with variable scope 1/scope 2 emissions profiles to increase the degree to which they rely on off-site electricity (scope 2 emissions) for operational energy needs. The steel industry has already experienced a tendency toward electricity-based machinery, and recent media coverage should serve to remind policy makers that iron ore mines are fully capable of transmitting the cost burden of emissions reduction to the sectors which receive the most government assistance (see Ferret.com 2008; Mineralszone.net 2008). Thus the EITE assistance threshold provides for permit leakages onto sectors where the level of assistance can encourage businesses to capitalise on lower transaction costs. In this case it comes as a welcome reminder that the Labor Government had the wisdom to include the assistance cap at all, which prevents runaway permit leakage, but there is little reason to expect that businesses will not exploit this assistance wherever possible. It is unclear, then, the degree to which increased production volumes could potentially offset the benefits EITE assistance purportedly delivers to the most emissions-intensive industries—it should be noted that this is the same logic involved when production volume increases offset efficiency gains in countries like China. It is also unclear the degree to which the already established competitiveness of Australian industry relies upon abnormally low electricity prices (Garnaut 2008b, p. 470).

Sixth, an EITE assistance threshold that clearly benefits larger emitters seems to rely on the assumption that larger emitters are more likely to trigger carbon leakage, but Mazouz and Knapp (2008) have found that such a standard actually encourages carbon leakage by smaller emitters, given that the CO_2 cost burden is thus shifted to those companies ineligible for compensation. In addition, Saddler, Diesendorf and Denniss (2007) note explicitly that the industries responsible for the bulk of Australia's carbon emissions should be held responsible for the bulk of a reduction burden.

Lastly, the entire idea of EITE assistance is predicated on the absence of international agreement, and without participation by countries like China, the aforementioned shortcomings are likely to be exacerbated to the tune of not only questionable CPRS effectiveness but also critically sensitive cost-efficiency. Different trajectories have, however, been recommended, depending on the willingness of Australia's trade partners and competitors to play by the same rules (i.e. price carbon). Costs likely to be borne by industry are therefore easily exacerbated when such a dynamic is conveniently ignored. CPRS concessions seem to have already formulated contingency plans that soften, to the greatest extent practical, the transaction costs without an adequate post-Kyoto successor.

3.22 Financial implications

Where economic efficiency arguments have been provided, they are often quantified in terms of the amount of profit, GDP, employment, etc. that Australia is expected to sacrifice under emissions control. Aside from the fact that these arguments largely ignore the increasingly dramatic and irreversible costs of climate change, it appears that these costs have been overstated. Even employment changes cannot be assumed to relate directly to the price of CO_2, since dynamic international industries experience the same from technological changes and variable consumer demand (Gale 2005). Though Graichen et al. (2008) found that iron and steel in Europe had a high risk of competitiveness distortion as a result of carbon pricing, they acknowledged that many different factors influence production and investment decisions. These factors present a complex counterfactual scenario which makes policy crafting difficult.

In early 2008, the Business Council of Australia provided, for the first time, the quantification of expected costs for trade-exposed, emissions-intensive industries. It is to be expected that the organisation that can be said to most directly represent the interests of industry would overstate the costs. The perceived impact of these costs does rely heavily on the social benefits that a successful business is purported to provide, but policy makers are expectedly wary of policy mechanisms that have obviously negative consequences.

As has been noted by Mazouz and Knapp (2008), the BCA study relied on a set of questionable assumptions. First, the 14 companies offered as a representative snapshot of Australian EITEs were never specifically referenced, nor were the reasons behind their selection. As well, the BCA assumes zero carbon price pass-through, which this analysis has shown to be improbable. There seems a certain degree of give in the Chinese steel market. The BCA assumes no EITE abatement opportunities beyond those that are currently viable, thus ignoring the progressive competitiveness of currently unviable technologies. This also fails to acknowledge that the high-emissions-intensity of Australian energy (Garnaut 2008b), which translates into the highest per capita carbon footprint in the world, presents a widely-acknowledged potential for energy efficiency improvements (Saddler, Diesendorf, and Denniss 2007). Finally, the Mazouz and Knapp (2008) analysis suggests that the BCA assumes 100% of reduced production to translate de facto into carbon leakage, which is improbable given the iron and steel complexities mentioned in Section 3.14. Reinaud (2008b, p. 4) also acknowledges that 100% leakage is “highly unlikely”.

As a side note, international steel prices are set largely via bilateral trade agreements and do not rely on a centralised international market (Reinaud 2008b). Therefore, the internalised cost of CO_2 will more immediately affect the profitability, rather than the marketability, of Australian steel. This means that steel producers negotiate their own prices and are to some degree insulated from trade exposure, but it also means that the costs of carbon will be more acutely felt by those in management positions. This may have something to do with the disastrous profit margin reductions the BCA (2008) seems to repeatedly highlight in its analysis.

3.3 Context of the critiques

Most of the inherent problems of an ETS risk compounding each other if Copenhagen fails to produce an agreement. Were Australia to proceed into aggressive climate change mitigation territory alone, they would rapidly be forced to re-think the benefits of doing so. The critics of Labor’s CPRS are right to worry that an ETS may disproportionately affect Australia, and inconsistencies that risk doing more harm than good may better be implemented if the Government waits until compromise and international agreement can provide a suitable environment for action. See Table 4 below for a simplified version of the information presented thus far:

Table 4

Column 1	***Column 2***	***Column 3***	***Column 4***
Problem	**Will it cost Australia?**	**Will it cost the planet?**	**Is it worse without China?**
Carbon leakage	yes	yes	yes
Reduced market share	yes	no	yes
Incomplete coverage	no	yes	yes
EITE assistance	yes	potentially	yes

Unilateral action with an improperly designed and contextualised ETS is at the moment very risky economically (column 2) and very risky environmentally (column 3). Column 2 justifies weaker emissions reductions and longer timelines, but it seems that costs have been in many cases overstated or unsubstantiated. Column 3 justifies aggressive emissions reductions and rapid timelines, but it seems that in the iron and steel industry emissions capture has been exceedingly difficult and that the included emissions are less than 1.25% (Iron & Steel) of 1.5% (Australia) of global emissions—an estimated 0.019% of the world total for this case study.

If Australia corrects column 2 out of concern for industry vulnerability, column 3 will suffer in that delayed responses increase the risk of catastrophic climate change. This result subsequently changes all answers in column 3 into a resounding yes, since delay is likely a very poor foreign policy decision that will set column 4 in stone.

If Australia corrects column 3 by fixing emissions coverage failures, column 2 will suffer because costs are likely to be exacerbated on several fronts. Simultaneously, aggressive emissions reductions can be seen as a very poor policy decision that will reduce domestic buy-in and delay action, thereby setting column 4 in stone.

If column 4 remains unchanged, no post-Kyoto climate agreement can hope to control enough of the world's emissions to avoid catastrophic environmental consequences. Previous discussion reminds the reader that the costs of an ETS to the Australian economy are generally less significant than critics propose. Given the problems associated with feasible emissions capture, though, it appears that the profundity of the scheme is significantly less than what would be ecologically effective. Indeed, Australia's per capita emissions are already among the highest in the world. Over time, climate research has suggested that the risks of climate change have been consistently underestimated (Weitzman 2007). This all serves to remind Australia that the Labor Government's CPRS is not nearly as invasive as everyone expects, and indeed may not be invasive enough.

Emissions coverage (column 2) is critical in dealing with climate risk, but "there is an inherent tension between full coverage on the one hand, and administrative feasibility on the other" (Reinaud 2008a). In the end, despite the green critique, there is no way to ignore the fact that Australia only produces 1.5% of the world's carbon emissions. Though this would seem to diminish the short-term effectiveness of Australian emissions reductions, it in no way diminishes the long-term effectiveness of global emissions reductions. Indeed, the green critique seems largely misplaced, and efforts to increase buy-in should not be frowned upon, even by a demographic that has been largely silenced for the past 12 years (see Pearse 2007).

Because the aims of columns 2 and 3 are assumed to be diametric, and because the setting in stone of column 4 is likely to trigger a political and environmental chain reaction, column 4 (i.e. international buy-in) should be the primary justification for a decision. If Australia corrects column 4, both column 2 and column 3 will be alleviated and potentially corrected, since international agreement will likely remove the trade-exposure of Australian industry and also increase our ability to effectively mitigate against climate destabilisation.

In order to maximise international buy-in, Australia would be well advised to pursue its ETS in full and as early as possible. This will, in turn, put the country in a position to negotiate for the inclusion of developing countries in post-Kyoto discussions (Quiggin 2007). For this goal to be realised, it is important for domestic buy-in to be maximised. The most appropriate compromise will send a real signal to China (borne with cost) but will avoid alienating sensitive industry interests by minimising unnecessary costs. In this case, it should come as no surprise that there is an inherently political dynamic behind the future of the Australian ETS. What clearly is a politically-charged compromise is aimed at increasing buy-in from business leaders while still accomplishing the goals of environmentalists. Political pressure is likely to manifest in both the domestic and foreign policy arenas, and the potential on each front for Australian policy makers must be appreciated in detail.

Chapter 4: The road to international agreement

Many critics are likely to point to the inability of Australia to influence non-Annex I countries on its own, and though there is reason to believe negotiations in Copenhagen will include cut-throat compromises, recent developments in the international arena spell a potent opportunity for Australian policy makers. Garnaut has repeatedly emphasised the role of developed country leadership in climate negotiations, and for several reasons Australia would be well advised to acknowledge if not the impact of its emissions then surely the weight of its actions, if for no other reason than to actualise the powerful symbolism that early behaviour can provide.

4.1 Foreign policy

As we have seen, international participation in the Kyoto process has been complex and unpredictable. The information I have gathered, when taken as a whole, suggests that full participation in Copenhagen by Russia and Brazil can be reasonably expected. It is therefore assumed that in the presence of similar carbon constraints, iron ore reserves from these producers will not regain competitive advantage over Australia. As has been noted, however, these advantages change over time, and Australia can most effectively protect its edge in trade-exposed industries by ensuring its emissions-intensity is lower than that of its competitors, an outcome facilitated by a domestic carbon price (Treasury of Australia 2008).

Participation by India and China in a post-Kyoto agreement is uncertain, but their investment trends hint at their increasing awareness of the climate change dilemma. Despite the fact that the developed world has shown little leadership, it cannot be expected that China will hold out forever, for even they see mitigation as being in their best interest.

The centralised, authoritative Chinese government, which is committed to being perceived as a responsible power, is also falling under increased pressure to participate fully in the international climate regime (multiple sources cited in Heggelund 2007). Pressure exerted by Annex I nations will likely trigger defensive responses, but gestures of diplomacy could be made more effective by mounting public concern.

Najam, Huq and Sokona (2003) suggest that the recent focus on developing country concerns could serve to empower non-Annex I countries in climate negotiations, potentially allowing them to lead the world into a post-Kyoto framework. Despite the fact that this is unlikely to produce dramatic emissions reductions, there is potential for reviewing particularly punitive emissions accounting standards. More flexible permutations of the per capita measurement standard are recommended by Zhou (2006), and new standards could serve to provide a more promising post-Kyoto framework for China, thereby potentially warming them to the possibility of a compromise at the same time that emissions reductions become plausible.

There has been a notable explosion of Clean Development Mechanism projects in China (Heggelund 2007; Wara 2007; Zhang and Zheng 2007). China's heavy coal use and aggressive push for renewable technologies make them more capable of dramatic efficiency improvements, and CDM projects provide a substantial revenue stream generated by developed nations struggling to meet their Kyoto targets. If Australia can use these flexibility mechanisms to encourage progressive Chinese investment, they can help buffer the transitional costs associated with Chinese carbon constraints, thereby enabling cooperation.

Aggressive bilateral negotiations could serve to coax Chinese officials into the debate. Russia saw an opportunity for leverage and used Kyoto ratification as a bargaining chip for World Trade Organisation membership (Buchner and Dall'Olio 2005; Henry and Sundstrom 2007; Korppoo, Karas, and Grubb 2006; Korppoo and Moe 2007). China will undoubtedly take advantage of desperation across the globe by demanding economic compromises. Australia is well-positioned to enter into a bilateral iron ore agreement, one which will serve to protect pre-existing trade relationships for both parties, secure long-term ore import commitments from Australia, and buffer Chinese steel mills from the immediate burdens of binding emissions limits. Price contracts like those mentioned in Section 3.21 and 3.22 could stabilise the price of ore over a period of time while the Chinese economy begins to develop an emissions trading scheme, at which point the price control would be phased out in favour of ETS linkage.

The onus should fall on the Australian government to pave an acceptable path for China's entry into the Copenhagen process, which will de facto protect our international competitiveness via a secure iron-steel trading relationship. Leadership is a chip Australia must play while it still has time. Commitment can be said to be the most potent gesture in terms of bringing the Chinese into good favour.

The Chinese government's decision to consolidate its steel industry in response to a rumoured merger between Rio Tinto and BHP Billiton clearly indicates their desire to increase bargaining power and influence over prices, the development of which could potentially threaten the competitive edge of Australian ore reserves. What is clear, though, is that Chinese officials are keenly aware of industry developments in Australia, another reason to capitalise on the short time it has left to establish credibility. There is little reason to expect China, whose delegates are notably shrewd, to be willing to compromise if the country with the largest carbon footprint in the world decides climate change is not critical enough to shave off a few points from record profit margins.

On the same note, iron ore reserves/reserve bases are inevitably finite (Garnaut 2008b). Current production is insufficient with respect to demand (see Section 2.1), so there is reason to suspect that in an ‘ideal’ situation, and I use the term loosely, mining companies would gladly increase output levels. If current levels were trebled, currently economic iron ore reserves would be exhausted in less than 30 years, while all known reserves on the planet would last only twice as long (Garnaut 2008b). If, knowing this, Australia uses iron ore trade exposure as a trump card for climate change policy, such a decision incorporates little of the wisdom and leadership Chinese leaders have so repeatedly been expecting and Western leaders have so repeatedly been lacking.

There is a clear dichotomy between China’s desire to capitalise on economic development while possible, and their acknowledgement that unimpeded emissions growth will stifle that development in the long run. Therefore, Chinese officials cannot play the “survival emissions” trump card forever, as even the term is a misnomer. The key to post-Kyoto negotiations will be clear participation and commitment by the entire developing world, as well as substantial development assistance, favourable terms of trade, and wealth redistribution (Parks and Roberts 2006a). Only by ensuring economic progress for the people of China can developed country officials hope to protect the prosperity of their own. Because of this, and due to the explicit demand of China for leadership by Annex I nations, Australia has no choice but to enter into an ETS as soon as possible and not wait for uncertainties to be addressed.

What is clear is that a gesture toward China will very definitely come at a cost, otherwise such a gesture would be meaningless. As Garnaut (2008b) has proposed, Australia should abandon the notion that appropriate policy responses come at no such cost. The Business Council of Australia consistently focuses on reduced profit margins as a source of concern, but as has already been noted, Western Australian iron ore has experienced record profit margins for quite some time. This is clearly not an industry on the brink of collapse. If, as a matter of good foreign policy and to increase buy-in by developing nations, Australia is expected to sacrifice a small proportion of its unprecedented profits, then there seems no more appropriate time to do so. There is an atmosphere of mistrust among the G-77 nations, which includes China, and it has been noted that overcoming this mistrust should be a high priority (Parks and Roberts 2006b). An ETS-driven message of good-will and sacrifice will speak volumes and carry with it significantly “positive international impact” (Diesendorf 2007, p. 3).

4.2 Domestic policy

Because this debate has evolved into the counterbalance of two competing alternatives (i.e. environmental effectiveness vs. economic prudence), it has attracted the ideologies associated with each frame of reference. As this report has shown, such a dichotomy is patently false, and the prudence of an ETS hinges instead upon a gesture of diplomacy.

Buy-in is paramount, and if industries are not brought into the debate because the balance has been shifted toward comprehensive emissions capture and reduction, it can be expected that ideological differences will be enhanced and positions entrenched. If, instead, the short-term importance of buy-in is acknowledged as a determining factor of long-term ecological effectiveness, then an ETS proposal can be crafted so as to favour economic interests. Though likely to elicit a negative response from the green ideologues, it is, ultimately, in their best interest. Climate change is a scientific problem to which environmentalists attach a great deal of weight, but the way a large society must respond to collective problems that ignore boundaries and jurisdictions should not be ignored, and in order to implement the CPRS, Labor has promoted transitional assistance, industry compensation, and variable trajectories.

It should be noted that a similar dichotomy surrounded the crafting of the Kyoto Protocol. Heralded as a monumental accomplishment in international relations, it failed to enter into force until 2005, a full eight years after its signing. What began as a political miracle has since been argued to be an environmental failure even from those who favour its intentions (Cooper 2001; Gardiner 2006). Lack of ecological effectiveness stifled support from the environmental community, and lack of a level economic playing field stifled support from the rest of the world economy. As a result of economic critiques, neither China nor the United States, the two largest emitters in the world, have included themselves in the process, and ecological effectiveness is even more fragile today than it was when compromises were made in 1997. Australia should not make the same mistake. It is my opinion that environmental critiques should never fail to acknowledge the political dimensions of compromise. There is little to be gained if emissions inconsistencies or weak trajectories trump action, and as a matter of prudent domestic policy, the government should remain wholly committed to its proposal.

4.3 Concluding remarks

Since the emissions trading debate has become inherently political, seemingly reasonable economic arguments are willingly ignored when they are framed as ecological critiques, and this has been the predominant trend in recent climate risk studies and other environmental dilemmas. It should be noted that because of this, thorough substantiation of climate catastrophe scenarios has been hastily demanded on every corner of the globe (Essex and McKitrick 2002), and environmentalists are frequently accused of fear-mongering (Porritt 2005). Economic catastrophe scenarios have been easier to publicise, and thorough justification of these claims is much less frequently required. Few business leaders, with their disastrous profit margin reductions, are accused of fear-mongering.

At the same time, environmentalists are understandably eager to begin aggressive mitigation, given the complete inactivity of the previous Australian government on the climate front, and claims for industry assistance are falling upon deaf ears. Their imbued sense of obligation to future generations should not be belittled, but green politics have grown increasingly numb to claims of corporate vulnerability. With that said, active communication with China and other developing nations in the lead-up to the Copenhagen Conference of the Parties seems a very important priority for the current administration. Australia stands to lose much more by failing to join forces with the international community than it does by forcing its industries to shoulder a carbon price.

In any case, it is clear that Australia has experienced a long-time lull in environmentally-oriented policy (Hamilton 2007; Pearse 2007), punctuated occasionally by a situation where its socio-political proclivities are put to the test and environmental concerns swell in the mainstream media (Tranter 1999). Time and time again it has fallen victim to the jobs v. trees stalemate, whereby sensationalised environmental concerns give way to the routine and immediate nature of economic security (Pakulski, Tranter, and Crook 1998). The Australian public is asked to sacrifice one for the sake of the other, often with the favoured demographic feeling vindicated and the other beaten, as if it were a competition between teams. In climate change the country has received its most intimate lesson on the clash of free-market capitalism and deep ecology, and for the first time common ground can be easily sought in an effort to promote mutually beneficial outcomes. What has been shown here, however, is that when tensions arise, misplaced dichotomies prevail and the status quo survives. The Labor party is committed to the Carbon Pollution Reduction Scheme. The Liberal party insists Australia should wait and see what happens next. Emissions trading should capture emissions. Emissions trading should minimise costs. Emissions trading, lest we forget, will likely serve everyone’s best interests.

4.4 Limitations and directions for future research

Emissions trading is a complex process, and the research for this thesis has occasionally highlighted several confounding factors which, though admittedly crucial, could not be addressed. Time and resource constraints restricted the extent to which I could tackle the issue in its entirety, and I hope that this section will serve as a brief guide for further research in the area. It is by no means exhaustive, but it does include some major problems that I discovered during my analysis.

EITE Assistance has been proposed under the CPRS, and critics offer a multitude of reasons why industries should have their transaction costs buffered so as to soften the impact of policy change, but current subsidies already distort international markets. Any claims of reduced international competitiveness must be weighed against the proposed impact of emissions trading. Research should focus on quantifying the distorting subsidies for trade-exposed, emissions-intensive industries so that a clearer version of current competitiveness can be defined.

China has emphasised more immediate environmental threats (i.e. water scarcity, air pollution, soil erosion, flooding, desertification, etc.) over the more ephemeral nature of climate change, despite the indirect effect of climate change over all of these issues. Europe has proceeded with climate change with the hope that other issues will be corrected ad hoc. The United States has perfected a position of limbo. In this case there are clearly leaders, followers, and free-riders. Has proactive leadership actually helped to correct the more acute ecological stresses in Europe, or is it still to early to tell? Has a carbon price actually translated into environmentally friendly behaviour, or is free-riding actually paying off for countries like China?

Funding transmission for developing nations is predicated on the desire to assist the countries which will be most severely impacted by climate change. The same desire manifests itself in the efforts to assist the industries likely to be most severely impacted by carbon constraints. The latter receives much more attention. In light of the obvious impact of industry concerns is the former sufficiently addressed? Are politicians willing to apply the same standard to both situations, or are they attempting to serve their own interests on both fronts?

Technological determinism has deep roots in China and the USA. There is reason to suspect that progress in international negotiations has been delayed out of hope that an end-of-pipe solution will be devised (e.g. clean coal). The same can be said of industries in Australia. Is this an instance of policy capture by an economically-oriented set of leaders and if so, is the young demographic poised to shed these burdens in favour of a new perception about the nature of governance?

The negative impact of reduced international competitiveness is heavily contingent upon the perceived benefits of said competitiveness (i.e. 'growth is good'). In an area like Port Hedland, where almost all of WA's iron ore is exported and where more wealth is being generated than in any other Australian city, the benefits of corporate strength must be weighed against the detriments. Hamilton (2007) has noted that governments could save money in particular situations by paying the employees of heavily polluting industries salaries to stay home. "The Money Pit" (Carney 2008) suggests that Port Hedland companies may actually cost the community more than it gains from their presence. Is it, then, more desirable to protect industries from the burdens of a carbon price via production-based points of obligation rather than protect the consumers from the burdens of a carbon price via consumption-based points of obligation? Ultimately, is a healthy economy one that grows rapidly or one that maximises net benefits to its citizens?

Chinese companies are investing in new technology, which could potentially reduce the need for high-grade iron ore. It is therefore important to note the degree to which this transition is occurring independent of ETS development. These technologies can be seen as good for the bottom line of a company (i.e. "no regrets" decisions), and any resulting transition toward domestic low-iron reserves should be seen as a logical consequence of modernisation, not the impact of a CO_2 price. The inelasticity of demand with respect to price, therefore, persists only insofar as Chinese technology remains steady-state. It is therefore critical for an Australian ETS to promote further innovation in a system that is clearly being advantaged by antiquated Chinese technology. The most recent Australian Treasury (2008, p. 15) modelling notes that "economies that defer action face higher long-term costs, as emissions-intensive infrastructure is locked in place and global investment is redirected to early movers".

Labson, Gooday, and Manson (1995) identified prices that have thus far promoted the competitive advantage of Australian reserves, but this information should be updated given the recent innovation in the Chinese economy. The price sensitivity may be lower than it was last decade, and China may be moving ever closer to increased dependence on domestic reserves. At the same time, industries cannot switch raw commodity bases overnight. The situation begs attention if Australia is to fully understand its own competitive advantage.

The absence of a CO_2 price in China can be said to promote unchecked steel demand and production. It is thus apparent that while a comprehensive international agreement requires participation by China in order to be environmentally effective, Australian businesses have a vested interest in keeping a carbon price out of Chinese markets. There suddenly arises a diametric trade-off between ecological effectiveness and economic efficiency with respect to Chinese participation, as a very clear conflict of interest is drawing Australian policy makers in opposite directions.

It has been suggested that metal over-production in China, driven by a focus on economic growth as the highest priority of the Chinese government, could serve to destabilise international markets via a flood of exports, which will likely cause prices to crash (Reinaud 2008a). China has an interest in suppressing information about domestic surplus, and further research should explore the potential for such a situation.

Finally, If the financial crisis manifests itself profoundly in the daily lives of Australians, as it already has to a certain extent, politicians will find it more difficult to implement an emissions trading scheme that further burdens the Australian consumer. Politicians are already using this perspective as leverage over opposition viewpoints. If they succeed in using this weak point as a political tool, climate change will be accepted as another political ploy which deserves little action. This has already been the case through much of John Howard's administration (Pearse 2007), and further analysis is needed if this is to be brought to the attention of the Australian public.

These factors, though admittedly crucial to a thorough understanding of industry dynamics under a carbon trading scenario, do not detract from the confidence of my conclusion. Absolute certainty is unnecessary, and in my opinion, none of these concerns justifies a 'wait and see' attitude.

References

ABC Online. 2008. *Kyoto Protocol gets boost as China signs*. Australian Broadcasting Company 2002 [cited 23 October 2008]. Available from http://www.abc.net.au/news/newsitems/200209/s666326.htm.

ACF Online. 2008. *Save Our Reef - Act Now On Climate Change*. Australian Conservation Foundation 2008 [cited 23 October 2008]. Available from http://www.acfonline.org.au/articles/news.asp?news_id=1927.

Agarwal, A., and S. Narain. 1991. *Global Warming in an Unequal World*. New Delhi: Centre for Science and Environment.

Arrhenius, S. 1896. On the Influence of Carbonic Acid in the Air Upon the Temperature of the Ground. *Dublin Philosophical Magazine and Journal of Science (fifth series)* 41:237-275.

Australia House of Representatives. 2002. 'Questions without notice: Environment-Kyoto'. *Hansard*, 5 June, p. 3163.

Australian Broadcasting Company. 2008. Episode 11: Money and Trees - the green stuff.Australia: ABC TV. 31 July,

Australian Bureau of Agricultural and Resource Economics. 2008. *Australian Minerals Statistics Tables*. Australian Government 2008 [cited 21 August 2008]. Available from http://www.abare.gov.au/publications_html/news/news/news.html.

———. 2008. Major development projects - April 2008 listing. Minerals and energy, edited by K. Penney and A. Copeland. Canberra.

Australian Bureau of Statistics. 2008. 1350.0 - Australian Economic Indicators. Australian Bureau of Statistics, Canberra.

———. 2008. 5368.0 - International Trade in Goods and Services. Australian Bureau of Statistics, Canberra.

———. 2008. *Profile of Major Minerals, Oil and Gas*, 7 February 2008 2008 [cited 21 August 2008]. Available from http://www.abs.gov.au/Ausstats/abs@.nsf/bb8db737e2af84b8ca2571780015701e/51D19819B535DC18CA2573D20010E528?opendocument.

Bettelli, P., C. Carpenter, P. Doran, and S. Wise. 1997. Report of the Meetings of the FCCC Subsidiary Bodies: 20-31 October 1997. Earth Negotiations Bulletin, edited by P. Chasek and L. J. Goree VI. International Institute for Sustainable Development.

BHP Billiton. 2008. *Submission on the Garnaut Climate Change Review Interim Report* 2008 [cited 20 September 2008]. Available from http://www.garnautreview.org.au/CA25734E0016A131/pages/submissions.

BlueScope Steel. 2006. "Submission on the National Emissions Trading Scheme". (ABN 16 000 011 058). December. Available from: <http://www.emissionstrading.net.au/__data/assets/pdf_file/0014/5054/Bluescope_Steel.pdf>.

———. 2008. *Submissions to Garnaut Climate Change Review* 2007 [cited 20 September 2008]. Available from http://www.garnautreview.org.au/CA25734E0016A131/pages/submissions.

Bode, J.W., J. De Beer, K. Blok, and J. Ellis. 2001. "An Initial View on Methodologies for Emission Baselines: Iron and Steel Case Study". (IEA(2001)5). Available from: <http://www.iea.org/textbase/papers/2001/cdmtran.pdf>.

Buchner, B., and C. Carraro. 2003. "China and the Evolution of the Present Climate Regime". (CLIM 103.2003). November. Available from: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=478841>.

Buchner, B., and S. Dall'Olio. 2005. Russia and the Kyoto Protocol: The Long Road to Ratification. *Transition Studies Review* 12 (2):349-382.

Business Council of Australia. 2008. Modelling Success: Designing an ETS that Works. Melbourne.

Butler, R.A., and W.F. Laurance. 2008. New strategies for conserving tropical forests. *Trends in Ecology and Evolution* 23 (9):469-472.
Carmody, G. 2008. *User pays key to climate*. The Australian: Opinion, 29 August 2008 2008 [cited 16 September 2008]. Available from http://www.theaustralian.news.com.au/story/0,25197,24257615-7583,00.html.
Carney, M. 2008. The Money Pit: Australian Broadcasting Company. 18 August, 44:41.
Cazorla, M., and M. Toman. 2000. International Equity and Climate Change Policy. Climate Issue Brief No. 27. Resources for the Future, Washington, D.C.
Chameides, W., and M. Oppenheimer. 2008. Carbon Trading Over Taxes. *Science Magazine*, 23 March, 1670.
Chandler, W., R. Schaeffer, D. Zhou, P.R. Shukla, F. Tudela, O. Davidson, and S. Alpan-Atamer. 2002. Climate change mitigation in developing countries: Brazil, China, India, Mexico, South Africa, and Turkey. Pew Center on Global Climate Change.
Chomitz, K.M. 1998. Baselines for Greenhouse Gas Reductions: Problems, Precedents, Solutions. Carbon Offset Unit, World Bank.
Cooper, D. E. 1998. The Kyoto Protocol and China: Global Warming's Sleeping Giant. *The Georgetown International Law Review* 11:401-438.
Cooper, R.N. 2001. "The Kyoto Protocol: A Flawed Concept". (FEEM Working Paper No. 52.2001). Available from: <http://ssrn.com/abstract=278536>.
Costanza, R., and M. Ruth. 1998. Using Dynamic Modeling to Scope Environmental Problems and Build Concensus. *Environmental Management* 22 (2):183-195.
Cunningham, S. 2005. Match Seller or Sparkplug? The Human Sciences and Business. *B-HERT (Business-Higher Education Round Table) News* 22:8-10.
De Moor, A. 2001. Towards a grand deal on subsidies and climate change. *Natural Resources Forum* 25 (2):167-176.
Department of Climate Change. 2006a. "National Greenhouse Gas Inventory: Accounting for the Kyoto Target". June 2008. Available from: <http://www.climatechange.gov.au/inventory/2006/pubs/inventory2006.pdf>.
———. 2006b. "National Inventory by Economic Sector". June 2008. Available from: <http://www.climatechange.gov.au/inventory/2006/pubs/inventory2006-economic.pdf>.
———. 2008. Carbon Pollution Reduction Scheme Green Paper: Commonwealth of Australia.
Department of Foreign Affairs and Trade. 2007. Australia's Trade With East Asia. edited by M. I. a. A. Section. Australian Government, Canberra.
———. 2008. Trade Topics: Quarterly Statistics. Australian Government, Barton, ACT.
Department of Industry and Resources. 2007a. Annual Report 2006/07. edited by J. Limerick. Government of Western Australia, Perth.
———. 2007b. Western Australian Mineral and Petroleum Statistics Digest. State of Western Australia, Perth.
———. 2007c. Western Australian Mineral and Petroleum Statistics Digest 2006-07. State of Western Australia, Perth.
Diesendorf, M. 2008. *Greenhouse Solutions with Sustainable Energy*. Institute of Environmental Studies: University of New South Wales, 1 December 2007 [cited 21 September 2008]. Available from http://www.garnautreview.org.au/CA25734E0016A131/pages/submissions.
EAAU. 1995. Iron and Steel in China and Australia. edited by E. A. A. Unit. Department of Foreign Affairs and Trade, Canberra.
Ellerman, A.D., and B. Buchner. 2007. The European Union Emissions Trading Scheme: Origins, Allocation, and Early Results. *Review of Environmental Economics and Policy* 1 (1):66-87.
Environment Australia. 1999. Emission Estimation Technique Manual for Iron and Steel Production. National Pollutant Inventory.
Environmental Protection Authority. 2008. *State of the Environment Report*. Western Australian Government 2007 [cited 4 November 2008]. Available from http://www.soe.wa.gov.au/report/atmosphere/greenhouse-gas-emissions.html.

Eskeland, G.S., and A.E. Harrison. 1997. Moving to Greener Pastures? Multinationals and the Pollution Haven Hypothesis.
Essex, C., and R. McKitrick. 2002. *Taken by Storm: The troubled science, policy and politics of global warming*. Toronto: Key Porter Books.
ETS threatens WA's economic boom: Opposition 2008. ABC News, 18 July 2008 [cited 16 September 2008]. Available from http://www.abc.net.au/news/stories/2008/07/18/2307711.htm.
Fearnside, P.M. 2005. Deforestation in Brazilian Amazonia: History, Rates, and Consequences. *Conservation Biology* 19 (3):680-688.
Ferret.com. 2008. *ABB Australia win $60 million order for power projects in Western Australia*, 7 October 2008 [cited 21 October 2008]. Available from http://www.ferret.com.au/c/ABB-Australia/ABB-Australia-win-60-million-order-for-power-projects-in-Western-Australia-n816105.
Gale, R. 2005. Old growth logging: does it matter if environmental protection costs jobs? *International Journal of Environment, Workplace and Employment* 1 (2):203-220.
Gardiner, S.M. 2006. The Global Warming Tragedy and the Dangerous Illusion of the Kyoto Protocol. *Ethics & International Affairs* 18 (1):23-39.
Garnaut, R. 2008a. Garnaut Climate Change Review, Draft Report to the Commonwealth, State and Territory Governments of Australia. Commonwealth of Australia, Canberra.
———. 2008b. Garnaut Climate Change Review, Final Report to the Commonwealth, State and Territory Governments of Australia. Commonwealth of Australia, Canberra.
———. 2008c. Garnaut Climate Change Review, Interim Report to the Commonwealth, State and Territory Governments of Australia. Commonwealth of Australia, Canberra.
———. 2008d. Targets and Trajectories: Supplementary Draft Report to the Commonwealth, State and Territory Governments of Australia. Commonwealth of Australia, Canberra.
Geoscience Australia. 2008. *Australian Atlas of Minerals Resources, Mines, & Processing Centres*. Department of Resources, Energy and Tourism/Minerals Council of Australia 2008 [cited 21 August 2008]. Available from http://www.australianminesatlas.gov.au/aimr/commodity/iron_ore.jsp.
Graichen, V., K. Schumacher, F.C. Matthes, L. Mohr, V. Duscha, J. Schleich, and J. Diekmann. 2008. Impacts of the EU Emissions Trading Scheme on the industrial competitiveness in Germany. Research Report 3707 41 501. Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety, Dessau-Roblau.
Greber, J. 2008. *Australia's Economic Growth Slows to 0.3% on Spending*. Bloomberg, 3 September 2008 [cited 16 September 2008]. Available from http://www.bloomberg.com/apps/news?pid=20601081&refer=Australia&sid=aHYxowDnvuaY.
Hamilton, C. 2007. *Scorcher: The Dirty Politics of Climate Change*: Black Inc.
Heggelund, G. 2007. China's Climate Change Policy: Domestic and International Developments. *Asian Perspective* 31 (2):155-191.
Henry, L.A., and L.M. Sundstrom. 2007. Russia and the Kyoto Protocol. Seeking an Alignment of Interests and Image. Presented for the Annual Meeting of the Canadian Political Science Association during the Congress of the Humanities and Social Sciences, 30 May - 1 June, at Saskatoon, Saskatchewan.
Hidalgo, I., L. Szabo, J.C. Cisar, and A. Soria. 2005. Technological prospects and CO2 emission trading analyses in the iron and steel industry: a global model. *Energy* 30:583-610.
HIsmelt Operations 2008. HIsmelt Corporation Pty. 2006 [cited 16 September 2008]. Available from http://www.hismelt.com.au/EN/HO_PageView.aspx?pageID=44.
Hon, C. Y. 1998. Beijing Warms to Green Campaign. *South China Morning Post*, 14 June.
Information Office of the State Council of the PRC. 1996. White Paper - Environmental Protection in China. <http://www.redfish.com/USEmbassy-China/Sandt/Sandt.htm>.

International Iron and Steel Institute. 2008. *World Steel in Figures* 2007 [cited 2 September 2008].

IPCC (Intergovernmental Panel on Climate Change). 2001. Climate Change 2001: Impacts, Adaptation, and Vulnerability. Working Group II Contribution to the IPCC Third Assessment Report, edited by J. McCarthy, O. F. Canziani, N. A. Leary, D. J. Dokken and K. S. White. Cambridge University Press, Cambridge, UK.

———. 2001b. Good Practice Guidance for LULUCF.

———. 2007a. Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability (Summary for Policymakers). Working Group II Contribution to the IPCC Fourth Assessment Report, edited by M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden and C. E. Hanson. Cambridge University Press, Cambridge, UK.

———. 2007b. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, edited by S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. Averyt, M. Tignor and H. Miller. Cambridge University Press, Cambridge, UK.

Kim, Y., and E. Worrell. 2002. International comparison of CO2 emissions trends in the iron and steel industry. *Energy Policy* 30:827-838.

Korppoo, A., J. Karas, and M. Grubb, eds. 2006. *Russia and the Kyoto Protocol - Opportunities and Challenges*: Chatham House, Brookings Institution.

Korppoo, A., and A. Moe. 2007. "Russian Climate Politics: Light at the End of the Tunnel?" April. Available from: <http://www.hcss.nl/en/download/703/file/Russian%20Climate%20Politics;%20Light%20at%20the%20end%20of%20the%20tunnel.pdf>.

Labson, S. 1997. Changing Patterns of Trade in the World Iron Ore and Steel Market: An Econometric Analysis. *Journal of Policy Modeling* 19 (3):237-251.

Labson, S., P. Gooday, and A. Manson. 1995. China's Emerging Steel Industry and its impact on the World Iron Ore and Steel Market. ABARE Research Report 95.4, Canberra.

Lague, D. 2007. Western Australia reaps huge profits from Chinese boom. *International Herald Tribune*, 4 September.

Landfield, A.H., and V. Karra. 2000. Life cycle assessment of a rock crusher. *Resources, Conservation and Recycling* 28:207-217.

Luterbacher, U., and D.F. Sprinz, eds. 2001. *International Relations and Global Climate Change*. Boston: MIT Press.

Maddison, A. 1997. Measuring Chinese economic growth and levels of performance. OECD, Paris.

Mai, Y., P. Adams, M. Fan, R. Li, and Z. Zheng. 2005. "Modelling the Potential Benefits of an Australia-China Free Trade Agreement". (Working Paper No. G-153). October. Available from: <http://www.dfat.gov.au/GEO/china/fta/modelling_benefits.pdf>.

Mankiw, N.G. 2007. One Answer to Global Warming: A New Tax. *The New York Times*, 16 September.

Mazouz, S., and S. Knapp. 2008. Emissions Intensive Trade Exposed Assistance Policy. Report to the Climate Institute. Melbourne.

McDonald, M. 2005. Fair Weather Friend? Ethics and Australia's Approach to Global Climate Change. *Australian Journal of Politics and History* 51 (2):216-234.

Meinshausen, M. 2006. What does a 2°C target mean for greenhouse gas concentrations? A brief analysis based on multi-gas emission pathways and several climate sensitivity uncertainty estimates'. In *Avoiding Dangerous Climate Change*, edited by H. J. Schellnhuber, C. Cramer, N. Nakicenovic, T. Wigley and G. Yohe. Cambridge: Cambridge University Press.

Mineralszone.net. 2008. *Rio Tinto invests US$500 million for regional power upgrade in the Pilbara* 2008 [cited 21 October 2008]. Available from http://www.mineralszone.com/mineralszone-news-link.html?url=http%3A%2F%2Fwww%2Epolitics%2Eco%2Euk%2Fopinion%2Dformers%2Fpress%2Dreleases%2Fopinion%2Dformer%2Dindex%2Fbusiness%2Dand

%2Dindustry%2Frio%2Dtinto%2Dinvests%2Dus%2D500%2Dmillion%2Dregional%2Dpower%2Dupgrade%2Din%2Dpilbara%2D%241231738%24365213%2Ehtm.
Najam, A., S. Huq, and Y. Sokona. 2003. Climate negotiations beyond Kyoto: developing countries concerns and interests. *Climate Policy* 3:221-231.
Najam, A., and A. Sagar. 1998. Avoiding a COP-out: moving towards systematic decision-making under the climate convention. *Climate Change* 39 (4).
National Emissions Trading Taskforce. 2006. Possible Design for a National Greenhouse Gas Emissions Trading Scheme.
The Parliament of the Commonwealth of Australia. 2007. *National Greenhouse and Energy Reporting Bill: Revised Explanatory Memorandum*.
Nordhaus, W.D. 2006. After Kyoto: Alternative Mechanisms to Control Global Warming. *American Economic Review* 96 (2):31-34.
OneSteel. 2008. *OneSteel Submission to the Garnaut Climate Change Review* 2008 [cited 20 September 2008]. Available from http://www.garnautreview.org.au/CA25734E0016A131/pages/submissions.
Orchison, K. 2008. Emissions control may cost billions before 2050. *The Weekend Australian*, 28-29 June, 1.
Pakulski, J., B. Tranter, and S. Crook. 1998. The Dynamics of Environmental Issues in Australia: Concerns, Clusters and Carriers. *Australian Journal of Political Science* 33 (2):235-252.
Parks, B.C., and J.T. Roberts. 2006a. Is Kyoto Suffering From a Wider Disease? Explaining Participation and Non-Participation in the Kyoto Protocol and Other Major Environmental Treaties. Presented for the International Studies Association, March 2006, at San Diego.
———. 2006b. Globalization, Vulnerability to Climate Change, and Perceived Injustice. *Society and Natural Resources* 19:337-355.
Paustian, K., J. Six, E.T. Elliott, and H.W. Hunt. 2000. Management options for reducing CO2 emissions from agricultural soils. *Biogeochemistry* 48:147-163.
Pearse, G. 2007. *High and Dry*. Camberwell, Victoria: Penguin Group.
Pelley, J. 2008. Carbon cap or tax? *Environmental Science & Technology*:2714.
People's Republic of China. 2004. The PRC Initial National Communication on Climate Change. Beijing.
Porritt, J. 2005. *Capitalism: As if the World Matters*. London: Earthscan.
Price, L., J. Sinton, E. Worrell, D. Phylipsen, H. Xiulan, and L. Ji. 2002. Energy use and carbon dioxide emissions from steel production in China. *Energy* 27:429-446.
Price, L., E. Worrell, and D. Phylipsen. 1999. Energy Use and Carbon Dioxide Emissions in Energy-Intensive Industries in Key Developing Countries. Presented for the 1999 Earth Technologies Forum, 27-29 September, at Washington, DC.
Prime Ministerial Task Group on Emissions Trading. 2007. Report of the Task Group on Emissions Trading. Commonwealth of Australia.
Quiggin, J. 2007. Complexity, Climate Change and the Precautionary Principle. *Environmental Health* 7 (3):15-21.
Ramstad, Evan. 2008. Steel makers changing recipe to cut pollution. *The Weekend Australian*, 30-31 August, 38.
Rapoport, A., A.M. Chammah, and C.J. Orwant. 1965. *Prisoner's Dilemma: A Study in Conflict and Cooperation*: University of Michigan Press.
Reinaud, J. 2008a. Climate Policy and Carbon Leakage: Impacts of the European Emissions Trading Scheme on Aluminium. IEA Information Paper.
———. 2008b. Issues behind Competitiveness and Carbon Leakage under Uneven Climate Policies - Focus on Heavy Industry. IEA Information Paper.
Reserve Bank of Australia. 2008. Submission to the Senate Select Committee on State Government Financial Management: Recent Developments in State Level Economic Activity: Reserve Bank of Australia. 9.
Richardson, D. 2008. "Who are the (un)intended losers from emissions trading?" (Research Paper No. 55). September. Available from: <http://www.tai.org.au/file.php?file=WP116.pdf>.

Richardson, D., and R. Denniss. 2008. "The Impact of an Emissions Trading Scheme on State Government Budgets". (Research Paper No. 54). August. Available from: <http://www.tai.org.au/file.php?file=WP115.pdf>.

Riedy, C., and M. Diesendorf. 2003. Financial subsidies to the Australian fossil fuel industry. *Energy Policy* 31:125-137.

Rio Tinto. 2008. *Rio Tinto Submissions to the Garnaut Climate Change Review* 2008 [cited 20 September 2008]. Available from http://www.garnautreview.org.au/CA25734E0016A131/pages/submissions.

Rogers, E. 2008. *'Weak' Garnaut carbon target under fire*. ABC News Online 2008 [cited 23 October 2008]. Available from http://www.abc.net.au/news/stories/2008/09/05/2356828.htm.

Rouen, R. 1997. China's economic performance in an international perspective. OECD, Paris.

Roxborough, S. 2008. *Check on China: General Steel Holdings, Inc.* SmallCap Investor 2008 [cited 4 September 2008]. Available from http://www.smallcapinvestor.com/smallcapinsights/china.

Saddler, H., M. Diesendorf, and R. Denniss. 2007. Clean energy scenarios for Australia. *Energy Policy* 35:1245-1256.

Saddler, H., and H. King. 2008. Agriculture and Emissions Trading: The impossible dream? , October.

SAMI. 1999. China's steel industry. Report prepared for a CHANNAR fund project. State Administration of Metallurgical Industry, Beijing.

Shanahan, D. 2008. Feeling the heat on carbon. *The Weekend Australian*, 28-29 June, 22.

Stern, N. 2007. *The Economics of Climate Change: The Stern Review*. Edited by W. N. Adger. Cambridge: Cambridge University Press.

Syed, A., R. Wilson, S. Sandu, C. Cuevas-Cubria, and A. Clarke. 2007. Australian Energy: National and state projections to 2029-30. ABARE research report 07.24. prepared for the Australian Government Department of Resources, Energy and Tourism, Canberra.

Tangen, K., G. Heggelund, and J. Buen. 2001. China's Climate Change Positions: At a Turning Point? *Energy & Environment* 12 (2&3):237-252.

Tcha, M., and D. Wright. 1999. Determinants of China's import demand for Australia's iron ore. *Resources Policy* 25:143-149.

The Associated Press. 2008. *Chinese steel companies create world's 5th-largest producer in government-led merger*. International Herald Tribune 2008 [cited 3 September 2008]. Available from http://www.iht.com.

Tietenberg, T.H. 1990. Economic Instruments for Environmental Regulation. *Oxford Review of Economic Policy* 6 (1):17-33.

Tranter, B. 1999. Environmentalism in Australia: elites and the public. *Journal of Sociology* 35 (3):331-350.

Treasury of Australia. 2008. Australia's Low Pollution Future: The Economics of Climate Change Mitigation. Commonwealth of Australia, Barton, ACT.

Trench, J. 2004. Role of the Chinese Steel Industry in the Economic Development of China and Australia's Contribution to the Industry as a Supplier of Raw Materials. PhD, Division of Arts, Murdoch University, Perth.

Turton, H. 2004. "Greenhouse gas emissions in industrialised countries: Where does Australia stand?" (66). June. Available from: <http://www.tai.org.au/file.php?file=DP66.pdf>.

United Nations Framework Convention on Climate Change. Rio de Janeiro, Intergovernmental Negotiating Committee. 9 May, 1992: 849.

Kyoto Protocol. Kyoto, Japan, United Nations Framework Convention on Climate Change. 1997: 20.

Wara, M. 2007. Is the global carbon market working? *Nature* 455 (8):595-596.

Weitzman, M.L. 2007. A Review of The Stern Review on the Economics of Climate Change. *Journal of Economic Literature* 45:703-724.

World Bank. 1997. Clear water, blue skies. The World Bank, Washington, D.C.

World Energy Council. 1995. Energy Efficiency Improvement Utilising High Technology, An Assessment of Energy Use in Industry and Buildings. WEC, London.
WorldSteel Association. 2008. *World Steel in Figures* 2008 [cited 21 October 2008].
Worldwatch Institute. 2006. State of the World: Special Focus: China and India. edited by L. Starke. Worldwatch Institute, London.
———. 2008. State of the World: Innovations for a Sustainable Economy. edited by L. Starke. Worldwatch Institute, London.
WRI (World Resources Institute). 2008. National Alcohol Program (PROALCOOL). <http://projects.wri.org/sd-pams-database/brazil/national-alcohol-program-proalcool>.
Wu, Y. 2000. The Chinese steel industry: recent developments and prospects. *Resources Policy* 26:171-178.
Zhang, Y., and Y. Zheng. 2007. New Development in China's Climate Change Policy. University of New South Wales Faculty of Law Research Series. University of New South Wales, Paper 73.
Zhou, D., and Y. Dai. 2003. *China's sustainable energy scenario in 2020*. Beijing: China Environmental Science Press.
Zhou, W. 2006. How developing countries can engage in GHG reduction: a case study for China. *Sustainability Science* 1:115-122.
Zhu, E. 2008. *Mergers loom for Chinese steel makers*. The Australian: Business 2008 [cited 3 September 2008]. Available from http://www.theaustralian.com.au.

Appendix A: Letter Requesting Site-Specific Emissions Profiles

To Whom It May Concern:

My name is Joey Hester, and I am a master's degree student at Murdoch University in Perth. I have been in Australia for almost 2 years, and at the moment I am completing my research dissertation in preparation for its final submission in November. Though much of my literature review has been produced with publicly available data, I find that an added degree of rigor will accompany my analysis if I can obtain real-world data from the field. I have spent some months familiarizing myself with the Labor government's proposed carbon emissions trading scheme, and my research hinges upon its proposed coverage standards and timeline, especially as they may impact the international competitiveness of the iron and steel industry. I intend for it to be a substantial critique of their proposal, and most of my information specifically involves the intricate relationship between iron ore mines in Western Australia and the steel industry in China. Using mostly ABARE, DoIR, DFAT, and ABS raw data, I (hopefully) have painted an accurate picture of this relationship, as well as the likely transaction burden that will be placed on companies such as Rio Tinto and BHP. If I can bend the right ears, I will make an attempt to provide my completed research to officials in the Department of Climate Change before the release of their White Paper this December. Whether they will pay any mind is another story altogether! At the very least I will make my research publicly available after its release, at which point it will be accessible to WA public officials and regional media outlets.

I have attempted to clarify the transaction costs associated with the 2010 inception the Labor government has proposed, namely emissions production, permit allocation, and coverage standards in the mining and steelmaking industry. As of yet, however, I have been unable to actually quantify real-world costs, as I do not have access to facility-specific emissions and energy inventories, something I hope you can help me with. I understand the unexpected nature of such a request, but I hope you can understand the mutually beneficial situation, given that independent, third-party impact assessments can be quite expensive. I've read several in-house responses to the Climate Department's proposed Carbon Pollution Reduction scheme, and I'm sure that not only did they cost the company significant time and energy, but they were also (probably) received attached to the inherent bias that accompanies an in-house analysis. Funding I do not need. Raw, verifiable data I do.

I cannot guarantee my findings will favour the Climate Department, nor can I guarantee that, all things considered, I will agree with one company's recent request for complete industry exemption. I am, after all, unaffiliated with either party. I can guarantee, however, that you will have full access to all of my research at every step between now and its publishing. As a representative of Murdoch University, I assure you that your confidentiality will be respected at all times. You will maintain first refusal if any of my information is deemed too sensitive for release. If at any time anonymity is required, I would not disclose any identifying information. Your privacy will be respected at every step in the process. A written confidentiality agreement is available upon request. As per Murdoch University's code of ethics, any information provided above and beyond ordinary facts and figures will not be released under any circumstances without Ethics Committee approval and will only serve as an informational basis for my personal analysis. Written agreements will also be required for both parties in the event that the Ethics Committee is consulted.

Murdoch University Research Code of Conduct:
http://www.research.murdoch.edu.au/management/policies/codeconres.html

Murdoch University Code of Ethics and Conduct:
http://www.murdoch.edu.au/vco/secretariat/admin/codes/ethics.html

Murdoch University Ethics Policies:
http://www.research.murdoch.edu.au/ethics/hrec/policies.html

There is considerable debate within the political sphere as to the delineation of a 'facility', but I assure you the measurement that applies for your pre-existing greenhouse reporting will be the most useful. I also do not wish to paint an unreasonable picture of the state of the steel industry in Australia. HISmelt and Corex technologies (along with others) are promising, but they do not yet represent the industry standard, and so would be of little use to me. A representative snapshot will be used not to point an accusatory finger at greenhouse intensity. I want to be very clear on that point. It will simply be used to accurately reflect the cost burden which will be imposed by the requirement of a permit for every tonne of carbon dioxide equivalent emitted. For this reason, accurate disclosure is in everyone's best interest.

In short, these are the kinds of inventory data that would be most helpful to me:

- Energy input (liquid and solid fuels)
- Electricity usage (on-site generation and off-site demand)
- Carbon emissions (all emissions required by NGER Bill 2007*)
- Output (raw iron ore from minesites; DRI, pig iron, and crude steel from steel mills)
- Input (raw iron ore to ISPs; scrap to EAFs)

*National Greenhouse and Energy Reporting Bill 2007

All data will be most helpful on a per annum basis, but multiple years will be even more so, as will month-by-month breakdowns. As could probably be expected, any extra information you can provide for clarification will be greatly appreciated, and of course, all information will remain confidential.

As I'm sure you can appreciate, deadlines often loom menacingly over thorough, patient research. My analysis will be submitted in print by the 7th of November, with the expectation that revision and final publication (before the release of the White Paper) will take some weeks, as will publication (though this is not necessarily dependent on the White Paper). For this reason a timely response is profoundly appreciated, but your participation is, of course, entirely voluntary.

I do hope that I have been clear in reiterating the benefits to be had by everyone, and I hope that I have efficiently assuaged your doubts and concerns. I offer rigorous, unbiased third-party analyses in exchange for a few excel spreadsheets—though I will gladly accept spiral notebooks as well! I am operating under the (reasonable?) assumption that such data is already available, and as such assume its compilation and delivery to be relatively minor undertakings. If no such data exists, I do appreciate your time nonetheless.

A great deal of manpower is currently devoted to ironing out the specifics of Kevin Rudd and Penny Wong's proposal, but many (including the Liberal Party) believe it is reckless to pursue carbon permitting before the post-Kyoto framework can be established. I intend to make very clear the implications of such a transition, especially given that the Chinese steel industry is free from carbon constraint at least until 2012—and there is no guarantee they will adopt binding limits when the time comes! I'm sure you can appreciate the concern.

Thank you for your time and assistance, and I keenly await your prompt response.

Sincerely,

Joey Hester
Institute of Sustainability and Technology Policy
Murdoch University
JRHester@gmail.com
0423862859