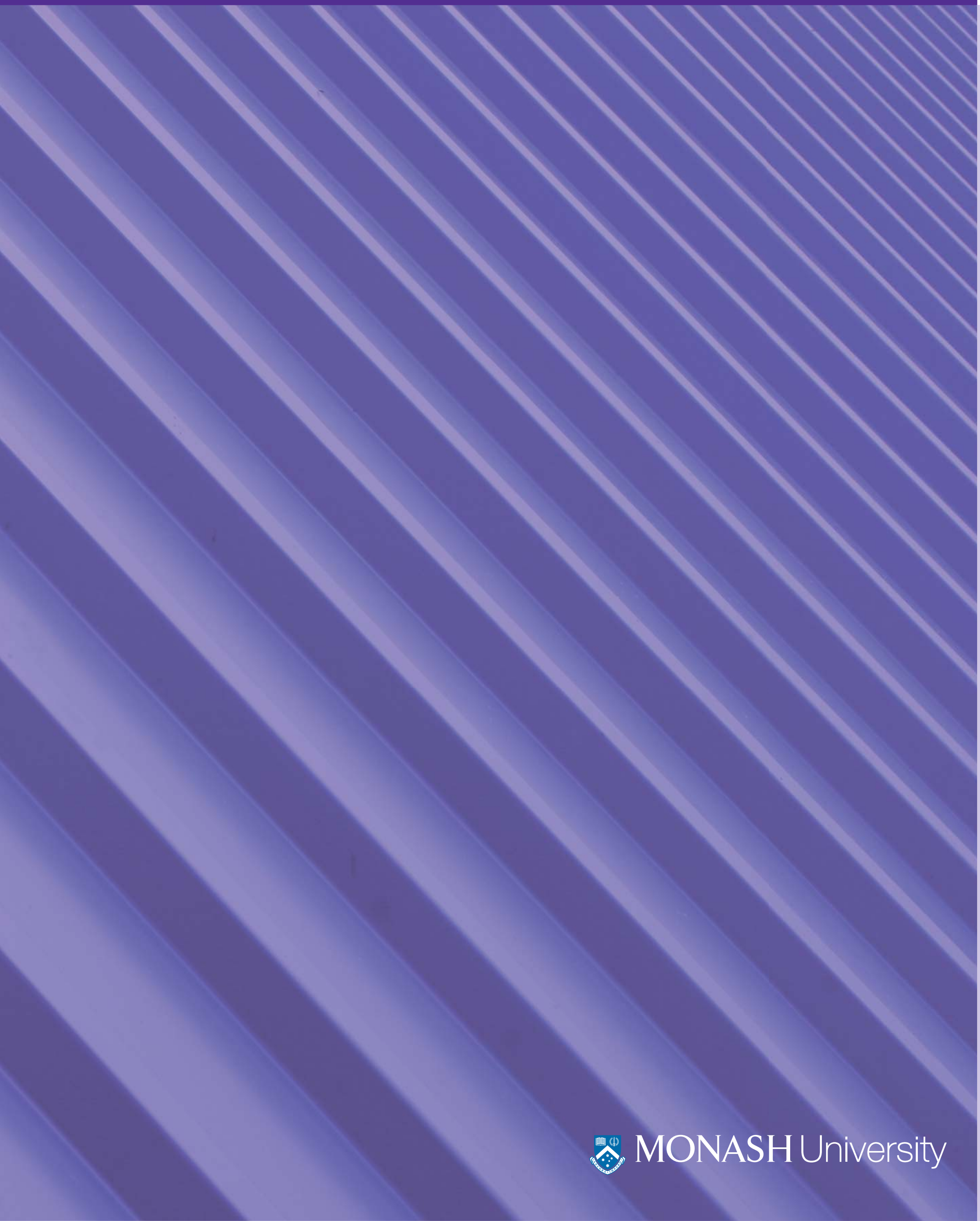
Investor Group on Climate Change

Potential Earnings Impacts from Climate Change

Steel Sector



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Note: These reports were researched and written before the Australian Government's commitment to an Australian Emissions Trading Scheme and before any details of the scheme were available. Readers can find more information on policy regarding the Australian Emissions Trading Scheme at http://www.pmc.gov.au/climate_change/#emissions

Executive Summary

- This report explores the exposure of the Australian steel sector of the S&P/ASX200 to climate change risk; focussing particularly on **carbon price risk**.
- **Physical damage** to infrastructure and operations is a potential risk but difficult to quantify.
- The steel sector is greenhouse gas intensive with as much as 11.6 kilograms of greenhouse gases (CO_2-e) emitted for each dollar of earnings (EBITDA). Modelling indicates that the cost to the Australian steel sector of a price on carbon varies considerably depending on the design of the potential carbon pricing scheme.
- Four different scenarios were modelled to help determine possible impacts on the sector. Depending on the permit price and other key design features, a carbon pricing scheme including all greenhouse gas emissions from the steel sector from facilities globally, including emissions arising directly from operations as well as indirectly from electricity use, may impact the Australian steel sector by between:
  - A reduction of 0.4% in mid-cycle EBITDA margins (reducing from 12.33% to 12.28%) at a carbon price of $5 per tonne CO_2-e and with 90% free allocation of permits; and
  - A reduction of 41% in low-cycle EBITDA margins (reducing from 9.1% to 5.4%) at a carbon price of $25 per tonne CO_2-e and with full auctioning of permits.
- These impacts represent the cost of carbon before considering cost pass through or emission reduction action, which both have the potential to reduce the ultimate impact experienced by the steel sector. Emissions abatement may also be a revenue generation opportunity, as reductions in excess of any mandatory requirements may be able to be traded as carbon credits.
- The key design features influencing this range are the emissions covered by the scheme and the method used to allocate permits. In the short term it is envisaged that a large proportion of permits will be allocated free to liable parties, resulting in impacts at the lower end of the range.
- **The cost to the Australian steel sector from carbon pricing will not be spread equally across companies.** Exposure will vary significantly depending on the relative importance of steel distribution verses production to the company and the different production technologies used, as these influence both emissions intensity and reduction opportunities.
- For example, steel producers using blast furnace technology will be most impacted under a scheme that covers all the emissions from steel production (i.e. direct emissions from operations as well as indirect emissions from electricity consumption). However, steel producers using electric arc furnace technology will be impacted more heavily under a carbon pricing scheme that covers only indirect emissions from electricity consumption.
- To minimise the exposure to carbon price risk, regardless of the design of the potential scheme, steel producers should focus on mitigation strategies incorporating both emissions reduction initiatives and emerging technologies.

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1. The Steel Sector's Contribution to Climate Change

Steel manufacturing involves the processing iron ore (e.g. using coking coal) to remove impurities before converting iron and other inputs into steel.

Iron and steel manufacturing results in significant greenhouse gas emissions, accounting for around 3.2% of total global emissions (see Chart 1).[i]

In Australia, iron and steel making contributed 13.3 million tonnes of carbon dioxide equivalent emissions (mt CO_2-e) or around 2.4% of total net emissions in 2004.[ii]

In 2004 greenhouse gas emissions from Australian steel production were similar to what they were in 1990, while steel production has increased by 17% over that period.[iii]

Australian steel production is not projected to grow significantly in the near future, with most existing plants nearing capacity and no major new developments expected.[iv] Therefore, emissions from the steel sector are not projected to increase significantly.

Greenhouse gas emissions arise throughout the steel making supply chain.

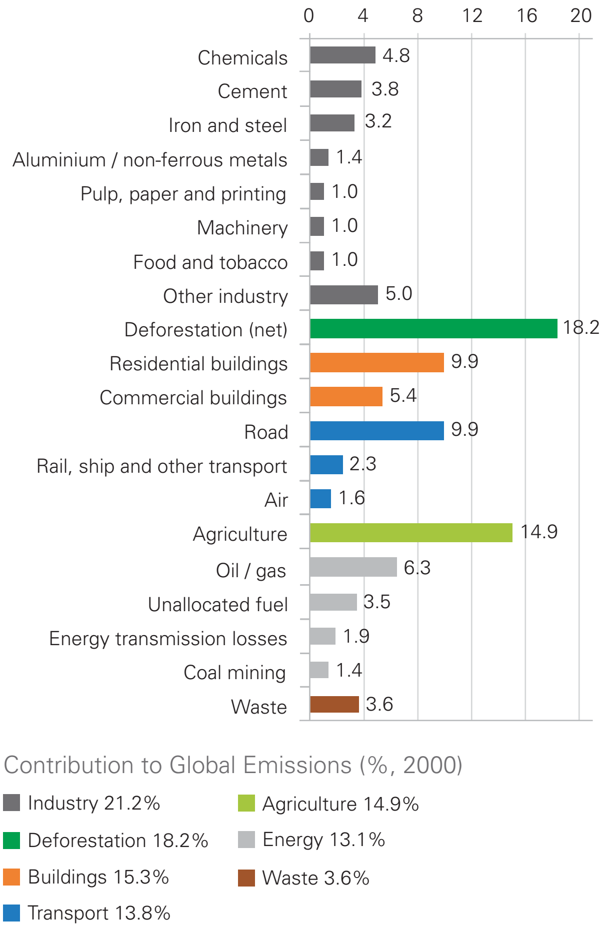
Of emissions attributed to the Australian steel sector in Australia's National Greenhouse Accounts, the majority of emissions (approximately 76%) are 'direct' emissions, arising from combustion or chemical processing of fossil fuels in operations. Direct emissions from iron and steel production in Australia were around 10.1 mt CO_2-e in 2004.[v]

The other greenhouse emissions attributed to the steel sector are predominantly 'indirect' emissions arising from electricity consumption (approximately 24%). Indirect emissions from the sector were around 3.2 mt CO_2-e in 2004.[vi]

Other emission make very minor contributions to the emissions profile of the sector (estimated to be less than 1% of attributed emissions).[vii]

The majority of emissions from iron and steel production are of carbon dioxide (CO_2), with only small amounts (less than 1%) of other greenhouse gases.[viii]

Chart 1: Global Emissions by End Use/Activity



There are two predominant technologies used to produce steel:

- Blast Furnace / Basic Oxygen Steel Making (BF/BOS); and
- Electric Arc Furnace (EAF or Mini Mill).

BF/BOS technology represents approximately 63% of total production by the global steel industry and approximately 83% of total production by Australian steel companies (see Table 1).

Table 1: Breakdown of Technology Used for Steel Production

Technology	Share of Production 2004	
	Global[ix]	Australia*
BF/BOS	63%	83%
EAF	34%	17%
Other	3%	–

*Total raw steel production by Australian companies from all facilities. Production data is the most recent year for which greenhouse gas emission data is available.

1. The Steel Sector's Contribution to Climate Change

Chart 2: Steel Making via Integrated BF/BOS and EAF Routes

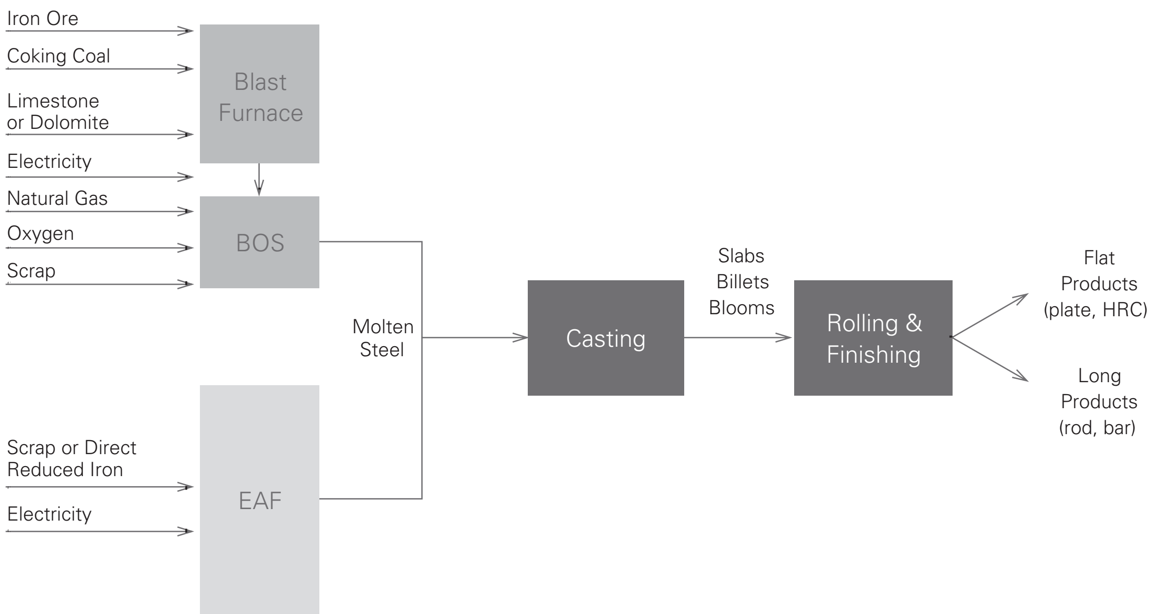


Chart 2 depicts the steel making process for each of the two main steel making technologies, showing the key inputs for each. BF/BOS technology uses iron ore as its primary input. Where EAF technology uses scrap steel as its primary input, such as in Australia, it operates as a steel reprocessing technology. Use of Direct Reduced Iron (DRI) as the primary feedstock enables EAFs to produce steel from virgin material. However, there are currently no DRI-based EAFs operating in Australia.

The two technologies differ both in the sources and total quantity of greenhouse gas emissions that result from the production of steel. Summarised in Table 2 on the following page are the main emission sources for both the steel production technologies.

Emissions sources have been grouped into the following three categories based on *The Greenhouse Gas Protocol* [x] – the leading standard globally on corporate greenhouse accounting and reporting:

- Direct – emissions from sources owned or controlled by the company/asset (includes both combustion and process emissions);
- Indirect electricity – emissions associated with the production of electricity consumed;
- Other indirect – emissions that are a consequence of the activities of the company, but arise from sources owned by another (suppliers or customers).

Estimates for greenhouse gas emissions (tonnes of carbon dioxide equivalents or tCO_2-e) per tonne of steel are presented where available.[xi] Where no estimate is available, the emissions category is indicated with a tick.

1. The Steel Sector's Contribution to Climate Change

Table 2: Steel Making – Greenhouse Gas Emissions Source (by Technology)

BF/BOS				
Emissions Source	**Direct**	**Indirect Electricity**	**Other Indirect**	**TOTAL**
Major	**Estimated tCO_2-e per tonne of steel**			
Process emissions – coking coal*	2.11			
Combustion emissions – natural gas	0.29			
Electricity in steel making		0.05		
Electricity in rolling & finishing		0.10		
TOTAL	2.4	0.15		2.55
Minor				
Electricity in oxygen production			✓	
Limestone / dolomite production			✓	
Coal mining & processing			✓	
Iron ore mining & processing			✓	
Natural gas production			✓	
Scrap processing			✓	
Transport:				
– Inputs			✓	
– On site	✓			
– Finished goods			✓	

EAF (scrap based)				
Emissions Source	**Direct**	**Indirect Electricity**	**Other Indirect**	**TOTAL**
Major	**Estimated tCO_2-e per tonne of steel**			
Electricity in steel making		0.6		
Electricity in rolling & finishing		0.3		
Combustion emissions – natural gas	0.17			
Combustion emissions – coal	0.05			
TOTAL	0.22	0.9		1.12
Minor				
Natural gas production			✓	
Scrap processing			✓	
Transport:				
– Inputs			✓	
– On site	✓			
– Finished goods			✓	

* Process emissions are those arising from chemical processes other than combustion.

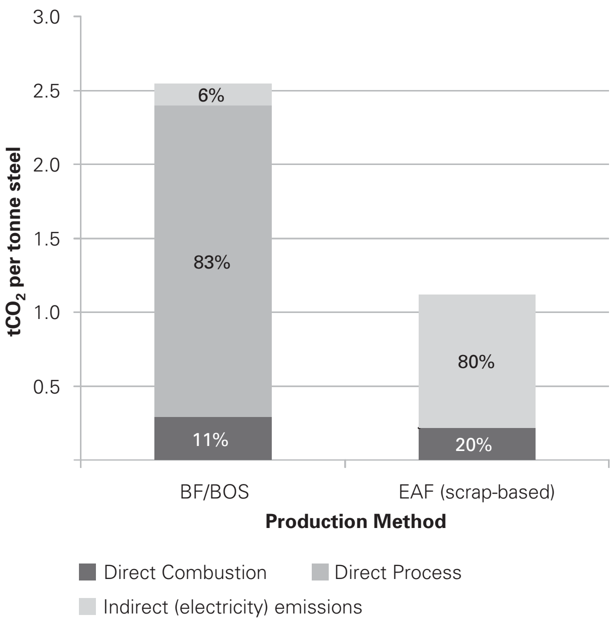
✓ Estimate not available

1. The Steel Sector's Contribution to Climate Change

While emissions for a particular producer can vary from the estimates in Table 2, in general:

- BF/BOS steel production is considerably more greenhouse gas intensive than scrap-based EAF production – around 2.3 times the emissions of EAF per tonne of steel produced based on the above figures.
- The majority of emissions from BF/BOS production are direct (around 94% based on the above figures). The bulk of direct emissions (around 83%) relate to coking coal, and are classified as 'process emissions' because coking coal is a necessary input in the chemical process of converting iron ore to pig iron.
- The majority of emissions from scrap-based EAF production are indirect, associated with electricity consumption (around 80% based on the above figures).

Chart 3: Steel Production – Emissions Profile



For a particular BF/BOS producer, greenhouse gas emissions intensity will vary depending on a number of factors including:

- The scale of the blast furnace:
  - Larger furnaces (capacity of 3-5 mt pa) are typically more energy efficient than smaller furnaces (capacity less than 2 mt pa).
- The extent to which waste heat is captured and used to reduce energy consumption elsewhere in the mill.
- The type of steel products produced.[xii]

For a particular EAF producer, greenhouse gas emissions intensity will vary depending, in particular, on the:

- Proportion of scrap steel used:
  - EAF production can use either scrap steel or direct reduced iron (DRI) as the primary feedstock. The estimated emissions per tonne presented above are based on a high proportion of scrap, which is typical for Australian EAF steel producers. Where DRI is used, emissions are typically double that of EAF steel production from scrap and only slightly lower than BF/BOS production.[xiii]
- Location of operations:
  - In Australia, average greenhouse intensity of the electricity supply varies from State to State as shown in Table 3.

Table 3: Greenhouse Intensity of Electricity Supply (2004)[xiv]

State	Vic	Qld	WA	SA	NSW	Tas
Kg CO_2-e per KWh	1.47	1.16	0.99	1.01	0.99	0.03

2. Overview of Australian Steel Sector

The Australian steel industry is relatively small by world standards, with production capacity of approx 7.7 million tonnes per annum (mt pa) – equivalent to approx 0.6% of global steel output in 2006.

Typically, Australia exports around 3 mtpa of steel and imports around 1-2 mt pa of steel. Domestic steel consumption is in the range of 5-6 mt pa.

Approximately 34% (2.6 mt pa) of the steel produced annually in Australia is long products, where production is largely for the domestic market. The remaining production capacity is in flat products, with a large proportion of the output exported.

As demonstrated in Table 4, the three steel companies have different characteristics in terms of size, steel production technology employed, relative importance of steel distribution to company EBITDA and relative importance of overseas operations to company EBITDA.

Of the three companies in the steel sector of the S&P/ASX200, two are steel producers and the other is a steel recycler. The recent merger of OneSteel and Smorgon Steel reduced the number from four to three. It should be noted that the Smorgon Steel distribution business was acquired by BlueScope Steel, with the remaining assets acquired by OneSteel.

Table 4: Companies in the Steel Sector of the S&P/ASX200

BlueScope Steel	Sims Group	OneSteel
BSL	SGM	OST
Market Cap (AUD) as at 6 August 2007		
7.6 billion	3.3 billion	5.6 billion
Primary Activities		
Production of steel using BF/BOS production. Processing into flat steel products. Distribution of long/flat steel products.	Recycling of ferrous and non-ferrous metals. Secondary processing of non-ferrous metals and plastics. International trading of metal commodities. Merchandising of steel and semi-fabricated products.	Mining of iron ore. Collection of scrap metal. Production of steel using both EAF and BF/BOS production. Processing into long steel products (structural, merchant bar, reinforcing, wire, pipe & tube etc). Distribution of long/flat steel products.
Countries of Operation		
• Australia	• Australia	• Australia
• Asia	• Asia	• New Zealand
• North America	• Europe	• Asia
• New Zealand	• North America	• North America
	• New Zealand	
Steel Production Facilities		
• Pt Kembla, Aus	n/a	• Whyalla, Aus
• Glenbrook, NZ		• Sydney, Aus
• USA JV n/a		• Melbourne Aus
		• Newcastle, Aus
Global Steel Production 2005-06 (mt pa)		
5.89[xv]	n/a	2.6

2. Overview of Australian Steel Sector

BlueScope Steel	Sims Group	OneSteel
EBITDA (AUD) FY06		
• HRC Australia A$589m • Coated & Building products Australia – A$122m • New Zealand Steel A$132m • Coated & Building Products Asia A$36m • HRC Nth America A$188m • Coated & Building Products Nth America A$47m • Distribution (acquired from SSX) A$ n/a	• Australia: A$121.8m • North America: A$129.1m • New Zealand: A$12.1m • Europe: A$64.1m	• Australian Distribution A$146m • Australian Manufacturing A$226m • International Distribution A$49m • Recycling (acquired from SSX) A$70m • Manufacturing (acquired from SSX) A$150m • Pipe & Tube and LiteSteel (acquired from SSX) A$ n/a

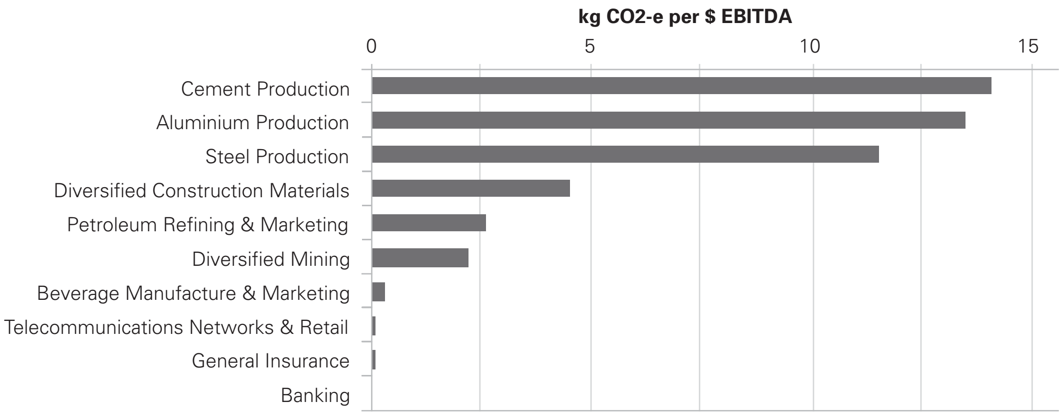
2.1 Sector Greenhouse Gas Intensity

Greenhouse gas intensity of earnings is given as kilograms of carbon dioxide equivalent emissions per dollar of earnings (kg CO_2-e per $ EBITDA). Simply, this is a measure of the amount of greenhouse gas emissions for each dollar earned. The greenhouse gas intensity of earnings provides a broad indication of exposure to carbon price risk.

Estimated greenhouse intensity of earnings for companies in the steel sector range from 0.7 to 11.6 kg CO_2-e per $ EBITDA. Details of the approach used to estimate greenhouse gas intensity for each company are included in Appendix One: Methodology Notes. It is noted that estimates are subject to variation from period to period due to the volatility of earnings in the steel sector. While each company is impacted by these cycles to varying degrees, it is still the case that relative intensity (that is, comparisons between companies) is likely to be more consistent than absolute values.

In Chart 4, the highest greenhouse gas intensity of earnings for the steel sector is shown compared to other examples drawn from across the S&P/ASX200.

Chart 4: Greenhouse Intensity of Earnings across the S&P/ASX 200 (estimated)



2. Overview of Australian Steel Sector

As mentioned above, greenhouse gas intensity of earnings for a particular steel producer is largely determined by the technology used for steel production – the greater the proportion of steel produced using the higher greenhouse-intensive BF/BOS technology, the higher the greenhouse gas intensity of earnings.

Table 5: Production Facilities – S&P/ASX200 Steel Sector

Technology	Number of Facilities	Total Output*	%
BF/BOS	3	6,845,000	83%
EAF	3	1,445,000	17%
TOTAL	6	8,290,000	100%

*Production data is the most recent year for which greenhouse gas data is available

Table 5 summarises the technology mix for production by Australian steel sector companies, which includes facilities in Australia and New Zealand.[xvi] While there is the same number of facilities for each of BF/BOS and EAF production, the majority of output (around 83%) comes from BF/BOS technology, reflecting the larger scale of these facilities.

Of the two steel producers in the S&P/ASX200:

- One has only BF/BOS production; and
- The other has a mixture of BF/BOS (46%) and EAF (54%).

Greenhouse gas intensity of earnings will also be influenced by the extent of value adding by the producer. Most emissions arise in the production of raw steel. Further processing adds only a small amount to emissions, but can add a large amount to earnings. Thus, the greater the proportion of more highly finished (downstream) goods the lower the greenhouse intensity of earnings.

3. Impact of a Carbon Price on the Steel Sector

The financial impact of a carbon price on the Australian steel sector will vary depending on the details of design and implementation of the scheme.

Carbon trading schemes fall into two broad categories:

- Cap and trade; and
- Baseline and credit.

Cap and trade schemes involve:

- Setting an emissions 'cap' – the maximum amount of greenhouse emissions allowable in a given period. The difference between the cap and 'business as usual' emissions is the targeted reduction in emissions. It is common for carbon trading proposals to involve modest reduction targets initially, with progressively more stringent targets over time.
- Creating tradeable permits ('carbon credits') for the allowable emissions, i.e. a right to emit. Typically a permit will be for one tonne of carbon dioxide equivalent greenhouse gas emissions (1 tCO_2-e).
- Allocating tradeable permits to affected parties (including those emitting greenhouse gases).

Liable parties are required to surrender sufficient tradeable permits at the end of each period to cover all of their actual emissions. Liable parties who are able to reduce their emissions below the level of emissions for which they have permits are able to sell excess permits on market. The EU ETS is an example of a cap and trade scheme.

Under a baseline and credit scheme, liable parties are assigned an emissions path or 'baseline' which sets out allowable emissions over time. The difference between the baseline and 'business as usual' emissions is the targeted reduction in emissions. Tradeable permits are allocated with reference to the baseline. The NSW Greenhouse Gas Abatement Scheme (GGAS) is an example of a baseline and credit scheme.

In practice, there are many similarities between the two categories of scheme. For simplicity, the following analysis, focuses on cap and trade schemes.

The design features of particular importance in determining the financial impact of a carbon pricing scheme are the:

- Sectors/sources and types of emissions covered; and
- Permit allocation method.

3.1 Emissions/sector coverage

Electricity generation is typically the focus of carbon pricing proposals, due to:

- The size of emissions from this sector (35% of Australia's greenhouse gas emissions in 2004);
- The comparative administrative simplicity of applying emission controls; and
- The low risk of import substitution.

Emissions from electricity generation may be the only sector covered by a potential carbon pricing scheme. Alternately, proposals may also cover emissions from other stationary sources as well as emissions from industrial processes (including BF/BOS steel production), fugitive emissions and from transportation.

While, in theory, it would be possible to have a carbon pricing scheme that covered all sources of greenhouse emission, this presents significant practical difficulties. The costs and difficulties associated with measuring emissions from waste, agriculture and land clearing makes it unlikely that emissions from these sectors would be included in any carbon pricing scheme. No economy-wide carbon pricing schemes have been implemented anywhere in the world.

Carbon pricing may be 'phased in' – applying to a small number of sectors initially, with additional sectors included at a later stage. For example, the EU ETS initially imposes controls only on:

- Large electricity generating units (over 20MW);
- Oil refineries; and
- Manufacturers of iron and steel, cement, brick, tile, glass, pulp and paper.

Consideration is being given to expanding the EU ETS to other sectors, such as aviation, from the beginning of the second or third phase (2008 and 2013 respectively).

Emission/sector coverage determines who has direct liability under a carbon pricing scheme and for what emissions. Where covered sectors provide inputs to other parts of an economy, this creates indirect exposure to the scheme for those downstream of covered sectors. This indirect exposure can be highly significant. Carbon pricing of electricity generation emissions has the potential to impact across the economy, as electricity is an input to production for every industry, to a greater or lesser extent.

3. Impact of a Carbon Price on the Steel Sector

3.2 Permit Allocation

A variety of permit allocation methods can be used. Typically this will involve some combination of:

- Auctioning – where liable parties are required to pay a market price for tradeable permits through an auctioning process.
- Free allowances – where permits are allocated to liable parties for free. The basis of this free allocation may be historical emissions or average emissions intensity and actual production levels. Free allocation on the basis of historical emissions is also referred to as 'grandfathering', as some emissions are allowed to continue without attracting a penalty (or carbon price).

In the first phase of the EU ETS allocations have been made using free allowances only. The cap established was around 10% lower than 'business as usual' emissions, resulting in only a small net liability for liable parties, which can be met either through reducing emissions or trading for permits on market.

Experience with the EU ETS to date has revealed one of the problems with free allowance allocations. Each liable party was granted free allowances for the bulk of expected emissions. Thus, each had only a small net liability and was facing only a small increase in costs to meet the liability under the scheme. However, each of the free allowances has value – it can be sold at the prevailing carbon price. Liable parties took the value associated with the free allowances into account when setting prices for sales after the scheme was introduced. Where they could raise prices to compensate for the lost opportunity to sell the free allowances, they did so, leading to larger price increases than were necessary to cover real cost increases.
In the case of electricity, generators have been highly successful in achieving price increases due to the relative inelasticity of electricity demand (that is, price rises typically result in only small decreases in consumption). This has resulted in a windfall profit for many generators, estimated to total £800 million p.a. in phase one of the EU ETS for the UK power generation sector.[xvii]

Other forms of permit allocation, such as auctioning or free allocations on the basis of sector average emissions intensity and actual production levels, have the potential to reduce or eliminate such windfall profits. In the second phase of the EU ETS, some governments are proposing to use auctioning to the extent necessary to recoup gains expected from opportunity cost pricing, with the balance of permits allocated as free allowances.

Thus, if carbon trading were implemented in Australia, the method of permit allocation has the potential to alter the financial impact on steel producers, both in relation to direct compliance costs and in relation to the indirect exposure to electricity price rises.

3.3 Modelling Scenarios

The cost of carbon pricing for the Australian steel sector has been estimated for four possible scenarios, which are described in Table 6.

Table 6: Summary of Emissions Trading Scenarios Used in Analysis

Scenario	Emissions Covered				Permit Allocation Method	Other Comments
	Direct Combustion	Direct Process	Indirect Electricity	% of Total Emissions Covered		
1	YES	YES	YES	100%	100% auctioning	
2	YES	NO	YES	30%	100% auctioning	
3	YES	YES	YES	100%	90% free allowances	Allowances based on historical emissions. Electricity generators are assumed to follow opportunity cost pricing.
4	YES	YES	YES	100%	90% free allowances	Allowances based on sector average emissions intensity and actual production levels. Electricity generators are assumed to recover only costs of compliance (no opportunity cost pricing).

3. Impact of a Carbon Price on the Steel Sector

Scenario 1 represents a carbon pricing scheme where liable parties are required to pay a carbon price (via auction) for 100% of greenhouse gas emissions (direct and indirect emissions). While this is close to the full potential liability for carbon pricing and is possible in the long run, such a scenario is highly unlikely in the short or medium term, where it is envisaged that a proportion of permits will be allocated free to liable parties.

Scenario 2 is similar to scenario 1 but only involves carbon pricing of combustion emissions – including direct combustion emissions and indirect emissions from electricity generation. Process emissions from steel production are excluded from liability.

Under scenario 3 and 4, 100% of greenhouse gas emissions (direct and indirect emissions) are covered, but free allowances are granted for the majority (90%) of emissions, resulting in a net liability equivalent to 10% of 'business as usual' emissions. This relatively modest net reduction target is consistent with an initial phase of a potential carbon pricing scheme.

The difference between scenario 3 and 4 is that in scenario 3 it is assumed that electricity generators engage in 'opportunity cost pricing' such that they over-recover the cost of carbon and make a windfall gain, as experienced under phase one of the EU ETS. In scenario 4, this windfall gain is assumed to be eliminated through alternative permit allocation approaches.

In each scenario, the impact is modelled for three example carbon prices:

- $5 per tonne of CO_2-e – approximately the price of credits under voluntary trading schemes, such as the Australian Greenhouse Office's Greenhouse Friendly Program and the Chicago Climate Exchange.[xviii]
- $10 per tonne of CO_2-e – approximately the spot price of a carbon credit under the New South Wales Greenhouse Gas Abatement Scheme (GGAS).[xix]
- $25 per tonne of CO_2-e – the average spot price in June 2006 for credits under the EU ETS.[xx]

In each scenario it is assumed that:

- Emissions from all company operations globally are covered by the trading scheme, i.e., includes emissions from operations outside Australia
- Financial impact is assessed at a sector level. The financial impact on a company or individual operations/divisions of a company maybe significantly different from that given for the sector as a whole.
- Production levels, product mix, and technology remain constant. Changes in these factors may impact on energy consumption and greenhouse emissions.
- All of the six main greenhouse gases are controlled. The most likely alternative to this is control of carbon dioxide emissions only. In the case of the steel sector, the majority of emissions are carbon dioxide, so this assumption is not expected to have a significant impact on results.
- The carbon price liability is met by purchasing credits on market, rather than through direct reductions. Therefore, excluding administrative costs, estimates represent the maximum costs of compliance. The potential for steel sector companies to reduce emissions and, therefore, reduce the compliance cost is discussed below under heading 4.4 Risk Mitigation Opportunities.
- Estimated emissions by Australian steel sector companies from all facilities globally are as follows:
  - Total emissions are approximately 19 million tonnes CO_2-e.
  - Direct combustion emissions represent 11%, direct process emissions 70%, and indirect electricity emissions 19%. This breakdown is derived from the emissions profile of the different steel production technologies and the proportion of steel produced from each technology.
  - For further details about how emission estimates were developed see Appendix: Methodology Notes.
- Average EBITDA margins are 12.3% mid cycle and 9.1% low cycle. It is noted that many companies in the sector are currently undertaking growth projects, which are likely to lift the mid cycle level of earnings. This makes the task of forecasting mid-cycle earnings more subjective.

The model used to calculate the total cost of carbon to the Australian steel sector is outlined in Appendix One: Methodology Notes.

3.4 Modelling Results

Applying a price to greenhouse gas emissions (tCO_2-e) from all facilities owned by Australian steel sector companies regardless of where the facilities are located (global emissions), results in a total cost of carbon ranging from $477 million p.a. at a carbon price of $25 per tCO_2-e in scenario 1 down to $10 million at a carbon price of $5 per tCO_2-e under scenario 4.

The effect of excluding greenhouse gas emissions from overseas facilities owned by Australian steel sector companies is not significant (as 88% of emissions are from Australian facilities). For example, where only greenhouse gas emissions from Australian facilities are subject to a carbon price, the cost range reduces slightly to $419 million p.a. (carbon price $25 per tCO_2-e; scenario 1) and to $8 million p.a. (carbon price $5 per tCO_2-e; scenario 4). As such, all the following results are from modelling including global emissions.

3. Impact of a Carbon Price on the Steel Sector

Chart 5: Annual Cost of Carbon to the Australian Steel Sector
(Carbon price applied to emissions from all facilities globally owned by companies in the steel sector of the S&P/ASX200)

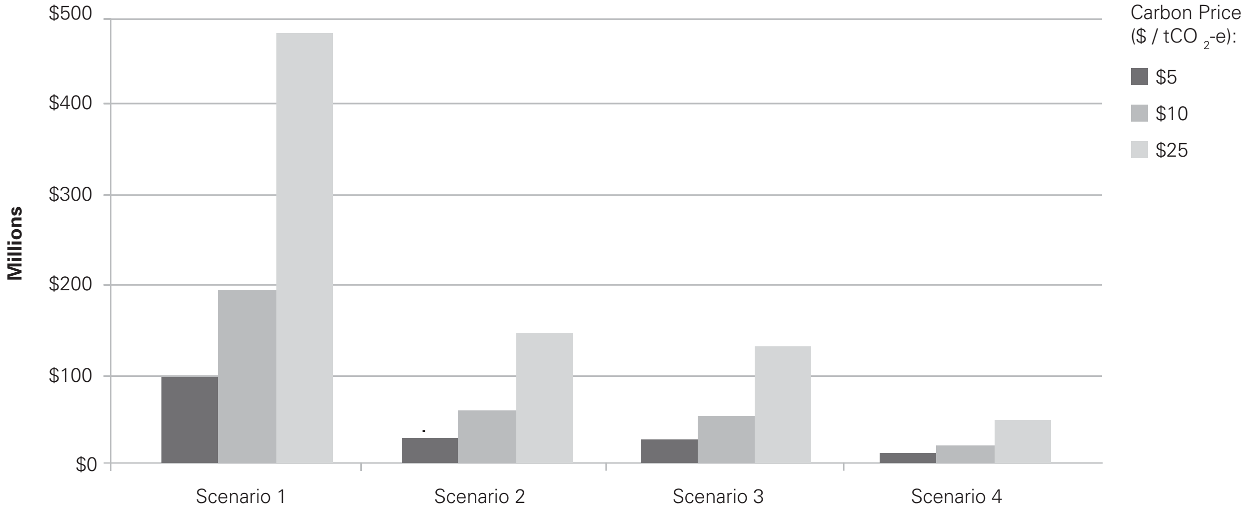
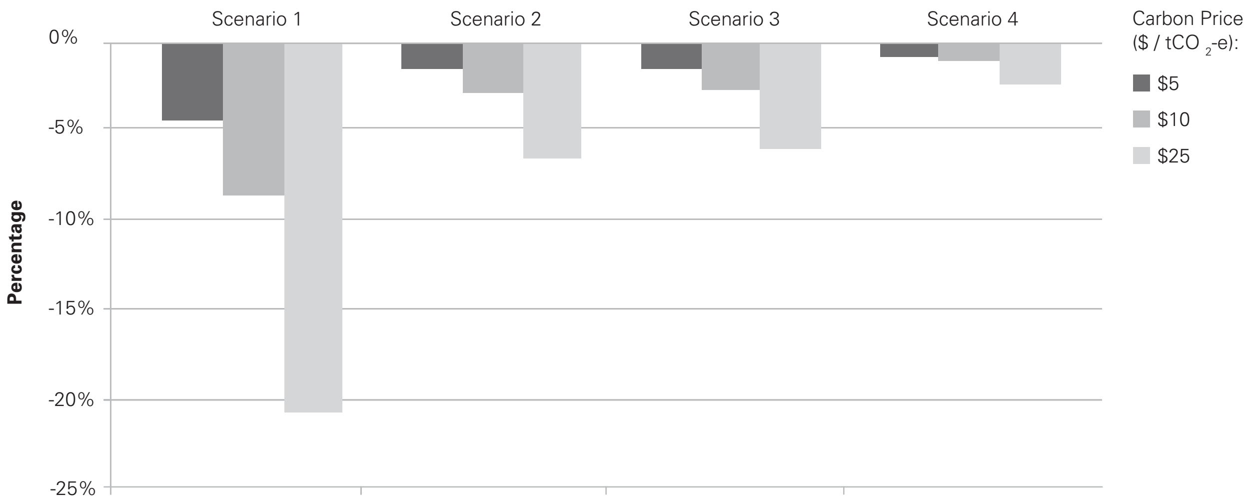


Chart 6 shows that the cost of carbon, before considering cost pass through or emissions reduction action, represents a potential decline in average mid-cycle EBITDA margins for the sector of between:

- 21% (from 12.33% to 9.77%) in scenario 1 (global emissions controlled; carbon price $25 per tCO_2-e); and
- 0.4% (from 12.33% to 12.28%) in scenario 4 (global emissions, carbon price $5 per tCO_2-e).

Modelled results are for the sector. The impact at the company level may vary significantly from the sector wide result, as companies have different exposures to carbon pricing (as outlined in the next section).

Chart 6: Percentage Change in Mid-Cycle EBITDA Margin
(Carbon price applied to emissions from all facilities globally owned by companies in the steel sector of the S&P/ASX200)



3. Impact of a Carbon Price on the Steel Sector

At the highest carbon price modelled ($25 per tCO_2-e) applied to emissions from facilities globally:

- Scenario 1 results in the highest cost of carbon of $477 million p.a. (see Chart 7). This is equivalent to a reduction in the sector average mid-cycle EBITDA margin of 21% (from 12.3% to 9.8%) and low-cycle EBITDA margin of 41% (from 9.1% to 5.4%) before considering cost pass through or emission reduction action (see Chart 8). As noted above, the impact at the company level may vary significantly from the sector wide result, due to differences in exposure, with the greatest impact being felt by BF/BOS producers. This scenario represents close to the full potential liability for carbon pricing for the sector, but it is highly unlikely that liable parties will be required to pay for 100% of emissions in the short or medium term.
- In scenario 2, process emissions from steel production using BF/BOS technology, which comprise almost 70% of sector emissions are excluded from liability. This results in a significant reduction in the cost of carbon to $144 million p.a. (see Chart 7) reducing EBITDA margins by 6% mid cycle (from 12.3% to 11.6%) and 21% low cycle (from 9.1% to 7.2%) (see Chart 8). The reduction in liability would accrue to BF/BOS producers, while the liability of scrap-based EAF producers would be the same as under scenario 1.

Chart 7: Annual Cost of $25 Carbon Price to the Australian Steel Sector
(Carbon price applied to emissions from all facilities globally owned by companies in the steel sector of the S&P/ASX200)

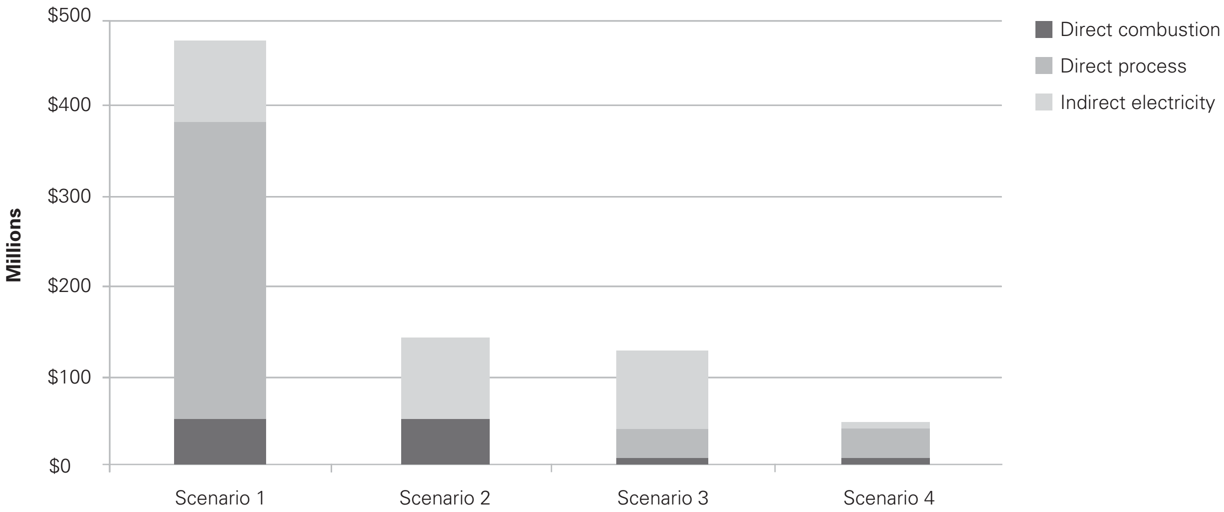
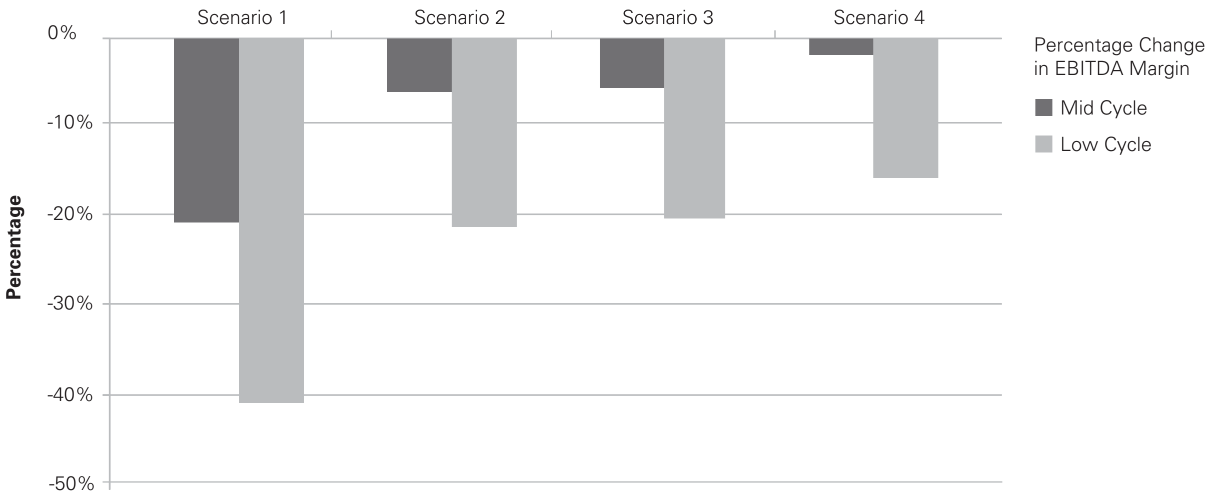


Chart 8: Impact of $25 Carbon Price on EBITDA Margins
(Carbon price applied to emissions from all facilities globally owned by companies in the steel sector of the S&P/ASX200)



3. Impact of a Carbon Price on the Steel Sector

- Under scenario 3 where all major emission sources are controlled, but free allowances are allocated for 90% of emissions, the total cost of carbon is estimated to be $130 million p.a. (with a carbon price of $25 per tCO_2-e) (see Chart 7). The majority of this total cost (71%) relates to electricity emissions because electricity generators are assumed to engage in 'opportunity cost pricing' such that they seek to recover the cost of carbon in relation to 100% of their emissions. This cost would fall more heavily on EAF producers, as the majority of EAF emissions are indirect, resulting from electricity consumption.
- Under scenario 4, this opportunity cost pricing is assumed to be eliminated. This significantly reduces the impact of carbon pricing (with the entire change attributable to a reduction in indirect exposure from electricity consumption). The total cost of carbon declines from $130 million p.a. in scenario 3 to $48 million p.a. in scenario 4 (with a carbon price of $25 per tCO_2-e) (see Chart 7).

3.5 Impact of Modelling Assumptions

3.5.1 Emissions Coverage

The emissions coverage modelled accounts for the majority of emissions in the steel industry supply chain. The extreme of economy-wide carbon pricing, where greenhouse emissions from all activities are subject to controls, would only increase the impact by a relatively small amount.

3.5.2 Carbon Prices

Results are sensitive to the carbon price assumptions. The carbon prices modelled are all based on prices in currently operating carbon markets.

Future carbon prices are highly uncertain, especially in the absence of specific regulatory proposals. Forecasts of future carbon prices vary significantly depending on the assumptions adopted. Recent attempts to model carbon price outcomes resulted in estimates of:

- $186 per tCO_2-e in 2050 – Allen Consulting Group modelling of an 'early action' scenario to reduce greenhouse gas emissions by 60 percent from year 2000 levels by 2050.[xxi]
- $77 to $525 (2005 A$) per tCO_2-e in 2050 – ABARE modelling across a range of scenarios to reduce global CO_2 emissions by 40% by 2100 relative to the reference case.[xxii]

These variations result in part from different reduction targets contemplated, but also reflect the uncertainty about how costly it will be to achieve the targeted greenhouse gas reductions.

The modelling in this report treats the carbon price as independent of other aspects of the carbon pricing regime such as sector coverage and the emissions 'cap' (or reduction target). However, in practice, carbon prices are determined by supply and demand for tradeable permits and demand is strongly affected by a range of factors including sector coverage and the emissions cap.

4. Assessing Individual Company Exposure to Climate Change Risk

In assessing the exposure of a particular steel sector company to climate change risk, consideration should be given to how exposure varies with each of the following elements:

1. Proportion of emissions subject to or likely to be subject to a carbon price – geography;
2. Emissions intensity – technology;
3. Ability to pass through cost; and
4. Risk mitigation opportunities.

Assessing exposure in relation to regulation that imposes a carbon price, which is considered to be an imminent risk associated with climate change, is described below. Other exposures are outlined briefly below under heading 5 Other Climate Change Risks.

4.1 Proportion of Emissions Subject to or Likely to be Subject to a Carbon Price – Geography

Exposure to carbon price risk varies across the jurisdictions where emissions occur, depending on the likelihood and design of a carbon pricing scheme.

Generally, countries that have committed to greenhouse gas reduction targets under the Kyoto Protocol present the highest likelihood of carbon pricing. However, there is no requirement on ratifying countries to establish domestic carbon pricing schemes and some ratifying nations intend to achieve their reductions without imposing any form of carbon price regulation.

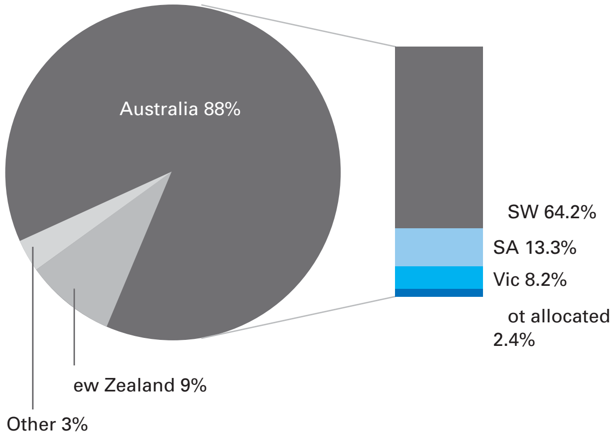
Equally, some jurisdictions that are not bound to reduction targets have proposed or introduced carbon pricing. For example, California has recently committed to implementing a carbon trading scheme.

The Californian example also demonstrates the potential for carbon price regulation to vary within a country – from region to region – as state and territory governments choose to implement carbon pricing where no national scheme is planned.

Accordingly, in assessing exposure to carbon price risk, it is necessary to gain an understanding of the jurisdictions in which significant emissions arise and the potential for carbon price regulation to be introduced in those jurisdictions. Ideally, an emissions profile would be developed for each jurisdiction in which there are significant emissions, to facilitate exposure analysis.

Chart 9 shows the geographic spread of greenhouse gas emissions from facilities owned by companies in the steel sector of the S&P/ASX200. The
vast majority of emissions (88%) occur in Australia. The only other jurisdiction where significant emissions occur is New Zealand.

Chart 9: Geographic Spread of Emissions* by Companies in the S&P/ASX200



* includes direct and indirect electricity emissions

At the company level, emissions from operations in Australia represent between 43% and 100% of total emissions from facilities globally.

Australia has not ratified the Kyoto Protocol, but has nonetheless stated its intention of meeting its Kyoto target (of increasing emissions by no more than 8% over 1990 levels over the period 2008-2012). On 3 June 2007, the Prime Minister announced that Australia will introduce a national emissions trading system beginning no later than 2012.[xxiii]

New Zealand has ratified the Kyoto Protocol and will introduce a domestic emissions trading scheme in 2008.

4. Assessing Individual Company Exposure to Climate Change Risk

4.2 Emissions Intensity – Technology

In assessing exposure to carbon price risk, it is important to understand the emissions intensity of the particular steel producer. As already mentioned, the emissions intensity of individual steel producers will depend largely on the production technology used.

Table 7 compares the emissions profile of BF/BOS to EAF (scrap-based) production. Emissions are grouped using the reporting classification recommended in *The Greenhouse Gas Protocol*, which closely aligns with exposure to different types of climate change regulation.

By comparing the share of each type of greenhouse gas emissions for the two principal steel production technologies it can be seen that:

- BF/BOS steel production has higher total exposure (2.55 tonnes CO_2-e per tonne of steel) and higher exposure to potential carbon pricing scheme that includes direct emissions from steel production (94% of emissions).
- EAF steel production has a higher exposure to potential carbon pricing scheme that only includes emissions from the electricity generation sector (80% of emissions).

As such, if a carbon price were imposed on electricity generation emissions only, similar to the NSW GGAS, steel producers using EAF technology would be more impacted than the steel producers using BF/BOS technology.

On the other hand, if industrial process emissions from the steel sector are subjected to a carbon price, as is the case with the EU ETS, steel producers using BF/BOS technology would be more impacted than the steel producers using EAF technology.

Where a producer has a mix of technologies, there may be some ability to switch production between facilities to minimise the cost impact under different scenarios. However, this will be constrained by numerous factors including capacity available. Even in the longer term, where new facilities can be built, use of lower emissions intensity EAF production may remain limited as:

- Scrap steel supplies are limited – where EAF production uses steel scrap as its primary feedstock, as in Australia, it operates as a reprocessing technology, ultimately reliant on BF/BOS steel production process to add new steel into the system;
- Scrap-based EAF production is not always able to achieve the same quality standards as BF/BOS, due to impurities in the scrap; and
- The capacity of EAF facilities is sometimes not large enough for them to compete in certain product segments, such as flat steel products.[xxiv]

Using iron from traditional DRI or new direct smelting techniques may be able to overcome these limitations of EAF production, but significantly increases greenhouse gas emissions per tonne of steel compared to scrap-based EAF production, bringing overall emissions intensity close to that of BF/BOS production.

Table 7: Exposure of Two Main Steel Making Technologies to different forms of Emissions Regulation

Scope	Emissions Type	Indicator of	Estimated tCO_2-e per tonne of steel	
			BF/BOS	EAF (Scrap-based)
1	Direct process emissions – process emissions from sources owned or controlled by the company / asset	Exposure to regulation of direct process emissions	2.11 (83%)	0
	Direct combustion emissions – combustion emissions from sources owned or controlled by the company / asset	Exposure to regulation of direct combustion emissions	0.29 (11%)	0.22 (20%)
2	Indirect electricity – emissions associated with the production of purchased electricity	Exposure to regulation of electricity sector emissions	0.15 (6%)	0.9 (80%)
3	Other indirect – emissions that are a consequence of the activities of the company, but arise from sources owned by another (suppliers or customers)	Exposure to regulation of emissions by other sectors	Minimal – specific estimate not available	Minimal – specific estimate not available
TOTAL			2.55	1.12

4. Assessing Individual Company Exposure to Climate Change Risk

4.3 Ability to Pass Through Costs

4.3.1 Directly

The impact of a carbon price will depend upon the extent to which the increased costs can be passed on to customers without reducing profits. Thus, in assessing the impact of carbon pricing, it is critical to understand the ability of the company to pass through costs by increasing the product price.

In general, the impact will be highest for companies that have a high exposure to international trade of commodity/ undifferentiated products. Companies that have a high exposure to this type of international trade, especially those with competitors in countries without greenhouse emission controls (with no need to increase prices), are price takers and any increase in prices will potentially result in customers moving to cheaper suppliers.

Overall, the Australian steel sector can be considered internationally trade exposed. Australian steel production represents less than 1% of global production and there are a number of potential sources of imported steel, particularly in Asia. Increasing supply from low cost producers in Asia has, in recent times, seen steel imports feature more prominently in the Australian market. China has recently become a net exporter of steel and Chinese capacity is projected to continue to grow rapidly.

While longer lead times, higher transport costs, and reliability of supply issues provide some barrier to imports, there is generally high substitutability between steel produced in different countries.[xxv]

However, import substitutability does vary among steel products. For some products, quality requirements and specific technical standards may still act as a constraint on imports. Thus, the exposure of a particular steel producer will depend on its product mix. Producers with a greater proportion of more high value add (downstream) products may have a comparative advantage at passing through cost increases. However, the quality of imported product continues to improve.

4.3.2 Via other Activities or Products

Steel producers may also be able to pass through costs via other activities or products.

While greenhouse gas emissions arise throughout the steel production supply chain – from iron ore and coal mining through to delivery and sale of finished goods – the vast majority of emissions arise in iron and steel making. Thus, the majority of carbon price exposure relates to these stages of production and would impact most heavily on manufacturing divisional margins.

Australian steel producers typically have a high degree of supply chain integration. Most are involved in all stages of steel production (see Table 8) and some also have involvement in supply or production of major inputs (iron ore or scrap).

Table 8: Stages of Steel Production
1. Processing of raw materials
2. Iron making
3. Steel making
4. Casting
5. Rolling and finishing

Thus, there is potential to spread the cost of carbon across activities and to choose on what products the carbon price is recovered. Integrated producers may forego recovery of carbon price costs on commoditised, internationally-traded intermediate products (such as hot rolled coil) where there are many potential substitutes which means that Australian steel producers are largely price takers.

Instead they can recover additional cost on differentiated, high value-add finished products, as these products have less potential substitutes and, therefore, have more price inelastic demand.

4.4 Risk Mitigation Opportunities

The cost of a carbon price can be greatly reduced through reducing greenhouse emissions (also referred to as emissions abatement). Thus, in assessing exposure to carbon price risk it is important to understand the company's ability to reduce emissions. Greenhouse gas emissions abatement may also be a revenue generation opportunity. Where reductions in excess of any mandatory requirements are able to be made, excess carbon credits can be sold, providing a new source of revenue.

Energy efficiency improvements have the potential to provide some emission reductions for producers using both BF/BOS and EAF technology. Historically, the steel industry has made significant improvements in energy efficiency. Developments over recent decades primarily relate to the collection and reuse of hot waste gases from the blast furnace, basic oxygen furnace and coke ovens (such as the cogeneration development announced by BlueScope Steel in November 2006[xxvi]); the partial substitution of coke with other fuels; and the introduction of continuous casting.

There is scope for Australian producers to further improve energy efficiency – Australian steel producers use around 26 gigajoules (GJ) of energy per tonne of steel produced, compared to Japan's average of 22 GJ and worlds' best practice of 19 GJ per tonne.[xxvii]

4. Assessing Individual Company Exposure to Climate Change Risk

BF/BOS technology relies on coking coal both as an energy source and as a necessary input in the chemical process of converting iron ore to pig iron. Despite the need for some coking coal in the process, there remains potential for BF/BOS producers to increase the proportion of energy needs met by fuels with lower greenhouse intensity than coal ('fuel switching').

Overall, the emissions reduction options are greater for steel producers using BF/BOS technology, primarily due to the high proportion of emissions from EAF technology that are indirect (related to electricity consumption). However, on site generation of electricity (using fuels with lower greenhouse intensity than the average of the electricity supply) may become a viable way for producers using EAF technology to reduce emissions.

Increasing the proportion of scrap input reduces emissions from both steel production processes.

- In BF/BOS production, maximum scrap input levels are around 35%[xxviii], whereas current scrap usage in Australia represents only approximately 20%.
- In EAF production, current scrap usage rates are already at maximum levels, so again emissions reduction opportunities are more limited.

Thus, carbon pricing has the potential to increase demand for scrap and drive up prices. If this occurred, the impact would be greater on EAF producers, for whom scrap represents a larger proportion of production costs. This may provide a competitive advantage to steel producers with better access to scrap.

Further opportunities for significant energy savings include:

- For BF/BOS production – coke dry quenching, which involves using an inert gas (usually nitrogen) to cool the hot coke produced to prevent it from oxidising. The hot gases can then be used to generate steam or electricity for use elsewhere in the mill. Compared to traditional water quenching, hot dry quenching offers significant environmental benefits, reducing energy consumption (and hence greenhouse emissions) by up to 1.7 GJ per tonne of dry coke quenched and significant reductions in water use.[xxix]
- For EAF production – capturing and using waste energy to preheat scrap. It is estimated that preheating scrap reduces electricity consumption by around 0.7 GJ per tonne crude steel.[xxx]

Emerging technologies, such as direct smelting and thin strip casting, outlined below, also offer potential for greenhouse gas emissions reductions, although their uptake depends on successful commercialisation and the ability to integrate new technologies with existing assets.

4.4.1 Emerging Technologies – Implications for Greenhouse Emissions

A range of new technologies being developed seek to reduce energy consumption and, hence, have the potential to reduce greenhouse gas emissions from steel making. Two technologies with significant emissions saving potential are:

- Direct smelting; and
- Thin strip casting.

Direct Smelting

Smelt reduction technologies are an alternative method of iron production that aim to provide a smaller scale, less capital intensive alternative to the blast furnace.[xxxi] Smelt technologies also offer the ability to produce pig iron from raw materials of a lesser quality than those required for blast furnace production.

Direct smelting can be combined with EAF steel production, enabling EAFs to move from steel reprocessing to steel production from virgin materials and compete directly with BF/BOS steel production technology.

Two vessel smelt reduction, such as the HIsmelt process, developed by Rio Tinto and partners, splits the iron making process in two:

- In the pre-reduction vessel, iron ore is partially reduced by hot waste gases originating from the second vessel.
- In the second smelt-reduction vessel, combustion of coal produces enough heat to smelt the pre-reduced iron ore.[xxxii]

The iron produced from direct smelting can be used in either an electric arc furnace or a basic oxygen furnace.

Table 9: Comparison of Iron Making Technologies – Energy Requirements and Greenhouse Gas Emissions

Iron Making Technology	gigajoules per tonne hot metal [xxxiii]	tCO_2 per tonne pig iron[xxxiv]
DRI (best practice)	13.5	n/a
HIsmelt	14-15	1.88
Corex	15.5-17.5	n/a
Blast Furnace (best practice)	16.1	2.35

n/a – estimate not available

Table 9 compares energy consumption and greenhouse gas emissions from different iron making technologies.

4. Assessing Individual Company Exposure to Climate Change Risk

While the HIsmelt process does not use less energy than current DRI processes, it offers other advantages by enabling steel making from non-coking coals and lower quality, high phosphorous iron ore fines.

HIsmelt Corporation claim that the technology presents the potential to reduce greenhouse gas emissions from pig iron manufacture by 20% (to 1.88 tCO_2 per tonne pig iron) compared to blast furnace production (at around 2.35 tCO_2 per tonne pig iron). [xxxv]

HIsmelt is undergoing progressive commercialisation with continuous production of molten iron from its smelt reduction vessel at Kwinana in Western Australia since late 2005. The plant is expected to reach its full production rate of 800,000 tonnes per year over the next three years.[xxxvi]

The only direct smelting process that has been successfully commercialised to date is the Corex process.[xxxvii]

EAF steel production using DRI as the primary feedstock has been growing rapidly in recent years, especially in Asia. Direct smelting technologies are highly applicable to this emerging market.

Thin Strip Casting

Thin strip casting represents a significant development in casting technologies, reducing rolling requirements well below those of conventional slab or thin slab casting.[xxxviii]

Thin strip casters cast steel strip of around 1-2 mm by pouring liquid steel between two counter rotating casting rolls. On exiting the rolls, the strip enters a controlled atmosphere to prevent scale formation and is then hot rolled before being cooled and coiled.

Thin strip casting has lower capital and operating costs than conventional hot strip casting technologies and also reduces energy consumption from the casting process by about 90% or around 2 gigajoules of energy for each tonne of steel cast.[xxxix]

Like thin slab casting, thin strip casting has the potential to enable smaller EAF producers to make hot rolled coil (HRC) and enter the flat products market. However, it presents challenges in commercialisation and diffusion because it is very different to conventional casting technologies.[xl]

US steel company Nucor operates the world's first commercial thin strip casting facility, which was developed following successful demonstration of the technology at BlueScope's Port Kembla steelworks.

4.4.2 Risk Mitigation – Good Practice Examples

Companies in the Australian steel sector are implementing a range of approaches to mitigating and managing climate change risk.

BlueScope Steel has approved a *Greenhouse Gas and Energy Policy* for its Industrial Markets Group, which accounts for approximately 90% of the company's global greenhouse emissions. The policy includes specific commitments to:

- Set targets to reduce greenhouse gas intensity and improve energy efficiency.
- Ensure greenhouse gas intensity and energy efficiency criteria are considered in the evaluation of acquisitions, mergers, agreements, new projects and contracts.
- Reduce greenhouse gas intensity and energy use through innovative design and efficient operating practices.
- Monitor, evaluate and report greenhouse gas emissions and energy intensity.[xli]

BlueScope Steel and OneSteel are both 'elective' participants in the New South Wales Greenhouse Gas Abatement Scheme. This means that they have chosen to be directly responsible for the greenhouse liability associated with their electricity consumption, rather than the electricity retailer meeting the liability and passing through the costs. By directly participating in the scheme, both companies are able to understand and better manage their cost exposure and gain valuable experience in the operation of a carbon pricing scheme.

In 2005, as part of an increased strategic focus on recycling, Smorgon Steel, which has recently merged with OneSteel, launched its Great Scrap Roundup to encourage farmers to clean up old metal scrap from their properties. As part of the Roundup, Smorgon paid for the scrap metal and made a $15 per tonne donation to local volunteer fire brigades. This initiative has multiple benefits, for:

- Shareholder value by tapping into new sources of scrap.
- Rural communities by supporting volunteer fire brigades.
- The environment by reducing raw material use and greenhouse gas emissions intensity.[xlii]

Sims Group's business model focuses on materials recovery and recycling, which are low emissions activities. Sims is expanding and diversifying its low-emissions activities. For example, through its investment in Landfill Management Services it is involved in the generation of renewable energy (from landfill gas) and carbon credits.

5. Other Climate Change Risks

Climate change presents multiple risks to company earnings, through a number of different exposures. This report has focused particularly on carbon price risk, which is considered to be a key risk and which is also increasingly imminent. While physical damage to infrastructure and operations is also a key risk to the Australian steel sector it is only outlined briefly below as it is covered more extensively in existing literature. Other risks associated with climate change such as other regulation, market risk, and litigation are also briefly outlined below. Each exposure and the potential impact on companies in the steel sector is discussed.

5.1 Exposure to Physical Impacts

Climate change is expected to make extreme weather events both more frequent and more severe. Such impacts are expected to cause damage to assets and infrastructure and lead to business and supply chain interruption.

Also, more frequent and extreme weather events are already leading to increases in insurance premiums. Climate change is expected to accentuate this trend and lead to an increasing number of weather-related risks becoming uninsurable.

Extreme weather events are also likely to lead to disruptions in the supply chain. For the steel sector, the most significant risk from exposure of the supply chain to physical impacts associated with climate change is an increase in weather-related construction delays. The impact of such supply chain exposure is capable of causing material impacts on sector earnings.

On the upside, an increase in weather-related disasters is expected to increase demand for steel for rebuilding efforts. While the effects of rebuilding efforts on demand from a particular disaster may be short-lived, they may also be material and climate change is expected to lead to such impacts becoming more frequent, potentially increasing the variability of earnings.

5.2 Climate Change Regulation other than Carbon Pricing

There is a growing range of regulation, other than carbon pricing, aimed at addressing climate change. This other regulation includes:

- Stringent approvals for new project for greenhouse/energy intensive industries; or
- Minimum standards and labelling of greenhouse/energy intensive products.

In Australia, a range of climate change related regulation has been introduced, for example:

- Schemes that promote the uptake of renewable energy, such as the Federal Mandatory Renewable Energy Target (MRET) and the Victorian Renewable Energy Target (VRET), which both place obligations on energy retailers to buy a minimum proportion of renewable energy.[xliii]
- The Greenhouse Challenge, which requires emissions reporting and reduction initiatives, has recently become compulsory for Australian companies receiving fuel excise credits of more than $3 million.[xliv]
- The Federal Government's Energy Efficiency Opportunities program, which commenced in July 2006, requires large energy users to undertake energy audits and develop and report against action plans to reduce energy consumption.[xlv]

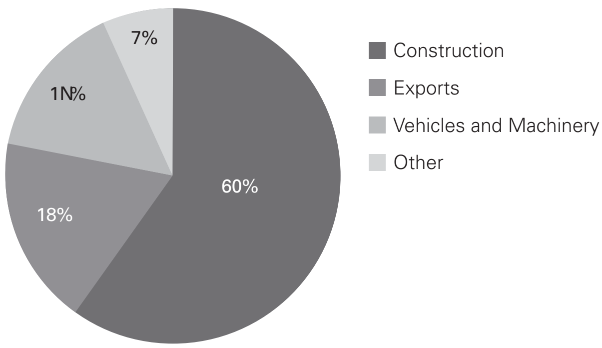
Ongoing rapid growth in emissions, along with increasing concern about the impacts of climate change, continues to create the impetus for new regulatory responses.

5.3 Exposure to Market Risk

Increasingly companies are facing market risks related to climate change. In addition to demand for low emissions 'green' products and the risk of consumer boycotts of greenhouse-intensive products, climate change regulation can also impact on demand.

The different energy and greenhouse profiles of products are expected to result in considerably different cost burdens from carbon price regulation and this has the potential to shift demand to less energy and greenhouse intensive substitute products.

Chart 10: Steel Market Segments



5. Other Climate Change Risks

The construction industry is the largest market for Australian steel totalling 60% of demand, with civil works representing 35% of total demand and buildings a further 24%. Vehicles and machinery markets together account for 15% and exports 18% of total steel demand (see Chart 10).[xlvi]

In the construction market segment, steel has limited substitutes in many applications. Key substitutes, such as aluminium and cement[xlvii], are also greenhouse intensive and are similarly exposed to potential regulation that imposes a cost for carbon.

In some applications, the impact of carbon pricing may be favourable for steel. While on a per tonne basis steel products may be relatively greenhouse intensive, in many applications the tonnage required is lower. This can result in the steel *product* having lower greenhouse intensity than substitutes. For example, in a timber framed house, steel cladding is estimated to result in the embodied energy of the wall system being 333 megajoules per square metre (MJ per m2) while clay brick veneer results in embodied energy of 561 MJ per m2.[xlviii] In such cases, a carbon price may result in substitution toward steel.

Steel is also highly recyclable. This means that some of the embodied energy can be recovered as energy savings in future production. As a result, where the total life cycle impact is considered, steel may have lower emissions than some substitutes.

In the motor vehicles sector, aluminium is the key substitute for steel. Aluminium is more greenhouse intensive to manufacture than steel. So, if carbon pricing was applied to all emissions from both sectors, steel may be at an advantage in relation to manufacturing costs. However, product substitution in this market is more likely to be driven by the impact of the product on emissions over the life of the vehicle, rather than emissions in manufacturing. Because aluminium is lighter than steel, replacing steel with aluminium can reduce vehicle weight and therefore, fuel consumption. This has already resulted in substitution away from steel and toward aluminium for automobile manufacturing. If a carbon price was applied to transport fuels, this would likely accentuate this trend.

New technologies that are producing lighter weight steel products could reduce the market risk associated with climate change for steel.

5.4 Exposure to Climate Change Litigation

Climate change litigation can involve actions against:

- Governments – seeking to influence policy or force action to limit greenhouse emissions, such as requiring climate change to be considered in environmental approval processes; or
- Businesses – seeking to impose liability for their contribution to climate change, following the example of tobacco and asbestos cases.

Australia has already seen several cases that have sought to stop new projects on the grounds of their greenhouse gas emissions, including actions against new coal mines.[xlix]

Potential litigation is greatest for companies whose products or operations are identified as being greenhouse intensive. Thus, the potential exposure of steel producers is relatively high. Showing leadership on climate change, in particular by taking action to minimise emissions, can help to reduce exposure.

6. Summary and Conclusions

The iron and steel sector is greenhouse intensive and this creates exposure to climate change risk, and in particular the risk of a carbon price.

Modelling shows that if steel companies were required to pay for emission permits for 100% of greenhouse gas emissions from facilities globally (full auctioning), the cost at a carbon price of $25 per tonne CO_2-e is equivalent to a reduction of 41% in low-cycle EBITDA margins (reducing from 9.1% to 5.4%) before considering cost pass through or emission reduction action.

While this is close to the full potential liability for carbon pricing at the sector level, it is unlikely that a scheme would be introduced that required companies to pay for 100% of emissions. A more likely scenario is that a proportion (and possibly a large proportion) of the permits will be allocated to companies for free.

Under a scenario with a low carbon price ($5 per tonne CO_2-e) and a large amount (90%) of emission permits allocated free, the cost to the steel sector is equivalent to a reduction of only 0.4% in mid-cycle EBITDA margins (reducing from 12.33% to 12.28%) before considering cost pass through or emission reduction action.

The modelling suggests that the potential cost of carbon pricing to the steel sector can be significantly reduced through the design and implementation of the carbon pricing scheme. Two key design issues are the emissions covered and the permit allocation method.

Under phase one of the EU ETS, the approach to permit allocation resulted in a windfall profit for many UK electricity generators, estimated to total £800 million per annum. Modelling shows that elimination of such opportunity cost pricing significantly reduces the impact of carbon pricing on the steel sector. At a carbon price of $25 per tCO_2-e with free allocation of 90% of permits, eliminating opportunity cost pricing resulted in the modelled total cost of carbon for the Australian steel sector declining from $130 million p.a. to $48 million p.a.

The sector level impact will not be shared equally across all steel companies. For example, if only emissions from electricity generation are covered the impact will be higher for steel producers using EAF technology as electricity costs are a much higher proportion of production costs than for BF/BOS technology and the industrial process emissions from the BF/BOS technology would not be covered.

For any company in the steel sector, there is the potential to minimise the impact of carbon price risk. Despite being an internationally trade exposed sector and largely a price taker in the commoditised, intermediate products market (such as hot rolled coil), there is potential for steel producers to pass on some of the cost of carbon to customers in the highly finished products market, thereby reducing the financial impact. Producers with a greater proportion of high value-add products may have a comparative advantage at passing through cost increases as these products have fewer potential substitutes and, therefore, more inelastic demand.

There is significant scope for steel producers to reduce the overall cost of carbon through reducing their emissions intensity. Emissions reduction opportunities differ between the two main steel making technologies and, as outlined, are generally more accessible to steel producers using BF/BOS technology. Emerging technologies present potential for further emissions reductions for both forms of steel production.

This report has focussed on one particular climate change exposure (carbon price risk), but climate change presents multiple risks to company earnings. Many climate change risks remain difficult to quantify. In part, this is due to uncertainty about the size, nature and timing of impacts. However, the key impediment to analysing the impact of climate change risk on value at the company level is availability of the relevant information. While leading companies are voluntarily publicly reporting on greenhouse emissions, climate change exposure, mitigation and management, the quality of disclosure varies and many companies do not report at all. Initiatives, such as the Carbon Disclosure Project, seek to increase the level of voluntary disclosure, by communicating to companies the importance of this information to investors and providing guidance about what should be disclosed.

Appendix: Methodology Notes

Greenhouse Gas Emission Estimates

Greenhouse gas emission estimates presented in this report have been developed using data from a variety of sources.

Wherever possible, data sourced directly from relevant Australian companies has been used. Estimates have been checked for reasonableness using relevant academic studies and other reliable third party sources.

Where no greenhouse data is disclosed at the company level, industry data or average product information has been used to develop estimates.

In aggregating emissions for the Australian steel sector, emissions associated with BlueScope's US-based joint venture facility have been excluded. For OneSteel, 2003-04 emissions estimates were used, as 2004-05 estimates were not reflective of historical trends due to a major upgrade in progress at the Whyalla facility.

The split between direct combustion, direct process, and indirect electricity emissions is based on company data where available. Where no company specific data was available, the typical values for different steel production methods presented in Table 2 have been applied to overall emission estimates.

Greenhouse Intensity of Earnings

Greenhouse intensity of earnings values presented in this report have been developed using:

- For the steel sector, estimates of:
  - Emissions for direct and indirect electricity emissions from facilities globally. Mobile sources have been excluded where possible.
  - Mid economic cycle earnings. It is noted that many companies in the sector are currently undertaking growth projects which are likely to lift the mid cycle level of earnings. This makes the task or forecasting mid-cycle earnings more subjective.
- For other example companies:
  - Emission estimates reported by the company. Thus, estimates reflect the geographic and emission source boundaries chosen by the company in preparation of its estimates. Wherever possible total global direct and indirect electricity emissions have been used and mobile sources have been excluded. Estimates are the most recent year for which data is available.
  - EBITDA values are as reported for the same period and the same geographic scope as greenhouse emission estimates. In cases where earnings are not reported for the same scope as greenhouse gas emissions, EBITDA has been calculated or estimated from available information.

Australian Steel Sector Model

The steel sector model developed for this report includes:

- Steel production data;
- Greenhouse gas emission estimates (tCO_2-e) for each of the following categories – direct combustion, direct process, and indirect electricity; and
- Mid and low cycle revenue and earnings estimates;

for each of the three companies in the steel sector of the S&P/ASX200.

As it is assumed that the carbon price liability is met by purchasing credits on market, the cost of carbon has been introduced into the model by multiplying the relevant emissions (direct combustion, direct process and/or indirect electricity) by the price per tCO_2-e. This additional cost flows through as a reduction in earnings and an impact on margins.

Company figures have been aggregated in arriving at sector totals.

References

[i] Includes energy and process emissions. Based on World Resources Institute (2005) *Navigating the Numbers: Greenhouse Gas Data and International Climate Policy*, available from http://www.wri.org/climate/pubs_description.cfm?pid=4093.

[ii] Emissions attributed to Iron and Steel (Kyoto accounting) in Dept of Environment and Heritage (2006) *National Greenhouse Gas Inventory 2004* available from http://www.greenhouse.gov.au/inventory/; excludes limestone and dolomite use, waste incineration, and transport.

[iii] International Iron and Steel Institute online steel production database available from www.worldsteel.org.

[iv] Dept of Environment and Heritage (2006) *Industrial Process Sector Greenhouse Gas Emissions Projections 2005*, p26, available from http://www.greenhouse.gov.au/projections/pubs/industrial2005.pdf

[v] Dept of Environment and Heritage (2006) *National Greenhouse Gas Inventory 2004*, p11, available from http://www.greenhouse.gov.au/inventory/. Figures are those attributed to Iron and Steel under the Kyoto accounting framework and excludes limestone and dolomite use, waste incineration, and transport.

[vi] Data retrieved from Australia's national greenhouse gas inventory for 2004, available from http://www.greenhouse.gov.au/inventory/.

[vii] Emissions in shipping and black coal mining are estimated to be around 1% of total embodied emissions of steel and natural gas production and iron ore mining less than 1% see Commonwealth Scientific and Industrial Research Organisation (2005) *Balancing Act: A Triple Bottom Line Analysis of the Australian Economy*, p175, available from http://www.cse.csiro.au/research/balancingact/.

[viii] Percentage non-$C0_2$ greenhouse gas emissions (direct and energy); calculated from data retrieved from Australia's national greenhouse gas inventory for 2004, available from http://www.greenhouse.gov.au/inventory/.

[ix] International Iron and Steel Institute (2005) *Sustainability Report of the World Steel Industry 2005* available from www.worldsteel.org.

[x] World Resources Institute and World Business Council for Sustainable Development (2004) *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)* available from www.ghgprotocol.org.

[xi] Per tonne values are estimates developed for this report. Data considered in developing these values include company emission estimates and production data (where available) and values included in Mæstad, O (2000) *Data for a Steel Industry Model*, p20, available from http://bora.nhh.no/handle/2330/1349.

[xii] Australian Bureau of Agricultural and Resource Economics (2005) *New Energy Technologies in APEC*, p69, available from www.ewg.apec.org.

[xiii] Mæstad (2002) *Climate Policy and the Steel Industry: Achieving Global Emission Reductions by an Incomplete Climate Agreement*, p8, available from www.nhh.no/sam/res-publ/2002/dp20.pdf.

[xiv] Full fuel cycle emission factors from Australian Greenhouse Office (2005) *AGO Factors and Methods Workbook*, pp43-45 available from http://www.greenhouse.gov.au/workbook/pubs/workbook-2005.pdf.

[xv] Excludes production from BlueScope's US joint venture.

[xvi] Excludes production from BlueScope's US joint venture.

[xvii] Numerous publications have discussed this issue. For a thorough treatment, including estimation of the size of windfall profits, see IPA Energy (2005) *Implications of the EU Emissions Trading Scheme for the UK Power Generation Sector (Report to UK Department of Trade and Industry)* available from http://www.ipaenergy.co.uk/downloads&publications/FINAL%20Report%201867%2011-11-05.pdf.

[xviii] There is no publicly available market data for the Greenhouse Friendly program. Approximate price information is based on personal communication from participants. For Chicago Climate Exchange carbon prices see www.chicagoclimatex.com.

[xix] $10 has been chosen for simplicity, actual spot prices at the time of drafting were slightly higher than this figure. For current price information refer to the environmental products page on www.afma.com.au.

[xx] Based on spot prices for trades on Powernext Carbon reported in *Tendances Carbone: The European Carbon Market Monthly Bulletin* (July 2006) available from http://www.caissedesdepots.fr/GB/publications/index.php.

[xxi] Allen Consulting Group (2006) *Deep Cuts in Greenhouse Gas Emissions: Economic, Social and Environmental Impacts for Australia*, p30, available from www.acfonline.org.au/uploads/res_BLRT_allensreport.pdf.

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[xxiii] Prime Minister of Australia John Howard, 'Address to the Liberal Party Federal Council' (Speech delivered in Sydney, 3 June 2007) available from http://www.pm.gov.au/media/Speech/2007/Speech24350.cfm.

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[xxv] Ibid, p13.

[xxvi] BlueScope Steel, 'NSW Government and BlueScope Steel: Working together to Reduce Greenhouse Gas Emissions' (Media Release, 16 November 2006) available from www.bluescopesteel.com.

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[xxviii] Mathiesen, L and O Mæstad (2002) *Climate Policy and the Steel Industry: Achieving Global Emission Reductions by an Incomplete Climate Agreement*, p5, available from www.nhh.no/sam/res-publ/2002/dp20.pdf.

[xxix] Australian Bureau of Agricultural and Resource Economics (2005) *New Energy Technologies in APEC*, p190, available from www.ewg.apec.org.

[xxx] Ibid, p192.

[xxxi] Australian Bureau of Agricultural and Resource Economics (2005) *New Energy Technologies in APEC*, p71, available from www.ewg.apec.org.

[xxxii] Ibid, p196.

[xxxiii] Ibid, p197.

[xxxiv] HIsmelt Corporation (2002) *HIsmelt – Meeting the Global Steel Industry Challenge*, p6, available from http://www.hismelt.com.au/EN/Documents/TechnicalPapers/2002_04_bates_goldsworthy.pdf

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[xxxix] Ibid, p94.

[xl] Ibid, p195.

[xli] BlueScope Steel, *Response to Carbon Disclosure Project Questionnaire* (2006) available from www.cdproject.net.

[xlii] Smorgon Steel, *Concise Annual Report 2005*, p15, available from www.smorgonsteel.com.au.

[xliii] For further information see http://www.orer.gov.au/publications/mret-overview.html.

[xliv] For further information see http://www.greenhouse.gov.au/challenge/.

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Resources

Climate Science
Intergovernmental Panel on Climate Change http://www.ipcc.ch/:
- *Fourth Assessment Report – Climate Change 2007*

Australian Greenhouse Office www.greenhouse.gov.au:
- *Stronger Evidence but New Challenges: Climate Change Science 2001-2005*

Australia's Greenhouse Gas Emissions
National Greenhouse Gas Inventory http://www.greenhouse.gov.au/inventory/index.html

Energy and Greenhouse Projections
National Greenhouse Gas Projections http://www.greenhouse.gov.au/projections/index.html

International Energy Agency www.iea.org:
- *World Energy Outlook www.worldenergyoutlook.org*

Australian Bureau of Agricultural and Resource Economics www.abare.gov.au:
- *Australian Energy: National and State Projections to 2029-2030*
- *Economic Impact of Climate Change Policy: the Role of Technology and Economic Instruments*

Projected Impacts for Australia
Australian Greenhouse Office www.greenhouse.gov.au:
- *Climate Change – An Australian Guide to the Science and Potential Impacts*
- *Climate Change Scenarios for Initial Assessment of Risk in Accordance with Risk Management Guidance*

Commonwealth Scientific and Industrial Research Organisation www.csiro.au:
- *Climate Change Projections for Australia http://www.dar.csiro.au/impacts/future.html*

International Agreements on Climate Change
United Nations Framework Convention on Climate Change and the Kyoto Protocol www.unfccc.int

Asia-Pacific Partnership on Clean Development (AP6) www.dfat.gov.au/environment/climate/ap6/

Greenhouse Accounting
World Resources Institute http://www.wri.org/ and World Business Council for Sustainable Development www.wbcsd.org:
- *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard www.ghgprotocol.org*

Carbon Trading
European Union Greenhouse Gas Emissions Trading Scheme http://ec.europa.eu/environment/climat/emission.htm

Chicago Climate Exchange www.chicagoclimatex.com

New South Wales Greenhouse Gas Abatement Scheme www.greenhousegas.nsw.gov.au

The World Bank Carbon Finance Unit www.carbonfinance.org:
- *State and Trends of the Carbon Market 2007*

International Emissions Trading Association www.ieta.org

Australian Financial Markets Association www.afma.com.au:
- *Market Data and Research – Environmental Products*

Australasian Emissions Trading Forum www.aetf.net.au

Climate Change and Investment
Institutional Investors Group on Climate Change (UK) www.iigcc.org

Investor Network on Climate Risk www.incr.com

Investor Group on Climate Change (Australia/New Zealand) www.igcc.org.au

The Carbon Disclosure Project www.cdproject.net

The Carbon Trust www.carbontrust.co.uk

Valuing Climate Change Risk
The Carbon Trust www.carbontrust.co.uk:
- *Climate Change and Shareholder Value*
- *A Climate for Change – A trustee's guide to understanding and addressing climate risk*
- *Brand Value at Risk from Climate Change*
- *Investor Guide to Climate Change*

United Nations Environment Programme Finance Initiative www.unepfi.org :
- *"Show Me The Money: Linking Environmental, Social and Governance Issues to Company Value"*
- *The Materiality of Social, Environmental and Corporate Governance Issues to Equity Pricing*

Enhanced Analytics Initiative www.enhancedanalytics.com

Ceres www.ceres.org and World Resources Institute www.wri.org:
- *Framing Climate Change Risk in Portfolio Management*

Total Environment Centre www.tec.org.au (authors AMP Capital Investors and Baker & McKenzie):
- *Climate Change and Company Value: a Guide for Company Analysts*

Climate Change and Steel
International Iron and Steel Institute www.worldsteel.org:
- *CO2 Breakthrough Programme*

Investor Group on Climate Change (IGCC)

The IGCC represents institutional investors, with total funds under management of over $375 billion, and others in the investment community interested in the impact of climate change on investments. The aim of the IGCC is to ensure that the risks and opportunities associated with climate change are incorporated into investment decisions for the ultimate benefit of individual investors. One of the key ways in which IGCC can work toward achieving this aim is through involvement in research projects such as this, to help the investment community better understand and assess climate change impacts.

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Australian Government

Australian Government
Department of the Environment and Water Resources

The Australian Government Department of the Environment and Water Resources (formerly the Department of the Environment and Heritage) develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage.

Other reports in the series are available at www.igcc.org.au