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New protectionism under carbon pricing:

case studies of LNG, coal mining and steel sectors

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Overview

The Federal Government has released a Clean Energy Plan and a draft of a Clean Energy Bill 2011 as part of its response to climate change. The plan provides assistance to Australia's emissions-intensive trade-exposed industries, which have argued that they should not pay a full price for their carbon pollution, or that taxpayers should pay them to reduce their emissions.

There is a legitimate role for government to protect industries by exempting them from some of their carbon pollution costs, where there is a credible threat that this could result in production shifting overseas without any improvement in global emissions (known as carbon leakage). However exemptions must be tightly targeted, because they increases the cost borne by the rest of the community to achieve Australia's emission reduction targets.

This report scrutinises three industries prominent in their claims for exemptions and other assistance: black coal; liquefied natural gas (LNG); and steel. It finds that taking into account recent commodity prices and exchange rates, the level of protection in the draft legislation is unjustified and costly.

With no protection, even if carbon prices rise for example, to $40 per tonne of CO_2 -- well above the Treasury forecast to 2020 -- it is difficult to foresee large job losses in black coal mining or LNG production. Australian export coal production and employment will continue to expand. And the viability of major LNG projects would not be significantly affected. Exemptions for LNG production put a particularly heavy burden on the rest of the community because its emissions are set to double in the next decade.

By contrast, the steel industry is under pressure due to shifts in global capacity and exchange rates that may well be structural and long-lasting. A carbon price with no assistance would add to these pressures. However, the government's proposed assistance is so generous that steel producers will receive an unjustified windfall gain.

The draft bill fails to tightly target assistance only where there is a genuine risk of carbon leakage. Instead, it implicitly aims to equalise carbon costs with international competitors irrespective of the risk of carbon leakage.

Claims for protection to ensure a level playing field and maintain jobs should always be scrutinised carefully. The Productivity Commission has played a vital role in doing so. Over 25 years, the Commission has exposed the costs of subsidising industries just because "other governments do it too". Unilaterally reducing industry assistance has lifted Australian living standards.

The draft bill asks the Productivity Commission to oversee industry assistance in the Clean Energy Plan. Yet it distracts the Commission from an unbiased consideration of the public interest in playing this role. The Commission should be given more scope to review protection in the wider public interest, applying a true carbon leakage test. To ensure transparency, the bill should also provide for public access to detailed data about industry emissions and levels of assistance.

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1. Report context

This report updates the analysis that was published in our 2010 report, *Restructuring the Australian Economy to Emit Less Carbon,*[1] which found that most claims for industry assistance to compensate for effects of a carbon price were unwarranted and expensive. In the current report we analyse the effects on three industries of a carbon price of $40 a tonne of CO_2-e ($40tCO_2). We have chosen this figure because it is well above the proposed starting carbon price and therefore any conclusions drawn from the analysis are robust well into the future.

The report follows the release in July this year of the Federal Government's Clean Energy Plan and scrutinises claims that the carbon price scheme should maintain an international "level playing field" - effectively an exemption for trade-exposed industries from the requirement to pay for their emissions permits. It evaluates these claims, and the government's response, relative to the government's original proposal for assistance for trade-exposed industry in its July 2008 Green Paper for the Carbon Pollution Reduction Scheme. The government's 2008 Green Paper provided a similar model of assistance to industry, but at lower levels and with more stringent eligibility criteria (see Appendix A for how assistance levels have changed over time).

1.1 Purposes of assistance

1.1.1 Assistance for businesses to remain open or workers to adjust and adapt

Economic theory[2] and empirical experience[3] suggest the most efficient method for achieving pollution reduction targets is to require the businesses that pollute to pay a fee or tax for each unit of pollution. However, this can be complicated by concerns for possible job losses.

In order to prevent the financial stress flowing from job losses, governments can often be drawn into policies that provide concessions and assistance directly to businesses, rather than workers, to shield them from competition and regulatory requirements. While these policies may preserve some jobs for a period of time in a particular sector, they come at a cost for the rest of the Australian community, who ultimately end up footing the bill for this assistance. Often the jobs that government sought to preserve are still lost, but the community as a whole has less money available to assist the displaced workers than if financial support had not been provided to the employing businesses.

In many cases it will be better for government to provide assistance directly to the workers themselves. When government attempts to protect existing jobs, it can lead to workers being stuck in unsustainable industries, and the local economy not

[1] Daley and Edis (2010)

[2] Stern (2006)
[3] Daley, Edis and Reichl (2011)

being given the incentive to innovate and produce the new industries that will employ workers of the next generation.[4]

1.1.2 Justifications for assisting businesses

In the case of reducing carbon emissions, assisting businesses is being justified by the government on two bases:

1. Creating a smooth transition. The argument for assistance is that industry needs to be given some time to adjust and innovate.

2. Preventing carbon leakage. The argument for assistance is to avoid a shift in production from Australia to another country with no improvement in global carbon emissions.

Such justifications must be examined very closely because the amounts of assistance per worker protected are in many cases very high. Our prior report found that across the seven industries examined, the government's prior CPRS would have awarded average assistance equating to $65,000 per worker per annum.[5]

Creating a smooth transition

Our April 2010 report identified that assistance premised on enabling a smooth transition requires good evidence that there will be deadweight losses without it (such as plants closing relatively shortly after the introduction of a carbon price that over a longer period would have been viable). There is still very little analytical work to support such a case from either government or the industries that are seeking assistance. The government's emissions reduction targets already embody an attempt to impose a relatively gradual economic impact calibrated to international efforts to restrict carbon emissions.[6] Furthermore the assistance proposed by the government for emissions intensive trade exposed industry does not appear to be particularly transitional. The proposed rate of degradation in the level of free permit assistance for EITE facilities, if maintained beyond 2020, would only conclude around the end of this century.

The government is proposing to provide direct assistance to operators of coal mines with particularly high emissions from the mining process. This has been justified as a way of providing time for exploring options to reduce these emissions and to safeguard jobs.

It might be better to direct assistance towards accelerating the development of abatement technologies directly, rather than propping-up existing plants in the hope they might direct some of this money towards research into abatement technologies.

[4] McColl and Young (2005)
[5] Daley and Edis (2010)

[6] For example the Stern Review (2006) estimated the social damage impact of a tonne of CO_2 at US$85 yet the Australian carbon price will commence at AUD$23t$CO_2$

Providing assistance to keep businesses operating that have high emissions intensity is likely to inhibit structural changes that enable the country to achieve its emission reduction targets efficiently. To provide assistance for "transitional" purposes requires a much more thorough justification than has been produced to date.

A rapid transition does not necessarily increase long-term unemployment and decay. As the Productivity Commission found, a high rate of economic change in a local area does not necessarily result in a shrinking economy and job losses; rather successful adjustment depends on how rapidly individuals and businesses reorganise their affairs to the new conditions.[7]

Carbon leakage

There is a legitimate role for government to protect some industries by exempting them from some of their carbon pollution costs, where there is a credible threat that this could result in production shifting overseas without any improvement in carbon leakage. However the possibility of carbon leakage does not necessitate a blanket exemption from the carbon price for any business exposed to international trade. Exemptions must be tightly targeted, because any exemption increases the cost borne by the rest of the community to achieve Australia's emission reduction targets.

Over the past three years since the government first proposed assistance for trade-exposed industry as part of its carbon pricing policy, it has faced intense lobbying from these industries for a large-scale exemption from their carbon costs. Industry have argued that until all other overseas competitors face an equivalent carbon price the government should protect them from a carbon cost in the interests of an international level playing field.

While the government always accepted the need to provide assistance to avoid carbon leakage, it originally rejected the idea that this meant the level of assistance must act to level the playing field.[8] The assistance rates, while generous, for most plants fell short of a complete exemption.

The Exposure Draft of the Clean Energy Bill 2011 implicitly adopts the level playing field rationale in the objectives it sets for the assistance package for trade-exposed industry. In effect it proposes that while our industries' competitors are not constrained by carbon policies comparable to Australia's, the level of shielding from the domestic carbon price will be frozen at levels of 60% to 90%. In other words, the Bill seeks to create an artificial international level playing field for our trade-exposed, emissions-intensive industries as a way to reduce the risks of carbon leakage. This is not the right approach.

The draft Bill departs from the standard definition of carbon leakage, which is the movement of industry production offshore without any fall in carbon emissions.[9] Instead, the Bill understands carbon leakage in terms of the incentives for production "to be located in, or relocated to, foreign countries as a result of different climate change policies applying in Australia compared to foreign

[7] Australian Government Productivity Commission (1998)

[8] See 1st and 2nd paragraphs of page 294 of the Carbon Pollution Reduction Scheme Green Paper (Australian Government (2008a));

[9] Garnaut (2008b)

countries''.[10] This definition does not consider the impact that industry relocation would have on emissions outcomes, which is the ultimate policy concern. If the Bill truly aimed to prevent carbon leakage, it would include principles testing whether industry is in fact likely to move offshore predominantly due to the carbon price, and whether this movement would lead to higher carbon emissions. Instead its provisions focus on whether competitors pay equivalent carbon prices.

The draft Bill's underlying assumption that there should be an international level playing field sounds fair on the surface. But in effect it embeds a protectionist policy. It perverts the historic role of the Productivity Commission in reducing protectionist measures to increase the productivity of the Australian economy. It perpetuates distortions that benefit emissions-intensive industries while imposing significant costs on other Australians.

Industry advocates say it is unfair to require some Australian companies to pay more than their international competitors. But the alternative is unfairness for other Australians and, on average, a community that is worse off. Both sides of politics are committed to the same emissions reduction target and there is no avoiding a tough choice. Either:

- Treat emissions intensive industries unfairly relative to their international competitors; OR
- Treat other Australians unfairly relative to emissions intensive industries.

Economic theory shows that the second choice reduces the welfare of Australians more.

If an industry is unduly shielded from the carbon price, it might be larger than if it paid the full price. As a result, its emissions will be higher. In order to reach Australia's emissions targets, other industries and consumers must reduce their emissions more, or pay others overseas for emission reduction credits.

By analogy, imagine a trucking company that doesn't have to pay fuel tax or road tax. As it expands, wear and tear on the roads increases. The wider community must pay for this, perhaps through higher fuel and road taxes. Surely the trucking company should pay for costs its activities impose on other Australians?

Carbon pricing imposes a variety of economic burdens across the community and the economy.

Overall, carbon pricing reduces net Australian welfare by the cost of reducing emissions to reach the emissions targets, plus the cost of administering and complying with carbon pricing legislation. In graphical terms, the net welfare loss is the area under the carbon emissions abatement cost curve, as shown in Figure 1.1.

[10] DCCEE (2011) *Exposure Draft (28/07/2011): Clean Energy Bill 2011* (2011) s.143(2)(b), s.156(2)(d), s.156(3).

Figure 1.1 Welfare impact of carbon pricing

CONCEPTUAL

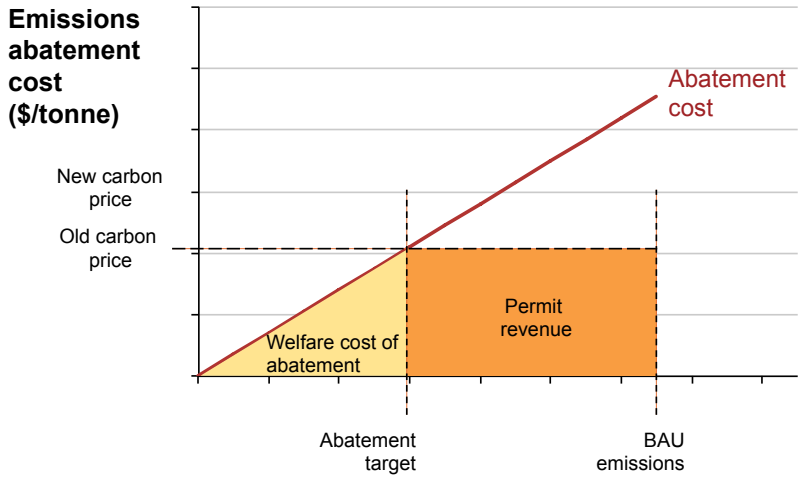
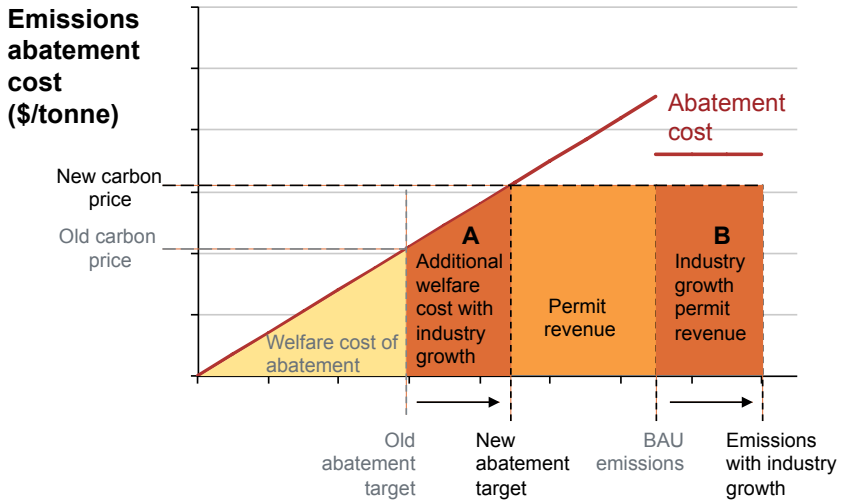


Figure 1.2 Welfare and fiscal impact of industry growth

CONCEPTUAL



The distribution of this welfare loss across the community depends on the emissions intensity of activities and how much of the carbon cost increase businesses pass on to consumers. Over the long run, one would expect domestic businesses to pass on all of these costs to Australian consumers, whose welfare reduces accordingly.

If an export industry increases production, this imposes a welfare cost on the community roughly equal to the carbon price liability, assuming no free permits. As shown in Figure 1.2, the area of additional welfare loss (A) is roughly equal to the additional tax revenue (B).

A carbon price also collects additional permit revenue, as shown in Figure 1.1. This increases general government revenue, and government can choose whether to increase spending, reduce taxes (on either individuals or companies) or provide "free" permits with this revenue. The appropriate distribution will ultimately depend on general principles of tax and redistribution policy.

If the LNG industry as assessed in this report paid for all its emission permits, it would have fewer incentives to expand so its emissions would be less than otherwise. Other Australians could then have higher emissions, and the cost of reaching targets would be lower. Alternatively, the carbon price might not in fact

change decisions about the size of the LNG industry's output. Expansion might be so profitable that carbon prices do not affect it. If so, it seems only fair that it should pay carbon prices for the costs that its expansion imposes on other Australians.

The issue is particularly stark for this industry. Since it is expected to expand substantially over the next two decades, other Australians will have to reduce their emissions much more. It is unfair that the LNG industry will not shoulder its share of this burden.

In effect, free permits or other carbon price shielding assistance for emissions intensive industries are a form of protection or industry subsidy justified on the basis that "other countries do it too". As Australia discovered over three decades of economic reform, such subsidies may preserve the affected industry, but they impose higher net costs on the community. Total productivity – and therefore living standards – is higher if subsidies to particular industries are minimised. Industry specific subsidies only make sense if governments are obliged to be fair to industries. But the primary obligation of governments is to maximise the prosperity of all Australians.

As the Bill's objectives are worded, the outcomes of industry assistance may well be protectionist. To avoid this, the provisions of the legislation could be simplified to just one of the four objectives currently in the Bill – to provide assistance to trade-exposed industries in a manner that is "economically and environmentally efficient". It can then be left up to suitably qualified institutions such as the Productivity Commission to assess whether assistance meets this broad objective.

2. Liquefied Natural Gas (LNG)

A carbon price of $23 – or even $40 – is unlikely to change decisions to invest in new LNG facilities or the production of existing facilities.

Nor is an Australian carbon price likely to increase global emissions by inhibiting a switch in power generation overseas from coal to gas.

Bereft of these justifications, free permits or an exemption for the LNG industry will simply increase the cost to Australia of achieving its emissions target. Assistance at the government's proposed level amounts to a cost of $4b over the period 2012-2020.

The LNG industry is forecast to double its emissions over the next decade. This will effectively increase the costs for other Australians of meeting Australia's emissions targets. It is unfair if free permits exempt the LNG industry from bearing its fair share of these costs.

2.1 Impact of carbon price on Australian LNG production

A carbon price of $23 – or even $40 – is a second order factor in the economics of LNG projects which has not inhibited multi-billion dollar investments in new LNG facilities, and would not change the output of existing facilities, even if the industry received no free permits.

As our 2010 report explained, projects already in operation – the North-West Shelf and Darwin LNG plants -- have substantial operating cash margins. The cost to operations of a carbon price is too small to affect production decisions.[11]

In terms of future Australian LNG projects, the carbon price represents a relatively small factor impacting on their financial viability. Table 2.1 details each of the LNG projects in which major international and Australian corporates have already committed to invest since July 2008 when the government released the CPRS Green Paper. These companies have clearly felt confident enough to commit billions of dollars in investment even though a carbon pricing scheme is reasonably likely in the near-term and there has been ongoing uncertainty about assistance levels for LNG.

[11] Daley and Edis (2010)

Table 2.1 LNG Project Investment Commitment since CPRS Green Paper

Project and date	Lead Developer	Investment
Gorgon (15Mtpa) – Sept 2009	Chevron	$50b
Queensland Curtis LNG (QCLNG) (8.5Mtpa) - Oct 2010	BG Group	$15b
Gladstone LNG (GLNG) (7.8Mtpa) – Jan 2011	Santos/Petronas	$16b
Prelude (3.6Mtpa) – May 2011	Shell	$8b
Australia Pacific LNG Train 1 (APLNG) – July 2011	Origin/Conoco Phillips	$14b
TOTAL		**$103b**

Sources:Hirjee et al (2009); Hirjee et al (2011b); Wilson, Butcher and Sweet (2010); Ramsey and Hardie (2011); Hirjee et al (2011c)

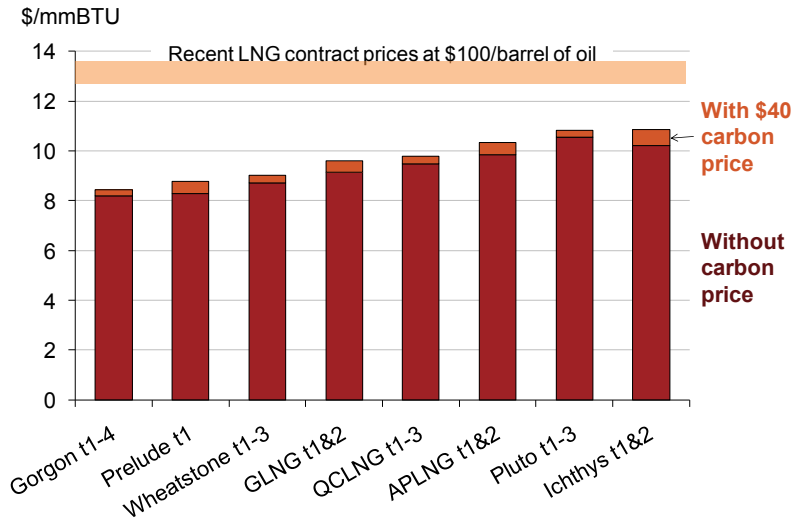
For LNG projects to proceed they need to obtain sufficient returns to repay lenders to the project and investors in the companies concerned, usually underpinned by long-term contracts with LNG customers. Analysts from several major investment banks estimate that the threshold rate of return these projects require is around 10% to 12% per annum.[12] Since our April 2010 report the expected construction costs of LNG projects have escalated. However this has been offset to a large degree by higher oil prices expected into the future (which is linked to prices for LNG). Figure 2.1 estimates the LNG price that several major Australian projects require to achieve a 12% return. This is based on reports from Citi, Macquarie Bank and Wood Mackenzie published since June 2011, and incorporating more recent construction cost estimates and exchange rates. It also indicates the price for LNG obtained from customers in recent contracts at oil prices of $100 per barrel (the US Government EIA reference case forecast is $95-$108 per barrel to 2020[13]). Based on this information, these projects would make returns above the 12% cost of funds. A carbon price makes the project less profitable but its impact is small relative to other factors such as oil price changes and construction costs.[14]

[12] Grunauer (2011), Bullen, Heard (2010), Hirjee, Morgan, Lewandowski (2011a), Wilson, Butcher, Gupta (2011), Wood and Hira (2011b)

[13] US Energy Information Administration (2010)

[14] See table 4.3 on page 25 of Daley and Edis (2010b)

Figure 2.1 LNG price required for 12% return on LNG projects (AUD per mmBTU)



Free on Board basis. Incorporates offsetting revenue from oil condensate. Assumes Parity in $A:$US; 12% WACC. t = LNG train which is a major increment of new liquefaction capacity
Sources: 12% return costs: Greenwood, Koenders, Pachnanda (2011), Wood and Hira (2011b) Wood MacKenzie (2011) with Grattan Institute estimates of carbon cost impact. LNG price: Spence, Chan, Pintar (2011); Greenwood, Koenders, Pachnanda (2011); Hirjee, Morgan, Lewandowski (2011b). Emissions: Gorgon: Chevron Australia (2006); Pluto: WA EPA (2011); QCLNG: QGC Limited. (2009); Wheatstone: WA EPA (2011); GLNG: GLNG (2009); Prelude: Shell Australia (2009) APLNG: Australia Pacific LNG (2010); Ichthys: INPEX (2010)

This is in line with investment bank analyses. A Macquarie Bank analysis, using a carbon price of $35tCO$_2$ found that,

> *"LNG project economics remain surprisingly unaffected by the proposed carbon tax."* [15]

The major constraints to LNG projects proceeding in Australia are labour and materials bottlenecks leading to construction cost escalation.[16] The carbon price by comparison has a relatively small impact on economics and has not inhibited very large investment commitments over the past 2 years, which are already running well ahead of actual construction.

2.2 Impact of carbon price on coal to gas switching

An Australian carbon price is unlikely to increase global emissions by inhibiting a switch in power generation overseas from coal to gas.

Industry representatives argue that LNG should be exempted from paying a carbon price because it has the *"potential"* to lower global emissions by replacing coal in electricity generation.[17] According to this argument, the extra cost imposed on Australian LNG as a result of the carbon price will lead to global emissions becoming worse as customers favour coal instead.

While gas certainly has the potential to produce lower emissions ***if*** it substitutes for coal in electricity generation, this is not enough to justify an entire exemption for the whole LNG sector. One

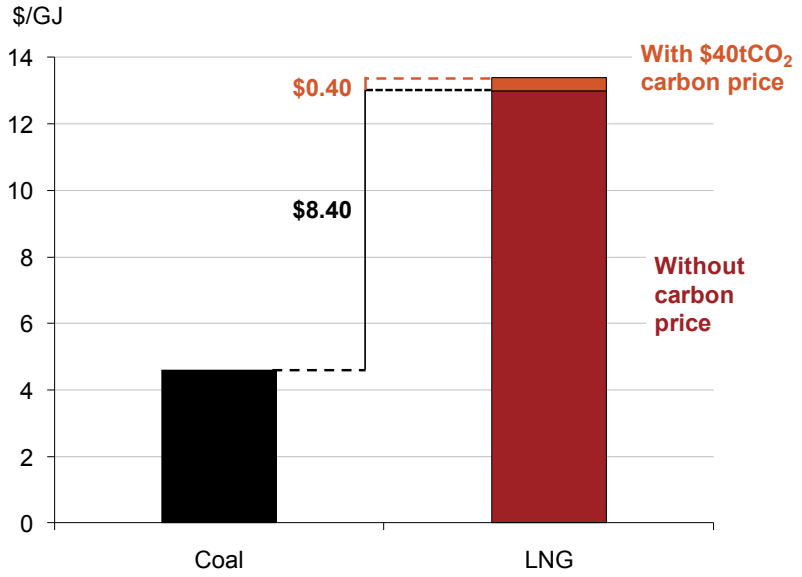
[15] Wood and Hira (2011)
[16] Wood and Hira (2011b)
[17] APPEA (2011); ABC Radio Australia (2011)

needs to consider the likelihood of a unit of Australian LNG substituting for coal and not just gas from other countries or possibly even nuclear power; and the degree to which a carbon price might inhibit that substitution from occurring. Taking this into account the case for an exemption is questionable.

Where gas might replace coal, carbon costs are a relatively small influence. The price of coal delivered to major Asian customers is around $4.60 per GJ[18] versus $13 per GJ[19] for LNG based on recent contracts (at oil price of $80/barrel). A carbon price of $40t$CO_2$ would change this price differential by 40 cents per GJ, or less than 5% as illustrated in Figure 2.2.

Because gas has different physical qualities, it usually does not compete directly with coal on price. It is a more convenient and safer fuel than coal for many purposes. It is easy to transport around cities and into homes and businesses via pipelines. For industrial and domestic heating and cooking it can be more easily ignited and turned up and down. It also burns with lower particulate and nitrogen oxide emissions than coal which is very important for household use and within city air sheds (due to their effect on human health). This means it is heavily favoured for direct heating purposes. Small incremental carbon costs will make little difference to these non-price factors.

Figure 2.2 Price of energy from coal and LNG in Asia (AUD per GJ)



Notes: Based on oil price of USD$80/barrel of oil. Assumes shipping cost of $1.20 per GJ of LNG taken from MMA and KPMG (2008); and $15 per tonne of coal to North Asia from Australia derived from Southwood and Gray (2011).. Based on parity between AUD:USD.

Sources: Coal price – Southwood and Gray (2011). LNG price – Spence, Chan, Pintar (2011). Carbon cost – Grattan analysis based on $40tCO2 carbon price

When producing electricity, generators using gas can vary their output far faster than coal generators and the cost of building gas power stations is less. So although gas fuel costs more than coal, it is favoured for meeting temporary daytime peaks in electricity demand. Energy industry analysts Wood Mackenzie believe that

[18] Southwood and Gray (2011)
[19] *Spence, Chan, Pintar (2011); And* MMA and KPMG (2008) for delivery costs

while there will be notable growth in demand for gas in China, this will not be because it will be replacing coal. Coal's substantially lower fuel cost means it will continue to be favoured for base-load power generation.[20]

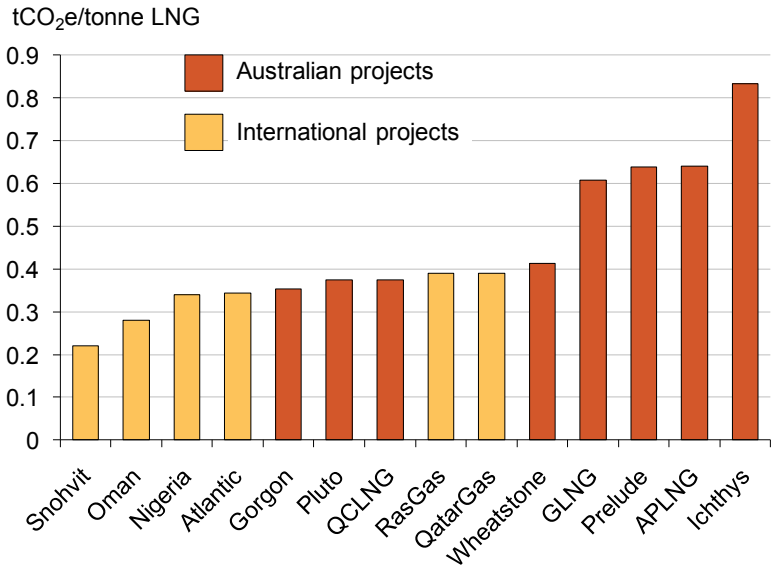
Even if an exemption to LNG would lower emissions in other countries by supplanting coal (which is highly unlikely), it creates a precedent that would be almost unworkable to implement in practice. If LNG receives an exemption because it lowers emissions overseas, then to maintain consistency, coal exported from Australia should have an additional carbon levy applied. Uranium and renewable energy exports would also be entitled to an additional subsidy. Trying to accurately estimate the impact of Australian exports on overseas emissions would be difficult.

2.3 Impact of Australian LNG production on global gas production

While it appears highly unlikely that a carbon price will inhibit LNG development, any marginal change in Australian LNG production is most likely to result in changed gas production elsewhere.

Such substitution may or may not reduce global emissions. Several of the Australian LNG projects under development have substantially greater carbon emissions than LNG projects overseas. For example several Australian projects under development – Ichthys and Prelude - have substantially more CO_2 within their oil and gas reservoirs than some LNG projects overseas (Figure 2.3). As well, the coal seam methane LNG projects under development in Queensland require greater amounts of energy to extract the gas than conventional gas projects. For example, even though the Asia-Pacific LNG (APLNG) project has low CO_2 within its gas reservoirs, its overall emissions intensity is about the same as Prelude which has a high proportion of CO_2 (9%) within its gas reservoirs. On this basis, the case for assistance has not been made.

Figure 2.3 Emissions intensity of LNG projects



Sources: Emissions intensity of international projects: QGC Limited (2009). Emissions intensity of Australian projects: Gorgon: Chevron Australia (2006); Pluto: WA EPA (2011); QCLNG: QGC Limited. (2009); Wheatstone: WA EPA (2011); GLNG: GLNG (2009); Prelude: Shell Australia (2009) APLNG: Australia Pacific LNG (2010); Ichthys: INPEX (2010)

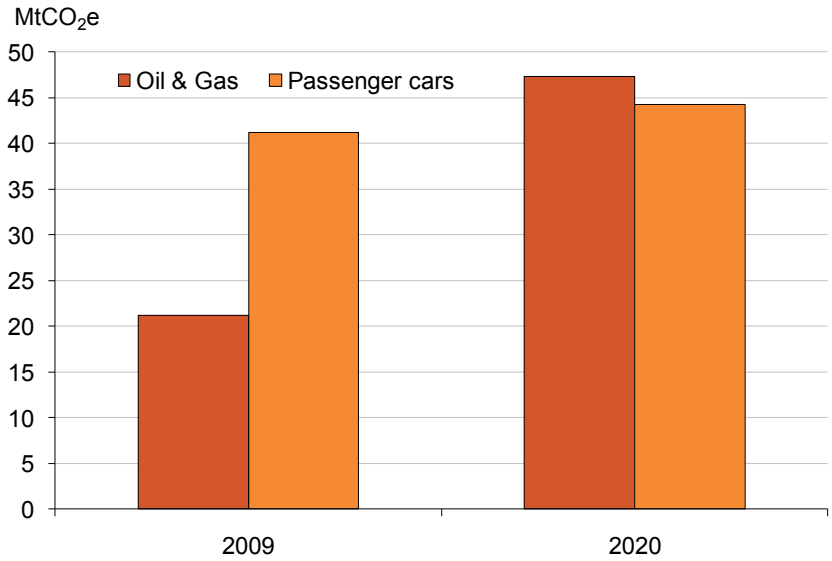
[20] Hirjee, Morgan, Lewandowski (2010)

2.4 Consequences of free permits for LNG

Development of oil and gas fields for LNG production is forecast to become a substantial source of greenhouse gas emissions in Australia. As discussed above, these LNG projects will almost certainly be developed irrespective of whether they pay a carbon price. These developments will effectively impose higher carbon costs on other Australians if they were granted a full exemption. Because LNG developments will substantially increase Australian emissions, other Australians will have to work harder, at higher costs, in order to meet Australia's greenhouse gas emissions targets, or pay countries overseas to implement emission reduction projects. It appears unfair for the LNG industry to impose these costs without paying its fair share of carbon costs.

Combustion emissions from liquefying gas for export are forecast to grow 400%: from 6m tonnes CO_2e in 2009 to 26m tonnes by 2020.[21] If we also incorporate fugitive emissions, growth in LNG emissions will make the oil and gas sector one of the largest sources of emissions in Australia by 2020. Figure 2.4 illustrates that LNG emissions will exceed those from Australia's entire passenger car fleet.

Figure 2.4 Oil and gas vs passenger car emissions



Sources: DCCEE (2010). ACIL Tasman (2011)

An exemption would also substantially reduce the amount of money available to government. For example, it could represent a substantial level of compensation to Australian households, as shown in Table 2.2. While the government did not grant a full exemption, rather than requiring the industry to pay their full carbon costs as originally proposed in the Green Paper, it will exempt them from 50% to 66% of their carbon liability via free permits equal to $4b over the 2012-2020 period.

[21] ACIL Tasman (2011)

Table 2.2 Potential forgone compensation to households from fully exempting the oil and gas sector from the carbon price

Oil & Gas sector – Expected cumulative carbon tax owing (2012-2020)	Forgone cumulative compensation/tax relief per household (2012-2020)
$8.57b	$910

Note: Liability calculated in 2012 dollars on basis of carbon price in 2012 of $23t$CO_2$ ascending by 2.5% real for next two years and then a linear rise to $40t$CO_2$ in real terms by 2020 (real $2.64 per annum increase)

Sources: DCCEE (2010), ACIL Tasman (2011), ABS (2010)

3. Coal Mining

An initial carbon price of $23 – or a rise in carbon prices to $40 – appears unlikely to substantially affect the future production and expansion of Australian black coal mines.

Even if a carbon price does make a significant difference to margins for some Australian mine expansions, it is not clear that this volume would be lost to overseas producers. For example, particularly for coking coal, the extra carbon cost may be passed on as higher international prices while Australian coal production continues to expand. Alternatively, even if some expansions were inhibited by the carbon price, other Australian projects may then proceed that are otherwise constrained by limited infrastructure, labour and materials.

Consequently assistance for black coal exports effectively just imposes costs on other Australians, with no material impact on total exports.

3.1 Impact of carbon pricing on Australian coal exports

A carbon price of $23 - or a rise in carbon prices to $40 - appears unlikely to substantially affect the future production and expansion of export-oriented Australian black coal mines. For the vast majority of coal mines the carbon price will represent a relatively modest increase in costs such that most mines appear to still be viable. This was also the broad conclusion of our 2010 report, and the latest data reinforce this conclusion.

This conclusion is strengthened by a more detailed breakdown of mine-by-mine emissions intensity and firm-specific and, in some cases, mine-specific data on production cash costs (mine-by-mine data and information sources are listed in Appendix B). Coupled with substantial rises in the price of thermal and metallurgical coal (which have outstripped rises in the Australian dollar exchange rate), the more detailed analysis shows that the Australian coal industry has greater capacity to absorb a carbon price than our earlier report suggested (mines focused on the domestic market were excluded because there is no risk of perverse carbon leakage).

As shown in Figure 3.1 and Figure 3.2, whilst the relative impact of a carbon price does vary, profit margins are generally expected to remain positive even with a $40 carbon price.

Recent price rises for coal in AUD terms are much higher than the proposed carbon costs. The price of thermal coal increased by $25 per tonne (AUD) and coking coal by $90 per tonne (AUD) between July 2009 and July 2010. Yet for 90% of thermal coal mine production and 70% of coking (metallurgical) coal production a carbon price of $40 would add less than $4 per tonne of coal produced.

Based on the evidence available, production costs of only one mine (about 0.2% of Australia's production) are close to expected prices for coal. This mine (Tasman) was already likely to be unviable before the $3.20/tCoal impact of the carbon price on production costs if thermal coal prices decline to the lower levels in forecasts. A review of publicly available information on global coal mine industry cost curves confirms that Australian producers

would remain competitive with a $4 rise in production costs per tonne of coal.[22]

Independent industry analyses support this view. CitiBank, using a carbon price of $20 and $50t$CO_2$ found that:

> *"…a carbon price is unlikely to force significant mine closures."*[23]

Wood Mackenzie in their analysis of the carbon price on Australian coal mines[24] stated:

> *We expect the government's carbon policies to have only a limited impact on average cash costs across Australia.*

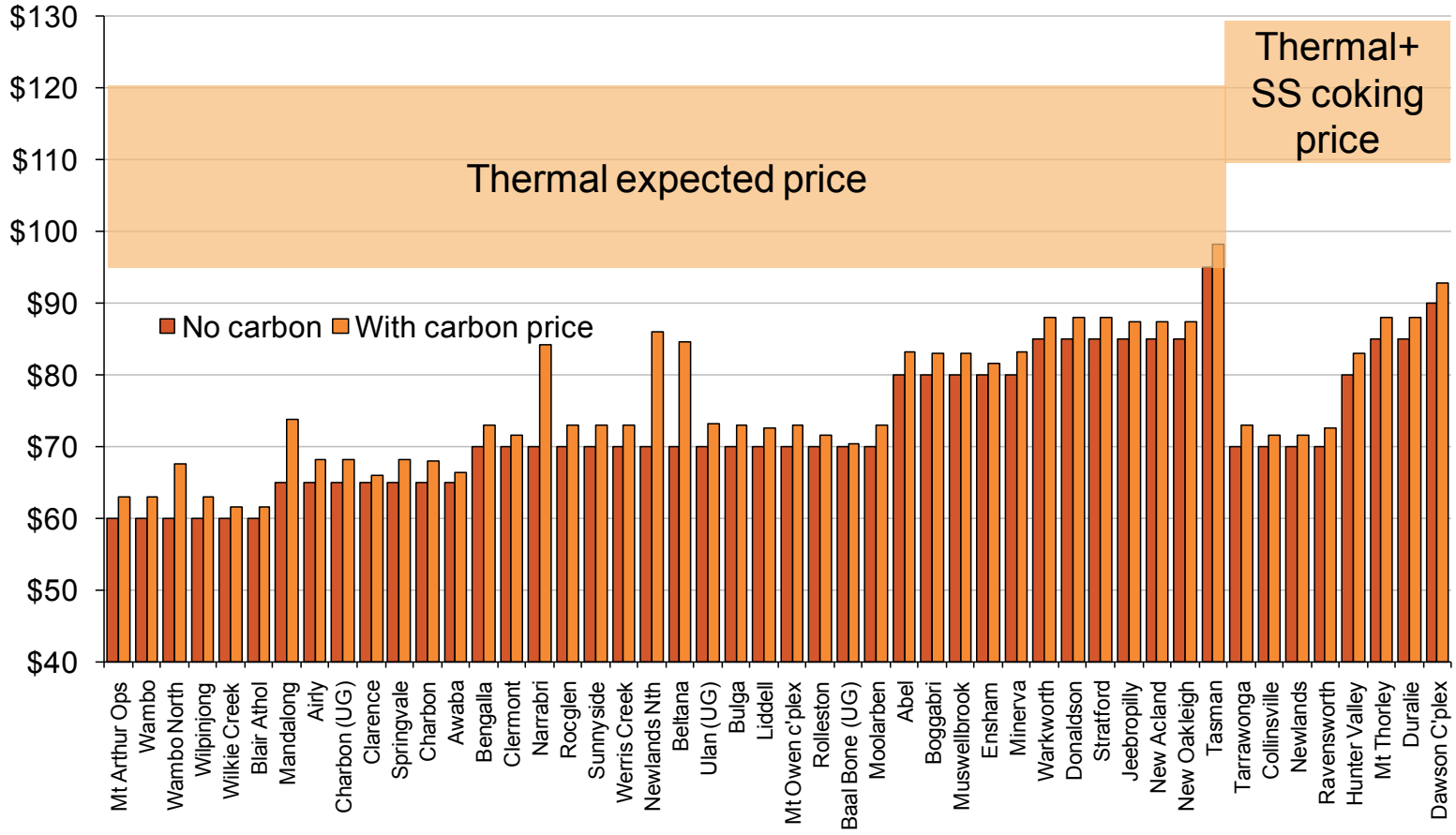
At $23t$CO_2$ they noted:

> *"the impact on profitability is likely to be no greater than fluctuations in the coal price and foreign exchange rates."*

In conclusion the risk of carbon leakage in the coal sector from carbon prices currently in contemplation ($23t$CO_2$ up to $40t$CO_2$ or possibly $50t$CO_2$) is too small to justify any assistance from the government, let alone the complete exemption the industry has sought.[25] Based on the available evidence it appears that the substantial majority of existing coal mines remain financially viable.

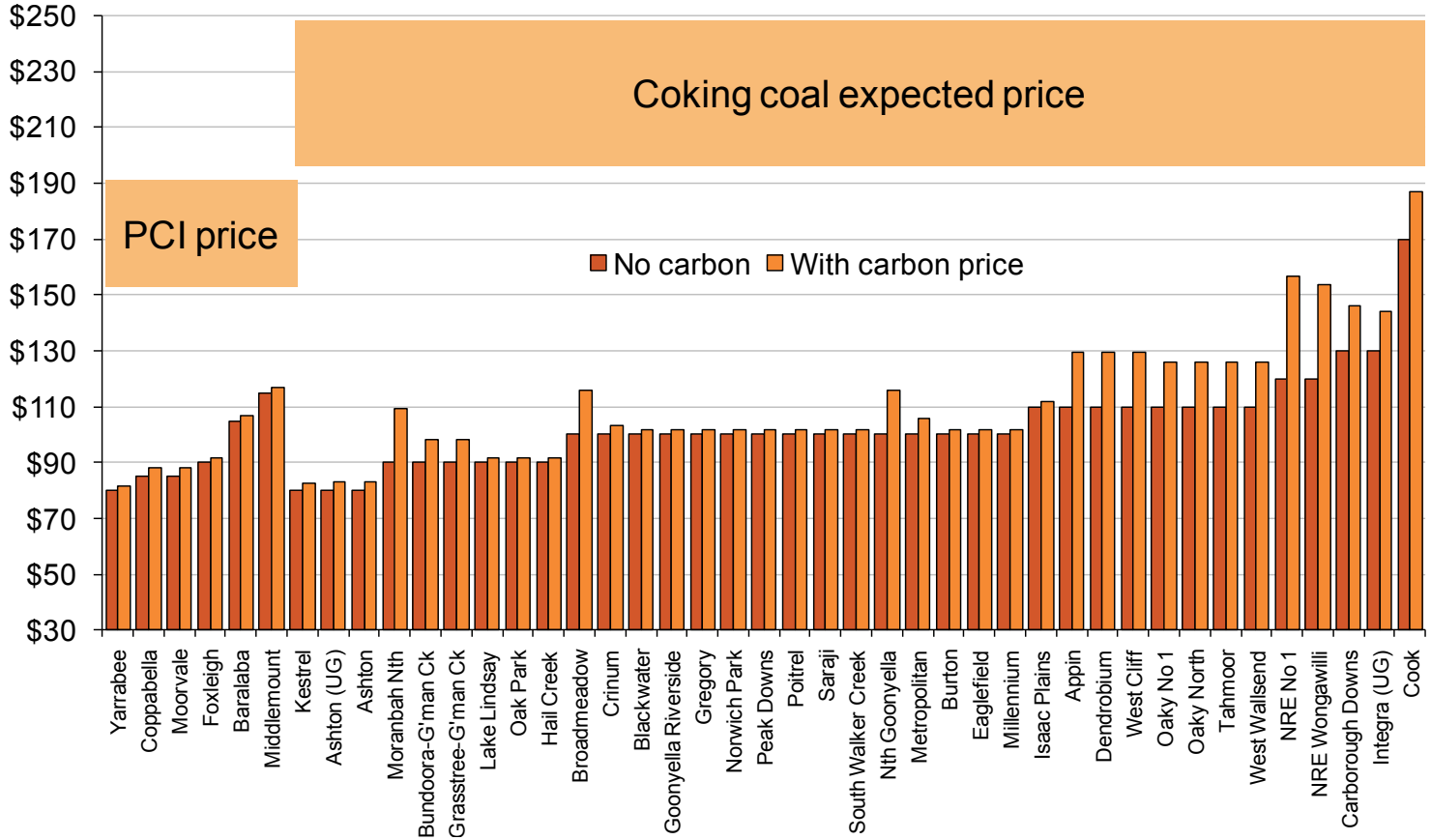
[22] See Daley and Edis (2010) but this is supported by more up-to-date cost curve information such as that in Bowers, Spartalis, Taylor, Ryan and Harris (2011) and Carroll (2011)
[23] Prior and Faria (2011)
[24] Willacy (2011)
[25] Australian Coal Association has sought an exemption from the carbon tax for their fugitive emissions, see: Australian Coal Association (2011);

Figure 3.1 Impact of $40tCO2 carbon price on Australian Thermal and Semi-Soft Coking Coal Export Mines (AUD/tCoal)



Expected prices based on forecasts to 2015 taken from Southwood and Gray (2011). Mines missing from figure due to inadequate data:Bloomfield, Rix's Creek, Drayton, Chain Valley Cameby Downs and Integra Open Cut which represent less than 7% of thermal/semi-soft coking export production. Cost data for some mines is based on average firm production costs across several mines. Sources: Appendix B for full sourcing of coal mine costs and emissions data.

Figure 3.2 Impact of $40tCO_2$ carbon price on Australian Coking and Pulverised Coal (PCI) Export Mines ($AUD/tCoal)



Expected prices are based on forecasts to 2015 taken from Southwood and Gray (2011). Mines missing from figure due to inadequate data: Jellinbah, Lake Vermont, Curragh, Austar which represent less than 12% of PCI/coking coal production Cost data for some mines is based on average firm production costs across several mines. Sources: Appendix B for full sourcing of coal mine costs and emissions data.

3.2 Impact of Australian carbon pricing on Australia's international competitiveness

The impact of the carbon price is relatively small for most mines, but even if the proposition is accepted that it might be significant to some future investment decisions, the critical issue is the extent to which other countries could take advantage of such a small relative change in costs.

Coal markets across the world are highly fragmented. Although Australia produces only 6.7% of the world's coal,[26] suggestions that our industry is therefore in fierce competition with every other coal-mining region in the world and easily replaceable[27] are exaggerated. If this were the case, then the price of coal around the world would largely equalise. In fact there are wide discrepancies within countries, let alone across the globe. Due to transport constraints and differences in coal quality, Australia faces a relatively limited set of overseas competitors.

In the markets in which Australia competes (largely the Asian seaborne coal market and in particular Japan, Korea and Taiwan) Australian coal production represents a large proportion of supply. Australia provides over half of global seaborne metallurgical coal supply and 34% of the Asian seaborne thermal coal market (in which most of our export coal competes).[28]

Australia's dominance of these markets is likely to continue. The US Government's Energy Information Administration's latest projections indicate that Australia will dominate expansions in the thermal coal trade to Asia (illustrated in Figure 3.3) and the metallurgical coal trade globally (illustrated in Figure 3.4), while our next biggest competitors' exports barely grow, or stall, as a result of declining production and increasing local demand.[29] It seems doubtful that a $4 average increase in production costs would reverse these trends.

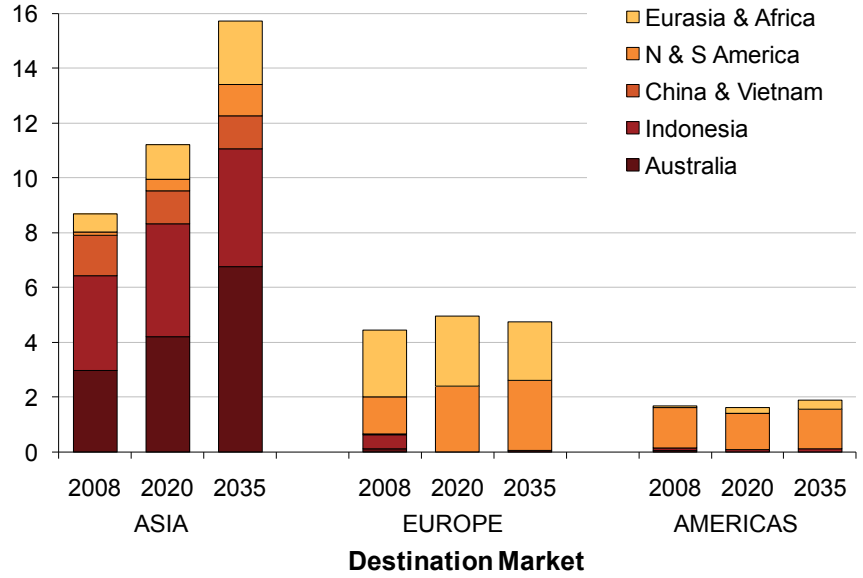
Major coal companies are themselves telling their investors that growth in supply of coal to Asian markets is constrained because it cannot keep up with demand, and their Australian coal mines are well positioned for growth. Xstrata (the world's largest thermal coal producer with most of its production located in Australia) confirms the Energy Information Administration's observations stating in its latest 2010 financial results (just as it did in its 2009 annual report) that,

> *"Meanwhile Indonesian supply, historically the primary source of supply growth, faces dwindling quality and shorter mine lives than Australia, South Africa or Colombia."*[30]

While South American thermal coal production (in particular Columbia) is expected to expand substantially as well, Australia's proximity to Asia gives it a shipping cost advantage; with South America focused primarily on serving Europe and the Americas, as shown in Figure 3.3.

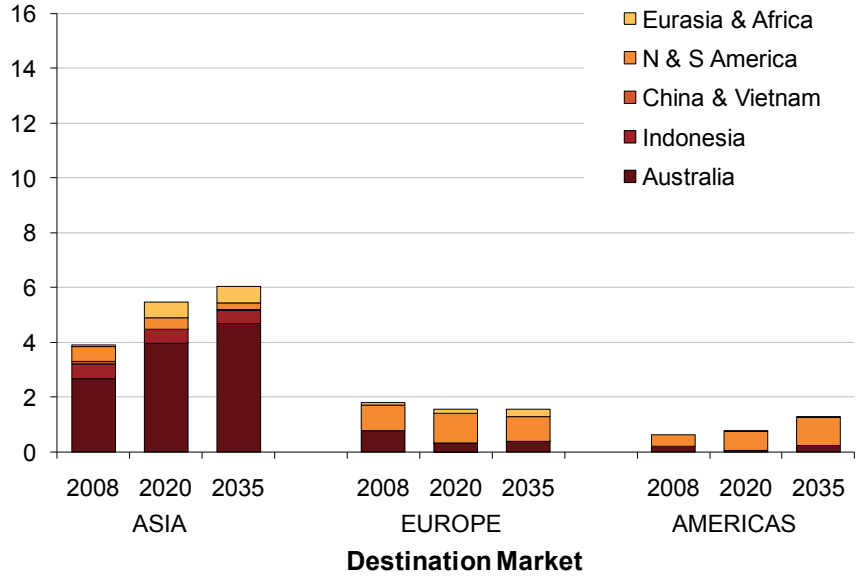
[26] US EIA (2010)
[27] For an example of this claim see: Steve Cannane interview with Ralph Hillman – ABC Lateline (2011)
[28] US EIA (2010)
[29] US EIA (2010). This largely echos the findings made in its 2009 study which were cited in the Grattan April 2010 report.
[30] Xstrata (2011)

Figure 3.3 World thermal coal trade flows – Major exporters and their market destinations – EIA reference case (quadrillion btu)



Source: US Energy Information Administration (2010)

Figure 3.4 World coking coal trade flows – Major exporters and their market destinations – EIA reference case (quadrillion btu)



Source: US Energy Information Administration (2010)

Statements to investors by senior executives from Peabody Energy[31], Anglo American[32], and Rio Tinto[33], in addition to Xstrata[34], all anticipate robust financial returns and growth from their Australian coal mine operations. These statements have been made in full knowledge of the government's preference to introduce a carbon price with assistance for only the highly gassy mines.

[31] Gregory Boyce (2011), Ford and Thornton (2010)
[32] Cockerill (2009)
[33] Rio Tinto (2010)
[34] Freyberg (2011)

Wood McKenzie found that higher carbon prices -- up to \$60tCO_2, which are not expected to occur until after 2020[35] -- could reduce the attractiveness of investing in Australian coal production. However, they noted that:

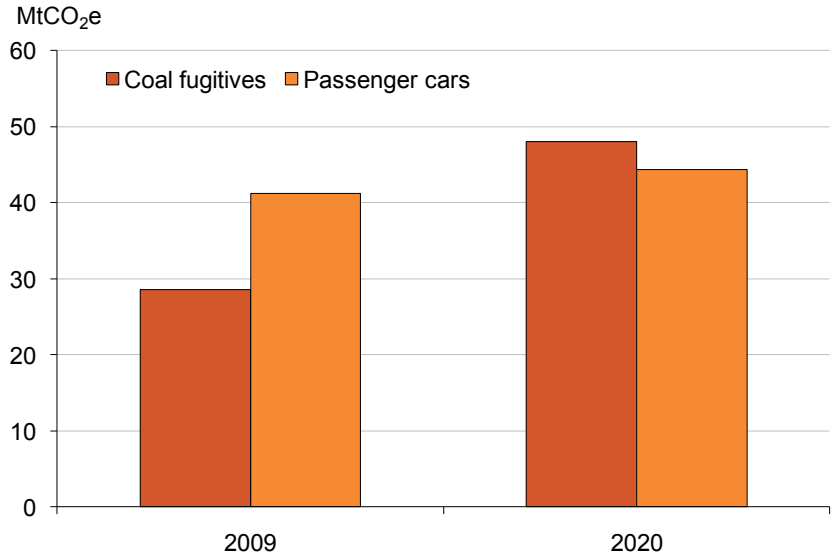
> *"some of the cost impact could be passed on to customers through the coal price. This is particularly likely for the global metallurgical coal market, which is dominated by Australian supply: the market structure provides large exporters with significant influence over the price.*

While they believed that there was less potential to pass on carbon costs for thermal coal, the cost increase is smaller on average per tonne of coal than for coking coal.

3.3 Consequences of assistance for coal mining

Government emission projections indicate that coal mining's fugitive emissions are likely to grow substantially between now and 2020. In time they will surpass the entire passenger car fleet (see Figure 3.5).

Figure 3.5 Coal mining fugitive emissions compared to Australia's passenger car emissions



Source: DCCEE (2010a)

[35] Australian Government Treasury (2011)

Claims by the coal industry to exempt such a large and growing source of emissions from any carbon price or emissions cap would impose much higher costs on other Australians to achieve emission reduction targets. It would also substantially reduce the amount of money available for government to compensate households or otherwise reduce the overall taxation burden, as shown in Table 3.1.

While the government did not ultimately grant an exemption, the proposed $1.33b in transitional assistance is unjustified. While this is limited to 5 years and is not available for production expansions, it could well inhibit replacement of high emissions mines by other Australian mines with much lower emissions over this period counteracting the underlying objective of a carbon price.

Table 3.1 Potential forgone compensation to households from exempting coal fugitive emissions from the carbon pricing scheme

Coal sector – Expected cumulative carbon tax owing (2012-2020)	Forgone cumulative compensation/tax relief per household (2012-2020)
$11.65b	$1234

Note: Liability calculated in 2012 dollars on basis of carbon price in 2012 of $23t$CO_2$ ascending by 2.5% real for next two years and then a linear rise to $40t$CO_2$ in real terms by 2020 (real $2.64 per annum increase)
Sources: DCCEE (2010a), ABS (2010)

3.4 A note on the ACIL Tasman studies undertaken for the Australian Coal Association

ACIL Tasman undertook studies commissioned by the Australian Coal Association in 2009[36] and also 2011[37] to assess the impact of a carbon pricing scheme (designed according to provisions similar to the Government's Carbon Pollution Reduction Scheme but with no assistance for coal mines).

The 2009 study used coal price assumption that have turned out to be too low (the 2011 study uses significantly higher coal price assumptions) and therefore this study is likely to overstate negative impacts from a carbon price.[38]

The 2011 study has adopted assumptions of coal prices similar to those in this report. The estimates of emissions intensity also appear to be similar, although there are a small number of underground mines for which we have used a government default emissions intensity factor that underestimates emissions intensity in some cases while overstating it for other mines. They assumed a carbon price ultimately reaching $50t$CO_2$-e by 2020 compared to our $40 assumption, although both are well above the latest Treasury forecast. Unfortunately ACIL Tasman do not provide any of the underlying information about different coal mines' cost structure on the basis that this is commercially sensitive. Our data set depends on a combination of some mine-specific cost

[36] ACIL Tasman (2009)
[37] ACIL Tasman (2011b)
[38] It assumed: hard coking coal price (AUD): $140/t in 2010 & $130/t by 2020; and thermal coal prices $95/t in 2010 & $80/t in 2020. The 2011 report now assumes Hard coking: $238/t in 2010 & $173 in 2020; and Thermal: $112/t in 2010 & $90/t in 2020.

data and also firm production cost data averaged over several mines but cross-checked for reasonableness against industry cost curve data.

ACIL's report results seem to suggest that the Australian coal industry will continue to grow between now and 2020 although this result is not clearly presented and requires some interpretation of the available data.[39] Instead the emphasis of its results is on negative impacts such as early closures of coal mines and the extent to which the growth of the coal industry would be less than what it would be without the carbon price. The report finds that by 2015 eight existing coal mines would close early and 18 coal mines by 2020 although it is not clear how much earlier they close than what would occur without the carbon price. It is also unclear whether some of these mines may be focussed on the domestic market and hence are likely to be replaced by other domestic sources of production. The decline in annual coal production relative to business as usual in 2020 is also not entirely clear. It appears to be around 17% lower than BAU[40] but about 25% higher than 2010 annual production.

We would also note that the ACIL Tasman's scope of work assumed a fixed international price for coal and does not consider whether withdrawal or delay in expansion of Australian coal supply might actually induce an increase in the price of coal therefore mitigating the relatively small increase in production costs from the carbon price. As our study illustrates, Australian coal supply represents a very large proportion of seaborne supply which, we conclude, would be difficult for competitors to replace. This is based on statements of major Australian coal companies to their investors and projections of the US Energy Information Administration. Ideally further research which sought to more precisely quantify the extent to which overseas producers might expand at the expense of Australian coal producers as a result of the carbon price would be very useful.

Finally, we are unable to reconcile our own conclusions of relatively mild impacts on Australian coal production (as well as those of other analysts) against those of ACIL Tasman, because the coal mine production costs which form the underlying basis for ACIL Tasman's conclusions are unavailable.[41] In the interests of transparency and to assist with possible future study in this area Appendix B of this report provides a full listing of our own data and sources for coal mine cost and emissions data.

[39] Black coal annual production in 2010 was 358m tonnes according to ABARES. Based on backward calculations of figures within the ACIL Tasman report it appears that 2020 production would be at least 468m tonnes after taking into account their estimates of premature mine closures. Statements by Ralph Hillman on ABC Lateline (2011) appear to support this conclusion of continued growth of the sector under a carbon price

[40] BAU production is 565m tonnes of saleable black coal sourced from DCCEE (2010b)

[41] Data was sought from the Australian Coal Association but they do not have access to the survey data either.

4. Steel production

Recent shifts in global steel prices and exchange rates have substantially reduced the profitability of the Australian steel industry. Consequently, there is a real risk that some parts of the Australian steel industry may move offshore. Paying a full carbon price increases this risk, but is not the primary driver. As discussed in our previous report, replacing Australian production with overseas production is unlikely to lead to materially lower global emissions.

However, Australian steel-making profitability may be marginal in any case due to structural shifts in the industry. Industry assistance, camouflaged as carbon pricing relief, should not be used as an excuse to delay structural shifts that will ultimately increase average Australian living standards.

As explained in our previous report, we believe that a border tax adjustment would distort the economy less than free permits. However, free permits are a reasonable "second best" policy to prevent carbon leakage. The free permits originally proposed in July 2008 for the steel industry would be enough to ensure that carbon pricing was not the primary driver of the closure of any Australian steel production facility.

However, substantially more free permits for the steel industry are now proposed in the draft legislation. The overall package will leave the steel industry better off than without a carbon price. In effect, it is protecting the Australian industry not from a carbon price, but from structural adjustments in the global steel industry.

4.1 Changing profitability of Australian steel making

Over the past two years global steel profitability has declined, and the profitability of Australia's steel makers has declined even more.

The global steel industry has had low returns historically. Steel production was traditionally seen as a symbol of an advanced modern economy, so that steel-making capacity was encouraged in part for its symbolic value. As a capital-intensive industry, the industry tended to cyclical periods of excess supply.

The global industry became less profitable over the last few years. Demand for steel in the developed world softened with the economic slowdown. Supply increased as China built substantial foundries.[42] Iron ore prices have also risen, although this cost would have been passed on to customers if the steel industry did not have over-capacity.[43]

The profitability of Australian steel makers reduced even further with the change in the exchange rate of the Australian dollar from around USD 0.75 to over parity.[44]

Although it is not yet certain whether these changes are structural, they may well be long-lasting. Developed world growth rates may only recover slowly. The Australian dollar exchange rate may

[42] Mittal (2010); Connolly and Orsmond, (2011)
[43] Macphillamy and Farlow (2011)
[44] Slifirski and Webb (2011a)

stay high for a long time. This rate is driven by the relative prices paid for mining commodities. Commodity demand will probably remain high for decades, while commodity production may only increase relatively slowly in response.[45]

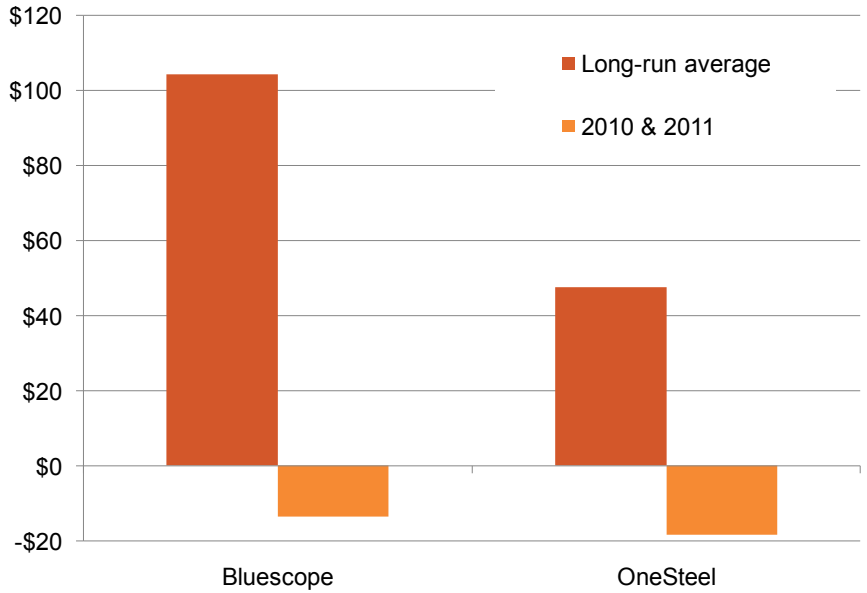
Consequently, after several years of reasonable profits, Australian steel-makers have been unprofitable over the last two years, as shown in Figure 4.1.

Paul O'Malley, CEO of Bluescope Steel, in commenting on the company's significant financial losses recently summarised the financial drivers:

> *"The key things we are facing are the macro-economic challenges around the high Aussie dollar, high raw material prices, and low steel prices -- it's definitely not about carbon"*[46]

It does not follow that Australian governments should protect the steel industry at all costs. Government attempts to preserve an otherwise unprofitable steel manufacturing sector would inhibit a shift of resources into sectors that would generate greater value for Australians. Some shift in steel production to other countries over the longer term may be both inevitable and desirable as our comparative advantage evolves. Consequently, the temptation to use carbon pricing as an excuse to hold back structural change should be resisted.

Figure 4.1 steel mill profitability (EBIT per tonne of steel)



Note: Bluescope long-run average data is for 2003-2011 financial years, OneSteel for 2005-2011 financial years. OneSteel 2011 data derived from a composite of EBIT from manufacturing division and mining consumables division.
Sources: OneSteel (2010), OneSteel (2011), Bluescope (2011)

[45] Eslake (2011)
[46] Chambers (2011)

4.2 Impact of carbon pricing on Australian steel production

Carbon pricing for the steel industry without any industry assistance might well cause carbon leakage. Industry profitability is poor, and carbon pricing would make it worse. Carbon emissions from overseas steelmaking are not likely to be materially lower than for Australian steelmaking, as our previous report concluded.[47]

4.3 Mechanisms to prevent carbon leakage in the steel industry

Carbon leakage might be prevented through a variety of mechanisms such as border tax adjustments, free permits, or a blanket exemption.

Our April 2010 report suggested the optimal means to prevent carbon leakage for industries predominantly focused on the Australian domestic market would be a carbon levy on imports (known as a 'border tax adjustment'). It argued that this was a feasible policy response given the small number of sectors genuinely facing carbon leakage risks. It would not be a protectionist measure and is the same approach we take to the GST and excise on products such as petrol. It could be implemented in a manner consistent with WTO requirements.[48] It would distort the economy less, and reduce special pleading. By contrast, free permits impose large costs on the rest of the community, and do not create incentives for consumers to use alternative products (such as using more wood and less steel).

However, the government has chosen to continue to address carbon leakage through free permits linked to production volumes, and calculated on the basis of historic emissions. This is an effective mechanism to prevent leakage, and can maintain incentives to reduce emissions.

A free permit mechanism immediately raises issues about the appropriate level of free permits.

4.4 Assistance levels

Substantial free permits are required to prevent carbon leakage. Less than 100% free permits would send a clear signal that industry is expected to reduce its emissions. At 90% free permits declining to 80% by 2020, as originally proposed in July 2008, the change in profitability would have been sufficiently small that it was unlikely to be material in any decision to close a steel-making facility. However, as a matter of principle, if there is "genuine" carbon leakage, there is a reasonable argument for up to 100% free permits.

However, the new package involving special assistance for the steel sector will leave it better off than without a carbon price.

Steel industry assistance has gradually increased, as detailed in Appendix A. At the levels most recently proposed, Figure 4.2 illustrates that all steel mills will initially receive more assistance that they actually pay out for carbon permits. This remains the case over the first four years of the carbon pricing scheme. In

[47] Daley and Edis (2010)
[48] Tamiotti, The, Kulacoglu, Olhoff, Simmons, Abaza (2009)

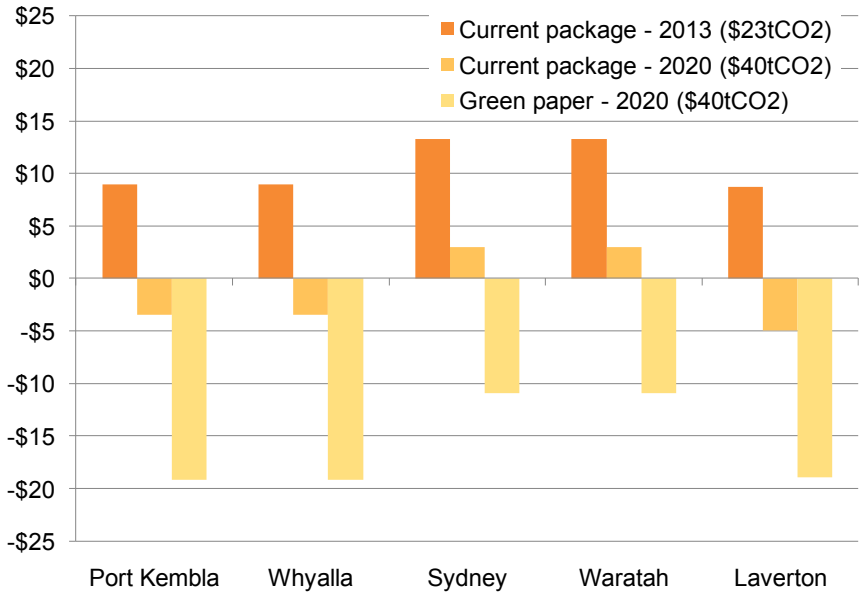
addition the Sydney and Waratah mills will still be receiving total assistance worth more than the cost of emissions permits in 2020.

In the Green Paper and White Paper, Port Kembla and Whyalla would have received free permits beginning at 90% declining to 80% by 2020, and Sydney, Waratah and Laverton beginning at 60% declining to 53.3% by 2020. Now all steel mills are entitled to 94.5% free permits at scheme commencement. This is scheduled to decline to 84% free permits after 10 years, although the draft carbon pricing legislation may effectively create a floor so that all steel mills receive a minimum of 90% free permits.[49]

In addition the government also announced a special assistance package just for the steel sector that will provide:

- $300m over five years in addition to free permits; and
- 10% increase in permit allocation baseline for crude steel under the Jobs and Competitiveness program, commencing in 2016/17.[50]

Figure 4.2 Net impact of carbon pricing with assistance for steel mills (AUD per tonne of steel)
Positive values = assistance greater than the carbon permit cost



Note: Assumes closure of Port Kembla No. 6 Furnace and reduced annual production to 2.6m tonnes of steel. $300m steel transformation package is estimated to provide average annual assistance per tonne of steel of approximately $12 although assistance will be provided on the basis of investments in plant and R&D rather than production.
Sources: Emissions intensity: One Steel (2010b); Hamer, Selleck (2011); Purvis (2011); Jordan, et al (2011); Assistance levels: Australian Government (2011a,b & c); Jordan, et al (2011); Australian Government (2008b)

[49] Within the July 2011 Clean Energy Future package it states that the Productivity Commission in its review of EITE assistance must consider, "whether less than 70 per cent of relevant competitors in each industry have introduced comparable carbon constraints …and hence whether the application of the carbon productivity contribution rate for a specific industry should pause when assistance rates reach 90 per cent for highly emissions intensive industries, or 60 per cent for moderately emissions intensive industries." The impact of this provision is discussed at Section 5.3 and 1.1.2

[50] Australian Government (2011b)

The steel package effectively protects the Australian industry not from a carbon price, but from structural adjustments in the global steel industry. This industry assistance cannot be justified by reference to carbon pricing. It reverts to the protectionist policies abandoned in the 1980s when Australia realised that bounties and tariff barriers reduce Australian productivity and living standards by inhibiting the shift of resources into sectors that would generate greater value for Australians.

4.5 Consequences of increased assistance for steel

This assistance has a substantial cost. The Green Paper proposed protection in the form of free permits worth $2.18b from 2012-2020, at an average cost of $29,258 per year per steel worker (incorporating the White Paper's rates for phase-out of free permits). Under the most recent proposals, this cost has risen to $2.82b, at an average cost of $36,000 per steel worker, as shown in Table 4.1 based on an assumption of the carbon pricing increasing to $40t$CO_2$ by 2020.

Table 4.1 Carbon price shielding assistance to Australian steel industry

Year	Carbon price (real)	July 2008 Green Paper Assistance	July 2011 extra assistance	Green Paper assistance per worker	July 2011 extra assistance per steel mill worker
2012	$23.00	$196,236,000	$77,636,400	$23,678	$7,465
2013	$23.58	$198,460,008	$77,975,466	$23,946	$7,498
2014	$24.16	$200,910,346	$78,082,685	$24,242	$7,508
2015	$26.80	$219,804,906	$79,941,913	$26,521	$7,687
2016	$29.44	$238,356,898	$82,389,572	$28,760	$7,922
2017	$32.08	$256,389,293	$48,099,152	$30,936	$4,625
2018	$34.72	$273,873,141	$55,664,327	$33,045	$5,352
2019	$37.36	$290,808,444	$63,778,049	$35,089	$6,133
2020	$40.00	$307,502,400	$72,133,116	$37,103	$6,936
TOTAL		**$2,182,341,437**	**$635,700,680**	**$263,319**	**$61,125**
			Annual Average	**$29,258**	**$6,792**

Note: Assumes closure of Port Kembla No. 6 Furnace and reduced annual production to 2.6m tonnes of steel. $300m steel transformation package is estimated to provide average annual assistance per tonne of steel of approximately $12 although assistance will be provided on the basis of investments in plant and R&D rather than production.Sources: Emissions intensity: One Steel (2010b); Hamer, Selleck (2011); Purvis (2011); Jordan, et al (2011). Assistance levels: Australian Government (2011a,b & c); Jordan, et al (2011); Australian Government (2008b). Workers: Bluescope Steel (2011b&c); OneSteel (2009). Production levels: Bluescope Steel (2011c); OneSteel (2010), OneSteel (2011)

5. Implications and recommendations

This report uses three industries as case studies to assess whether the industry assistance proposed in the draft legislation is justified. The analysis illustrates how public debate around carbon pricing is heavily influenced by arguments that are often not well supported by transparent evidence. In the past six months, various industry groups have argued that changed circumstances over the past few years mean they should receive more generous assistance than was proposed under the 2008 Green Paper, or that implementing a carbon pricing scheme should be delayed.[51] Our analysis of three of the most prominent industries prosecuting this argument has found little to support such a claim. However, these and other sectors have succeeded in having generous assistance included in the draft legislation. Three consequences flow from our analysis and this outcome:

1. Only a small number of sectors are genuinely exposed to undesirable impacts from carbon pricing;
2. Emissions data and carbon pricing assistance arrangements must be transparent in order to ensure a robust policy outcome in the face of vested interests;
3. The draft Clean Energy Bill requires revisions to provide clear direction and greater scope for the Productivity Commission to focus on the risk of carbon leakage as the key criterion for its proposed inquiries.

[51] ABC Radio National (2011b); Maher and Ryan (2011); Kirk (2011)

5.1 Few sectors are genuinely exposed to carbon leakage

This report and our April 2010 report, *Restructuring the Australian Economy to Emit Less Carbon*, as well as several other detailed studies[52], illustrate that only in very limited circumstances would carbon pricing so undermine business competitiveness that government assistance would be necessary. Even sectors such as coal mining and LNG, which represent a large proportion of Australia's emissions, are not substantially threatened by a carbon price at the level proposed in the draft legislation.

For a carbon price to threaten industry competitiveness, and to result in carbon leakage, three conditions must be met:

1. The carbon price needs to both represent such a proportion of an industry's costs that it might lead to a marked decline in competitiveness; and the industry's facilities must be unable to easily reduce their emissions.
2. The Australian industry must be exposed to international competition from countries with equivalent or higher emissions intensity that carries little penalty in the competing country. Under such circumstances production might shift from Australia to the other country for little or no environmental benefit.
3. The Australian industry lacks access to unique assets or other restrictions to competition that may otherwise enable it to maintain viable margins in spite of a substantial increase in costs not faced by international competitors.

[52] Droge et al. (2009) US Department of Energy et al (2009) Saddler, Muller, Cuevas (2006); Australian Treasury (2008)

No service industry is sufficiently emissions intensive for the carbon price to be material. Many manufacturing and mining sectors are not particularly emissions intensive, with even a $40 carbon price likely to represent a small proportion of their cost structure . This includes car manufacturing, iron ore and non-ferrous ore mining, downstream metal fabrication, and textile manufacture.[53] All these industries would fail to satisfy condition one.

More than 90% of economic activity and more than 95% of employment in Australia, as well as of other developed nations, is either not particularly emissions intensive – meaning that a carbon price would represent less than 5% of costs – or cannot be relocated overseas. Examples of the latter include water or electricity supply, which fail condition two.[54] Among the remaining sectors, many have competitive advantages that suggest they would struggle to pass condition three.

Much of recent industry claims would fail the above conditions. The building industry, for example, has argued for assistance on the basis that the cost of building materials such as steel and cement will increase substantially.[55] Yet the cement and steel industry has been granted assistance in the draft legislation on the basis that they can't pass on cost increases because they are exposed to international competition. In this case the building industry's claims fail condition one because the cement and steel industry are genuinely exposed to international competition and other inputs are open to competition from less emissions intensive substitutes (e.g. bricks versus fibro-cement or wood). Therefore the cost increases for the building sector are likely to be far less than the claimed $6000 per home.[56] The food manufacturing industry has produced information that others have used to claim that that food prices will rise sharply.[57] Yet this material is used by the food manufacturing industry to seek assistance from the government on the basis that it is exposed to international competition.[58] For the most part, this sector doesn't pass condition one, since agricultural emissions are excluded from the carbon price.[59] Lastly there have been claims for compensation to small businesses outside of those defined as emissions intensive and trade exposed.[60] Yet these claims commonly fail to adequately explain which types of small businesses would be unable to pass on their increased costs to Australian consumers, as most are not exposed to significant competition from overseas. Also small businesses serving EITE businesses don't require compensation when the EITE business itself is already protected from the carbon price and will continue to operate in Australia.

5.2 Transparency of emissions data and assistance levels

Much of the debate around policy to manage the risk of carbon leakage has been conducted without the benefit of detailed data and analysis on the genuine extent of this risk. The 2008 Treasury modelling[61] was the first comprehensive effort by government to

[53] Centre for Integrated Sustainability Analysis-The University of Sydney (2008)
[54] Centre for Integrated Sustainability Analysis-The University of Sydney (2008) combined with Australian Bureau of Statistics data; US Department of Energy et al (2009) Saddler, Muller, Cuevas (2006);
[55] HIA (2011a) ; HIA (2011b)
[56] HIA (2011b)
[57] Collier and Johnson (2011)
[58] Australian Food and Grocery Council (2011)
[59] Grattan Institute (2011)
[60] Anderson (2011); ABC Radio National (2011)
[61] Australian Government Treasury (2008)

examine the extent of risk of carbon leakage. Policy deliberations have been dominated for the most part by a small number of high emitting sectors.[62]

As a result, Government policy makers, the media and the public have been poorly equipped to scrutinise and test the claims made by industry about the impacts of a carbon price on their businesses.

In circumstances where there is little information and data, policy makers and the media tend to focus on those with the loudest voice, irrespective of the strength of their arguments. Partly because of such pressure, 95% of permits in the European Emissions Trading Scheme were allocated for free in the initial phase, a decision subsequently acknowledged to have been unwise.[63] Electricity generators received almost all their emissions permits for free, but then passed on the market price of these permits in electricity prices.[64] The cement sector also obtained generous numbers of free permits and then implemented substantial low cost abatement options that left them with a large surplus of permits to sell to others.[65] The result was that permit allocation was far too generous and these industries benefited at the expense of the rest of the community.

To guard against such mistakes it is important that the broader community, and not just government or affected industry, have access to information on the emissions and levels of assistance for each individual facility within the National Greenhouse and Energy Reporting System, and ultimately the emissions permit registry.

The current draft legislation does not provide this transparency. Instead:

- Emissions data are only available publicly at the controlling corporation level and there are provisions for businesses to conceal these data via a process that is opaque to the general public.

- While the legislation requires the regulator to publish how many free permits were issued to an organisation as a whole, it does not require disclosure of the number of free permits provided to each facility engaged in a production activity (e.g. liquefaction of gas) that qualifies for assistance. It is also vague about whether the amounts of free permits given for each activity an organisation undertakes must be published.[66] Even the formula the government intends to use to determine the number of free permits for which some production activities qualify can be opaque. For example, to estimate the

[62] Five of the six members of Prime Ministers Task Group on Emissions Trading that were drawn from businesses would be major beneficiaries of its generous free permit provisions, and the secretariat for the Taskgroup included staff from the AIGN and BCA. There was no representation from business interests involved in clean energy nor environmental NGOs.
[63] European Commission (2008)
[64] European Commission (2008)
[65] Grubb (2011)

[66] Section 198, subsection 1 is open to interpretation as to whether the regulator must either: publish the amount of free permits awarded per activity undertaken by an organisation(termed a “person”); or just publish the total amount of free permits awarded to the entire organisation and then list the activities under which the organisation qualified for these permits without specifying how many free permits were associated with each individual activity. Irrespective, it would better to publish down to the level of facilities rather than activities.

number of free permits for which steel production is eligible, one needs to know not just their steel production but also how many tonnes of coke and iron ore sinter were used to produce the steel.[67]

This makes it extremely difficult for independent organisations and citizens to assess with reasonable accuracy the impact of a carbon price on the actual physical facilities. This level of detail is important because it is the actual facility, rather than an abstract legal entity, which is of ultimate concern to the community and policy makers. Information about a controlling corporation is far less helpful because it typically contains a broad mix of businesses and facilities with varying exposure to a carbon price. It is therefore difficult to separate the differing effects on the individual production plants, yet it is these plants that determine employment, economic production and emissions.

If companies wish to obtain special assistance that add up to millions or billions of dollars, it is not unreasonable to require high levels of transparency about this assistance. Often, businesses claim that these data are commercially sensitive and therefore cannot be published publicly as that will disadvantage them against their competitors. As recipients of large amounts of government assistance, the companies should be obliged to help inform the community about how this decision was reached. Furthermore, the specific argument is questionable. Companies suggest they need to keep this data from their competitors. However, competitors generally have a good understanding of competing facilities' energy use and inputs, and can readily obtain emissions information. In many cases the data are already public, but located in dispersed and obscure sources, or accessible for a fee. Competitors usually have the capability and resources available to collect these data, but it is considerably more difficult for others without a self-interest in maintaining carbon pricing assistance.

Mistakes of poor transparency have been made in both the Renewable Energy Target and the NSW Greenhouse Gas Abatement Scheme, which are similar to a carbon emissions trading scheme. Non-government organisations had to undertake painstaking analyses of the certificate registries of these schemes to expose excessively generous baselines awarded by governments to electricity generators.[68] These baselines meant that the generator owners received certificates worth hundreds of millions of dollars at the expense of electricity consumers, and they provided very few environmental benefits in return.[69]

5.3 Objects of industry assistance

The objects of industry assistance as set out in the Bill are misguided and internally inconsistent. They should be reviewed.

Many of the problems arise because the Bill and its supporting material adopt a definition of carbon leakage that differs from previous understandings.

[67] This is based on Australian Government (2011c). When asked for details on the amount of free permits per tonne of steel production government have informed us that this is confidential.

[68] Brazzale (2005) Pers Comm; Passey (2005) Pers Comm. The painstaking analyses involved searching through millions of certificates on registries to identify how many were being created by different facilities and companies and combining with other historical data.

[69] MacGill, Passey, Nolles, Outhred (2005); BCSE (2003)

As discussed in Section 1.1, the object of the Bill's assistance is to reduce incentives for industry to relocate overseas because Australia has different carbon policies to other countries. [70] The Commentary on the Bill defines "carbon leakage" in these terms.[71] But in the past "carbon leakage" has been understood as the *actual* relocation of activities with no corresponding reduction in emissions.[72] Such an outcome is clearly environmentally undesirable. But the Bill and its Commentary aim to prevent a much broader set of outcomes.

Alongside these aims about incentives for industry relocation, the Bill also aims to provide assistance "in a manner that is economically and environmentally efficient".[73]

Carbon pricing in Australia without industry assistance would create "incentives to relocate", but might nevertheless be environmentally or economically efficient if:

- despite carbon price incentives, industry stays in Australia; or,
- relocation reduces global emissions; or,
- other countries use mechanisms substantially different from a carbon price to discourage emissions; or,
- relocation results in Australian workers and capital being redeployed to activities that create more value (including carbon costs).

All of these distinctions matter in practice.

Although carbon pricing creates an "incentive" to relocate, many industries will remain in Australia because countervailing forces are stronger. For example, coal mining and LNG production will continue to expand in Australia despite carbon pricing because other advantages outweigh the impact of carbon pricing, as shown in Sections 2 and 3.

The relocation of some trade-exposed emissions intensive industries from Australia would *reduce* global emissions. Because carbon emissions from producing electricity in Australia are relatively high, many industries would have lower emissions if they moved offshore.[74] Direct emissions by Australian production may also be higher than overseas production, as shown by a comparison of LNG projects discussed in Section 2.

Many countries are attempting to reduce emissions through measures other than a carbon price. These may burden their economies more overall than Australia's carbon price. As illustrated in the Productivity Commission's report, *Carbon Emission Policies in Key Economies*, many countries have taken politically easier but economically inefficient routes, such as rebate schemes, to reduce carbon pollution. [75] There is no reason to assist Australian industry merely because other governments

[70] *Clean Energy Bill 2011* (2011) s.143(2)(b) defines the object as "to reduce the incentives for [emissions-intensive trade-exposed activities] to be located in, or relocated to, foreign countries as a result of different climate change policies applying in Australia compared to foreign countries".
[71] DCCEE (2011) *Exposure Draft (28/07/2011)* p.32, p.135.
[72] Australian Government (2008a), Garnaut (2008a)
[73] *Clean Energy Bill 2011* (2011) s.143(2)(d)
[74] Daley and Edis (2010)
[75] Productivity Commission (2011)

allocate the burden of reducing emissions differently to Australia. Indeed, other mechanisms are likely to burden an economy more than a carbon price in order to reduce emissions by a given level.

Although the Commentary indicates that "all relevant market-based and regulatory measures" should be considered,[76] the actual Bill requires an inquiry into whether "foreign countries have implemented emissions reductions measures that have an impact that is comparable to the impact of this Act and the associated provisions".[77] It is open to industries to argue that overseas measures do not have a "comparable impact" if they impose greater burdens overall, but lesser burdens on their particular industry. There may also be arguments about whether a regulation is an "emissions reduction measure". For example, while the Chinese government does not currently levy a carbon price, it does impose a 15% export tariff on primary aluminium metal that has much the same effect on competitiveness as a $20 carbon price.[78] Removal of energy subsidies, that are endemic in developing countries, are another measure not commonly thought of as an emissions reduction measure, but have similar effects to a carbon price on emissions and competitiveness.

If relocation does occur due to a carbon price, then the labour can work on other activities. Depending on how capital is allocated, this labour may then produce more value (after including the cost of carbon emissions). This is why, when Australia dismantled industry protection, it made sense to cut bounties to Australian industry even when other countries continued to provide them. Australia benefited from buying products subsidised by overseas taxpayers, and could reallocate resources to activities that generated more value for Australians. Similarly, if other countries meet their emissions targets but implicitly subsidise emissions intensive activities, Australians will be better off taking the benefit of that subsidy and reallocating the resources to activities that generate more value. In a free market economy, relative profits indicate which activities are generating the most value, including the price signals from carbon pricing.

Thus the object of the Bill to reduce incentives for industry relocation (an object much broader than previous definitions of carbon leakage) – will often be inconsistent with its object of providing assistance "in a manner that is economically and environmentally efficient".

The Bill also aims to provide "transitional assistance" to emissions-intensive trade-exposed activities. This provision is reinforced by a requirement to inquire into whether free permit levels should not be reduced below 90% for highly emissions-intensive industries, and 60% for moderately emissions-intensive industries.[79] However, there is no indication in either the Bill or its Commentary of what the assistance is transitioning "from" or "to". As section 1.1.2 explains, the benefits from assistance provided on the basis of smoothing a transition are questionable. The inclusion of this vaguely defined objective creates room for maintaining or even increasing assistance that provides little overall benefit to the community.

[76] DCCEE (2011) *Exposure Draft (28/07/2011)* p.135
[77] *Clean Energy Bill 2011* (2011) s.156(2)(d)
[78] Harbor Intelligence (2009)
[79] *Clean Energy Bill 2011* (2011) s.156(3)(b)

5.4 Productivity Commission role

The Productivity Commission's role of reviewing industry assistance is appropriate, but will be hampered by the Bill's problems in defining the purpose of industry assistance. The legislation will ultimately serve the Australian public interest best by focusing on whether industry assistance promotes environmental and economic efficiency.

The Bill provides a role for the Productivity Commission to review the appropriateness of assistance to emissions intensive-trade exposed businesses.[80] This is a valuable institutional structure. The Productivity Commission (and its forerunner the Industry Assistance Commission) played a vital role in scrutinising industry claims for assistance over 25 years. Its investigations exposed the costs of subsidising industries just because "other governments do it too". Unilaterally dismantling tariffs and industry assistance lifted Australian living standards, and the Productivity Commission's role in this was vital.[81]

However, in reviewing carbon pricing industry assistance, the draft legislation requires the Productivity Commission to have regard to a range of matters[82] that distract from an unbiased consideration of the public interest. The Bill explicitly directs the Commission to consider whether industry has incentives to relocate overseas because Australia has different carbon policies to other countries. It attempts to buttress this object by directing the Commission to consider whether 70% of an industry's competitors are in countries with emissions reduction measures comparable to Australia.[83] As discussed above, this is not a true definition of carbon leakage. In many cases, it would lead to the maintenance of industry assistance when it should be reduced.

The Productivity Commission's review will inevitably need to deal with the incoherency between reducing incentives to relocate overseas whether or not there is carbon leakage, and promoting environmental and economic efficiency, as discussed in the previous section. The Commission will be most consistent with its historic role in reducing protection in the Australian public interest if it focuses on testing whether industry assistance does in fact promote environmental and economic efficiency.

The Commission is also explicitly required to consider linking the number of free permits to the anticipated increase in international prices if there were global carbon pricing,[84] a model advocated in the Garnaut review.[85] The Bill leaves open to the Productivity Commission considering other models for providing industry assistance such as border tax adjustments. We would encourage it to do so for the reasons outlined in our previous report.[86]

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[80] *Clean Energy Bill 2011* (2011) s.155
[81] Eslake (2011b); Carmichael, Eslake, Thirlwell (2009)
[82] *Clean Energy Bill 2011* (2011) s.155
[83] *Clean Energy Bill 2011* (2011) s.156(3)(a)
[84] Section 156, subsection 2 (e) of the Bill
[85] Garnaut (2008b)
[86] Daley and Edis (2010)

6. Appendix A – The evolution of carbon pricing protection measures for trade exposed industries

The table below documents how assistance for trade exposed industries has changed over several key stages since the Government's original proposal in the July 2008 Green Paper for the Carbon Pollution Reduction Scheme.

Round	Eligibility criteria	Levels of assistance	Implications for Steel, LNG and Coal Mining
July 2008 – Green Paper. Scheme start: July 2010[87]	- Production activities deemed to be trade exposed with combined direct emissions and emissions associated with electricity consumption above 1500tCO_2 per $1m in revenue to be classified as "Moderately Emissions Intensive" (MEI) and above 2000tCO_2 to be classified as "Highly emissions intensive"(HEI). -Trade exposure not explicitly defined.	-Free permits provided that are set at a proportion of the industry average emissions per unit of production (e.g. tonne of steel). -Moderately emissions intensive (MEI):60% of permits free of charge in first year. -Highly emissions intensive (HEI): 90% of permits free of change in first year of scheme. -Commitment to reduce percentage of free permits over time. Flags annual rates of decline in emissions per unit of output of between 3%-5% are required to stablise or ultimately reduce emissions but makes no firm commitment to a rate of decline.	-Steel - Blast furnace mills (BF) would qualify as HEI. Electric arcs (EAF) would be close to threshold of MEI -Coal mining and LNG – No assistance
December 2008 – White Paper.Scheme Start: July 2008[88]	-Qualification criteria relaxed with MEI cut-in point reduced to 1000tCO2 per $1m revenue. In addition an alternative metric added for qualification on the basis of emissions per $1m of value added enabling a greater number of activities to qualify. -Trade exposed defined at being an industry with trade share above 10% or constrained pricing power due to threat of imports.	-MEI: 60% free permits at scheme commencement declining to 53.3% by 2020. Rate of annual decline 1.3%. -HEI: 90% free permits declining to 80% by 2020. Rate of annual decline 1.3%. -Coal mining provided with $750m in assistance for highly gassy mines but excluded from assistance related to emissions-intensive trade-exposed sector. -$1.37b for small and medium enterprises for investment in abatement and energy efficiency. -Aluminium smelters provided with an exception on electricity emission factor calculation relative to other EITEs (with Alcoa Victoria Smelters the primary beneficiary)	-Steel – No change to BF mills but EAF mills now more clearly eligible as MEI. -LNG now qualified as MEI due to addition of value-added eligibility metric. -Coal gets $750m in cash assistance.

[87] Australian Government (2008a)
[88] Australian Government (2008b)

Round	Eligibility criteria	Levels of assistance	Implications for Steel, LNG and Coal Mining
May 2009 – Recession Buffer[89] Scheme start: July 2011 and fixed price of $10tCO$_2$ for first year	No change to eligibility criteria	-Increase in free permit allocation by 10% for moderately emissions intensive and 5% for highly emissions intensive activities relative to levels in White Paper, retained for first five years of scheme before returning to levels set out in White Paper.	-Steel and LNG now qualify for enlarged amount of free permits and benefit from delay and reduction in carbon price. -Coal sees no change in assistance although benefits from delay and reduction in carbon price.
November 2009 – Negotiations with Coalition. Scheme start: July 2011[90]	No change to eligibility criteria	-The Recession Buffer increase in free permits (10% increase for MEI, and 5% for HEI) retained out to 2020. -Production activities using recycled material treated on same basis as activities using primary materials. -Decline in free permits freezed at 90% for HEI and 60% MEI unless 70 per cent of relevant overseas competitors in an industry have introduced “comparable carbon constraints”. -An additional supplementary allocation of permits will be provided for LNG projects to ensure that all projects receive an effective assistance rate at or above 50 per cent in relation to their LNG production, irrespective of industry average baseline. -Increase in assistance for coal mining of a further $750m. -New assistance of $150m for the food processing sector that does not qualify as emissions intensive.	-Steel: EAF mills now entitled to assistance as if they were classified as HEI due to recycled materials provision. Both BF and EAF mills benefit from extension of Recession Buffer and proposal to freeze free permit decline to 90% dependent on international action. -Particularly emissions intensive LNG projects receive a very substantial increase in their assistance entitlement. All projects benefit from extension of recession buffer and freeze in free permit decline rate at 60%. -Coal now to receive $1.5b in assistance.

[89] Prime Minister Kevin Rudd, Treasurer Wayne Swan, Minister for Climate Change and Water Penny Wong (2009)
[90] Australian Government (2009)

Round	Eligibility criteria	Levels of assistance	Implications for Steel, LNG and Coal Mining
July 2011 – Clean Energy Plan. Scheme start July 2012. Fixed price for first 3 years[91]	No change to eligibility criteria	-Steel transformation plan providing $300m in additional assistance and a 10% increase in permit allocations for crude steel under the Jobs and Competitiveness program, commencing in 2016/17.[92] -Coal assistance package rearranged and slightly reduced to $1.33b. -$50m for metal forging and foundry sector in addition to $150m for food manufacturers. -$800m for manufacturing sector to invest in energy efficiency and low emission equipment, products and processes.	-Steel: extra $300m and 10% increase in amount of free permits from 2016/17 -Coal: assistance reduced by $170m. -LNG: unchanged assistance but benefit from delay in scheme by another year.

[91] Australian Government (2011a)
[92] Australian Government (2011b)

7. Appendix B – Listing of Australian export coal mines cost and emissions data

The table below provides the cost and emissions data we have derived for Australian coal mines focussed on the export market. In some cases the cost and/or emissions data is specific to an individual mine but in some cases we have had to use firm-wide cost data averaged across several mines, although we have had this reviewed for reasonableness against industry cost curve data and have avoided averaging cost data across thermal and coking coal mines. For emissions intensity we have gone to great lengths to identify which underground coal mines are highly gassy as a carbon price will have greatest cost impact on them. However sometimes precise emissions data for these mines is unavailable and we have used a government default emissions factor for gassy underground mines corrected for run of mine production losses in the washing process (Saleable assumed to be 80% of run of mine (ROM) production). For most open cut mines we have used government default emission factors for fugitive emissions which are also used for determining liability under the carbon pricing scheme (corrected for production losses in the washing process with saleable assumed to be 80% of ROM) and with some adjustment to account for energy usage (basis is 0.02tCO2 per tonne of saleable coal).

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Abel	Donaldson Coal	0.08	$70	$80	$73.2	$83.2	Gloucester Coal (2011) Investor Presentation- Acquisition of Donaldson coal and Monash Group And Entitlement Offer to Raise A$230M, May 2011.	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Assumed to be low methane based on statement on page 30 of 2009 Annual Environmental Management Report
Airly	Centennial	0.08	$55	$65	$58.2	$68.2	Ernst and Young (2010) Independent Expert's Report in relation to the takeover offer for all of the shares in Centennial Coal Company, 16 August 2010. Cited in Centennial Coal's Target's Statement in response to takeover bid by Banpu Minerals	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Assumed tobe low methane based on Page 132 of Centennial Coal Takeover Target Statement says, The western mines are characterised by an extremely low methane environment
Appin	BHP Billiton	0.48	$100	$110	$119.3	$129.3	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coalmore than iron ore, Goldman Sachs, 2 September 2010	07/08 Source: Illawarra Coal 2008 Sustainability Report
Ashton	Yanzhou	0.08	$70	$80	$73.1	$83.1	Felix Resources 2009 Annual Report	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Ashton (Underground)	Yanzhou	0.08	$70	$80	$73.2	$83.2	Felix Resources 2009 Annual Report	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Estimated to be low emissions based on Yancoal and Felix Resources data within DCCEE(2011) National Greenhouse and Energy Reporting, Greenhouse and Energy Reporting 2009-2010
Awaba	Centennial	0.03	$55	$65	$56.3	$66.3	Ernst and Young (2010) Independent Expert's Report in relation to the takeover offer for all of the shares in Centennial Coal Company, 16 August 2010. Cited in Centennial Coal's Target's Statement in response to takeover bid by Banpu Minerals	Source: Environmental Assessment for Awaba Coliery mining project Sept 2010
Baal Bone (Underground)	Xstrata	0.01	$60	$70	$60.3	$70.3	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	For mine expansion as detailed under NSW Planning application P07_0035 - Determination. Source: NSW Dept of Planning Assessment Report - Oct 2007
Baralaba	Cockatoo Coal	0.04	$105	$105	$106.7	$106.7	Cockatoo Coal Limited Presentation to Annual General Meeting 26 October 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Beltana	Xstrata	0.36	$60	$70	$74.5	$84.5	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	Source: Umwelt - Environmental Assessment Blakefield South Power Generation and Ventilation air methane abatement - Beltana Highwall mining December 2009. Based on an assessment of the mining complex's GH gas emissions with and without power gen and VAM
Bengalla	Coal & Allied	0.08	$60	$70	$63.1	$73.1	Coal and Allied Industries Limited 2010 Full Financial Report; Rio Tinto Coal Australia Financial Community Presentation, June 2010 - Sydney	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Blackwater	BMA	0.04	$90	$100	$91.7	$101.7	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coal more than iron ore, Goldman Sachs, 2 September 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Blair Athol	Rio Tinto	0.04	$50	$60	$51.7	$61.7	Rio Tinto Coal Australia Financial Community Presentation, June 2010 - Sydney	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Boggabri	Idemitsu	0.08	$70	$80	$73.1	$83.1	Presentation on Results for FY 2010 - Idemitsu Kosan Co., Ltd, May 2, 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Broadmeadow	BMA	0.40	$90	$100	$106.1	$116.1	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coal more than iron ore, Goldman Sachs, 2 September 2010	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Lukas Weber (2010) Australian Treasury Freedom of Information Release - Email from Lukas Weber to Matthew Brine, dated 11 October 2010.
Bulga	Xstrata	0.08	$60	$70	$63.1	$73.1	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Burton	Peabody Energy	0.04	$90	$100	$91.7	$101.7	Peabody Energy News Release - Peabody Energy Announces Results for the Year Ended December 31, 2010 - Jan 25 2011; Thermal mines adjusted downwards from average by $10-$20/tonne and met mines adjusted upwards by $20-$30/tonne based on feedback from industry analysts	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Carborough Downs	Vale	0.40	$120	$130	$136.1	$146.1	Backward Calculations based on Willacy (2011) Australia: Impact of the Carbon Tax,Coal Supply Service Insight-Australia, July 2011, Wood Mackenzie AND discussions with coal industry analysts	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Lukas Weber (2010) Australian Treasury Freedom of Information Release - Email from Lukas Weber to Matthew Brine, dated 11 October 2010.

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Charbon	Centennial	0.08	$55	$65	$58.1	$68.1	Ernst and Young (2010) Independent Expert's Report in relation to the takeover offer for all of the shares in Centennial Coal Company, 16 August 2010. Cited in Centennial Coal's Target's Statement in response to takeover bid by Banpu Minerals	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Charbon (Underground)	Centennial	0.08	$55	$65	$58.2	$68.2	Ernst and Young (2010) Independent Expert's Report in relation to the takeover offer for all of the shares in Centennial Coal Company, 16 August 2010. Cited in Centennial Coal's Target's Statement in response to takeover bid by Banpu Minerals	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Assumed to be low based on Page 132 of Centennial Coal Takeover Target Statement says, The western mines are characterised by an extremely low methane environment
Clarence	Centennial	0.02	$55	$65	$55.9	$65.9	Ernst and Young (2010) Independent Expert's Report in relation to the takeover offer for all of the shares in Centennial Coal Company, 16 August 2010. Cited in Centennial Coal's Target's Statement in response to takeover bid by Banpu Minerals	2010 Fin Year. Clarence 2010 Environmental Management Report
Clermont	Rio Tinto	0.04	$60	$70	$61.7	$71.7	Rio Tinto Coal Australia Financial Community Presentation, June 2010 - Sydney	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Collinsville	Xstrata	0.04	$60	$70	$61.7	$71.7	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Cook	Caledon	0.42	$150	$170	$166.7	$186.7	Caledon Resources 2010 Annual Report for year ended 31 December 2010	Caledon Resources data within DCCEE(2011) National Greenhouse and Energy Reporting, Greenhouse and Energy Reporting 2009-2010
Coppabella	Macarthur Coal	0.08	$75	$85	$78.3	$88.3	Macarthur Coal 2010 Annual Report	Macarthur Coal 2010 Annual Report

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Crinum	BMA	0.08	$90	$100	$93.2	$103.2	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coal more than iron ore, Goldman Sachs, 2 September 2010	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Lukas Weber (2010) Australian Treasury Freedom of Information Release - Email from Lukas Weber to Matthew Brine, dated 11 October 2010.
Dawson Complex	Anglo American	0.07	$80	$90	$82.8	$92.8	Anglo American Preliminary Results Year Ended 31 December 2010, 18 February 2011; Cynthia Carroll (2011) Bank of America Merrill Lynch Global Metals and Mining Conference 2011, Anglo American 10 May 2011	2008 Calendar year source: Anglo Coal 2007 Sustainable Development Report
Dendrobium	BHP Billiton	0.48	$100	$110	$119.3	$129.3	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coalmore than iron ore, Goldman Sachs, 2 September 2011	07/08 Source: Illawarra Coal 2008 Sustainability Report
Donaldson	Donaldson Coal	0.08	$75	$85	$78.1	$88.1	Gloucester Coal (2011) Investor Presentation- Acquisition of Donaldson coal and Monash Group And Entitlement Offer to Raise A$230M, May 2011.	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Duralie	Gloucester	0.08	$85	$85	$88.1	$88.1	Gloucester Coal - Middlemount acquisition and equity raising investor presentaion - August 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Eaglefield	Peabody Energy	0.04	$90	$100	$91.7	$101.7	Peabody Energy News Release - Peabody Energy Announces Results for the Year Ended December 31, 2010 - Jan 25 2011; Thermal mines adjusted downwards from average by $10-$20/tonne and met mines adjusted upwards by $20-$30/tonne based on feedback from industry analysts	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Ensham	Idemitsu	0.04	$70	$80	$71.7	$81.7	Presentation on Results for FY 2010 - Idemitsu Kosan Co., Ltd, May 2, 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Foxleigh	Anglo American	0.04	$80	$90	$81.7	$91.7	Anglo American Preliminary Results Year Ended 31 December 2010, 18 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
German Creek Bundoora	Anglo American	0.20	$80	$90	$88.0	$98.0	Anglo American Preliminary Results Year Ended 31 December 2010, 18 February 2011	2007 Calendar year source: Anglo Coal 2007 Sustainable Development Report
German Creek Grasstree	Anglo American	0.20	$80	$90	$88.0	$98.0	Anglo American Preliminary Results Year Ended 31 December 2010, 18 February 2011; Cynthia Carroll (2011) Bank of America Merrill Lynch Global Metals and Mining Conference 2011, Anglo American 10 May 2011	2008 Calendar year source: Anglo Coal 2007 Sustainable Development Report
Goonyella Riverside	BMA	0.04	$90	$100	$91.7	$101.7	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coal more than iron ore, Goldman Sachs, 2 September 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Gregory	BMA	0.04	$90	$100	$91.7	$101.7	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coal more than iron ore, Goldman Sachs, 2 September 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Hail Creek	Rio Tinto	0.04	$80	$90	$81.7	$91.7	Rio Tinto Coal Australia Financial Community Presentation, June 2010 - Sydney; AND Bowers, Spartalis, Taylor, Ryanand Harris (2011) Metals and Mining Sector Carbon pricing implications revisited, Macquarie Equities Research, 23 March 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Hunter Valley Operations	Coal & Allied	0.08	$70	$80	$73.1	$83.1	Coal and Allied Industries Limited 2010 Full Financial Report; Rio Tinto Coal Australia Financial Community Presentation, June 2010 - Sydney	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Integra (Underground)	Vale	0.35	$120	$130	$133.9	$143.9	Backward Calculations based on Willacy (2011) Australia: Impact of the Carbon Tax,Coal Supply Service Insight-Australia, July 2011, Wood Mackenzie AND discussions with coal industry analysts	ERM Environmental Assessment Proposed Integra Underground Coal Project July 2009
Isaac Plains	Aquila	0.04	$110	$110	$111.7	$111.7	Aquila Resources (2011) ASX Emerging Growth Conference, March 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Jeebropilly	New Hope	0.06	$65	$85	$67.4	$87.4	New Hope Corporation Limited Directors Annual Report and Financial Statements 2010, Hadad, Wilkins, Sainsbury, Seeney, Schwarz (2011)ASX coals:rising cash costs- what goes up doesn't alsways come down, Citigroup Global Markets, 30 May 2011	New Hope data within DCCEE(2011) National Greenhouse and Energy Reporting, Greenhouse and Energy Reporting 2009-2010
Kestrel	Rio Tinto	0.06	$70	$80	$72.6	$82.6	Rio Tinto Coal Australia Financial Community Presentation, June 2010 - Sydney; AND Bowers, Spartalis, Taylor, Ryan and Harris (2011) Metals and Mining Sector Carbon pricing implications revisited, Macquarie Equities Research, 23 March 2011	Source: Rio Tinto Australia Coal 2008 Sustainable Development Report
Lake Lindsay	Anglo American	0.04	$80	$90	$81.7	$91.7	Anglo American Preliminary Results Year Ended 31 December 2010, 18 February 2011; Cynthia Carroll (2011) Bank of America Merrill Lynch Global Metals and Mining Conference 2011, Anglo American 10 May 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Liddell	Xstrata	0.07	$60	$70	$62.6	$72.6	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	Liddell Coal Operations Annual Environmental Management Report year ending June 2008 - Umwelt Environmental Consultants
Mandalong	Centennial	0.22	$55	$65	$63.8	$73.8	Ernst and Young (2010) Independent Expert's Report in relation to the takeover offer for all of the shares in Centennial Coal Company, 16 August 2010. Cited in Centennial Coal's Target's Statement in response to takeover bid by Banpu Minerals	Mandalong Annual Environmental Management Report 2010 for NSW Dept of Planning

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Metropolitan	Peabody Energy	0.14	$90	$100	$95.6	$105.6	Peabody Energy News Release - Peabody Energy Announces Results for the Year Ended December 31, 2010 - Jan 25 2011; Thermal mines adjusted downwards from average by $10-$20/tonne and met mines adjusted upwards by $20-$30/tonne based on feedback from industry analysts	Metropolitan Coal Project Environmental Assessment 2008 for Peabody Energy Appendix K page 28
Middlemount	Macarthur Coal	0.04	$110	$115	$111.7	$116.7	Gloucester Coal (2010) Middlemount Acquisition and Equity Raising Investor Presentation,August 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Millennium	Peabody Energy	0.04	$90	$100	$91.7	$101.7	Peabody Energy News Release - Peabody Energy Announces Results for the Year Ended December 31, 2010 - Jan 25 2011; Thermal mines adjusted downwards from average by $10-$20/tonne and met mines adjusted upwards by $20-$30/tonne based on feedback from industry analysts	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Minerva	Yanzhou	0.08	$70	$80	$73.2	$83.2	Felix Resources 2009 Annual Report	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Estimated to be low emissions based on Yancoal and Felix Resources data within DCCEE(2011) National Greenhouse and Energy Reporting, Greenhouse and Energy Reporting 2009-2010
Moolarben	Yanzhou	0.08	$55	$70	$58.1	$73.1	Felix Resources 2009 Annual Report	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Moorvale	Macarthur Coal	0.08	$75	$85	$78.3	$88.3	Macarthur Coal 2010 Annual Report	Macarthur Coal 2010 Annual Report
Moranbah North	Anglo American	0.48	$80	$90	$99.3	$109.3	Anglo American Preliminary Results Year Ended 31 December 2010, 18 February 2011; Cynthia Carroll (2011) Bank of America Merrill Lynch Global Metals and Mining Conference 2011, Anglo American 10 May 2011	2007 Calendar year source: Anglo Coal 2007 Sustainable Development Report

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Mt Arthur Operations	BHP Billiton	0.08	$50	$60	$53.1	$63.1	Goodwill and Widdup (2011) BHP Billiton/Rio Tinto Energy Coal and the Energy Option, Goldman Sachs, 22 March 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Mt Owen Complex	Xstrata	0.08	$60	$70	$63.1	$73.1	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Mt Thorley	Coal & Allied	0.08	$75	$85	$78.1	$88.1	Coal and Allied Industries Limited 2010 Full Financial Report; Rio Tinto Coal Australia Financial Community Presentation, June 2010 - Sydney	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Muswellbrook	Idemitsu	0.08	$70	$80	$73.1	$83.1	Presentation on Results for FY 2010 - Idemitsu Kosan Co., Ltd, May 2, 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Narrabri	Whitehaven	0.36	$60	$70	$74.3	$84.3	Whitehaven Coal (2011) Whitehaven Coal Limited Delivering Growth, Half-year Results - December 2010, 22 February 2011	Environmental Approval for Narribri Coal Mine Stage 2 Longwall Project. See page 8-23 of Greenhouse Gas Assessment
New Acland	New Hope	0.06	$65	$85	$67.4	$87.4	New Hope Corporation Limited Directors Annual Reportand Financial Statements 2010, Hadad, Wilkins, Sainsbury, Seeney, Schwarz (2011)ASX coals:rising cash costs- what goes up doesn't alsways come down, Citigroup Global Markets, 30 May 2012	New Hope data within DCCEE(2011) National Greenhouse and Energy Reporting, Greenhouse and Energy Reporting 2009-2011
New Oakleigh	New Hope	0.06	$65	$85	$67.4	$87.4	New Hope Corporation Limited Directors Annual Reportand Financial Statements 2010, Hadad, Wilkins, Sainsbury, Seeney, Schwarz (2011)ASX coals:rising cash costs- what goes up doesn't alsways come down, Citigroup Global Markets, 30 May 2013	New Hope data within DCCEE(2011) National Greenhouse and Energy Reporting, Greenhouse and Energy Reporting 2009-2012

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Newlands	Xstrata	0.04	$60	$70	$61.7	$71.7	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Newlands Northern	Xstrata	0.40	$60	$70	$76.1	$86.1	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Lukas Weber (2010) Australian Treasury Freedom of Information Release - Email from Lukas Weber to Matthew Brine, dated 11 October 2010.
North Goonyella	Peabody Energy	0.40	$90	$100	$106.1	$116.1	Peabody Energy News Release - Peabody Energy Announces Results for the Year Ended December 31, 2010 - Jan 25 2011; Thermal mines adjusted downwards from average by $10-$20/tonne and met mines adjusted upwards by $20-$30/tonne based on feedback from industry analysts	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Lukas Weber (2010) Australian Treasury Freedom of Information Release - Email from Lukas Weber to Matthew Brine, dated 11 October 2010.
Norwich Park	BMA	0.04	$90	$100	$91.7	$101.7	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coal more than iron ore, Goldman Sachs, 2 September 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
NRE No 1	Gujarat	0.92	$110	$120	$146.8	$156.8	Gujarat NRE Coking Coal LTD 2010 Annual Report	Page 202 of ERM Environmental Assessment Volume 1 for NRE No. 1 - October 2010
NRE Wongawilli	Gujarat	0.84	$110	$120	$143.6	$153.6	Gujarat NRE Coking Coal LTD 2010 Annual Report	Page 199 of ERM Environmental Assessment Volume 1 NRE Wongawilli Colliery - October 2010
Oak Park	Anglo American	0.04	$80	$90	$81.7	$91.7	Anglo American Preliminary Results Year Ended 31 December 2010, 18 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Oaky No 1	Xstrata	0.40	$100	$110	$116.1	$126.1	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Lukas Weber (2010) Australian Treasury Freedom of Information Release - Email from Lukas Weber to Matthew Brine, dated 11 October 2010.

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Oaky North	Xstrata	0.40	$100	$110	$116.1	$126.1	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Lukas Weber (2010) Australian Treasury Freedom of Information Release - Email from Lukas Weber to Matthew Brine, dated 11 October 2010.
Peak Downs	BMA	0.04	$90	$100	$91.7	$101.7	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coal more than iron ore, Goldman Sachs, 2 September 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Poitrel	BMA	0.04	$90	$100	$91.7	$101.7	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coal more than iron ore, Goldman Sachs, 2 September 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Ravensworth (Underground)	Xstrata	0.07	$60	$70	$62.6	$72.6	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	Source: table 9 on page 49 using option 2. from Ravensworth UndergroundMine Environemntal Assessment Proposed modification to DA 104/96 for the extension of longwall Panels 6 to 10
Rocglen	Whitehaven	0.08	$60	$70	$63.1	$73.1	Whitehaven Coal (2011) Whitehaven Coal Limited Delivering Growth, Half-year Results - December 2010, 22 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Rolleston	Xstrata	0.04	$60	$70	$61.7	$71.7	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Saraji	BMA	0.04	$90	$100	$91.7	$101.7	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coal more than iron ore, Goldman Sachs, 2 September 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
South Walker Creek	BMA	0.04	$90	$100	$91.7	$101.7	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coal more than iron ore, Goldman Sachs, 2 September 2010	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Springvale	Centennial	0.08	$55	$65	$58.2	$68.2	Ernst and Young (2010) Independent Expert's Report in relation to the takeover offer for all of the shares in Centennial Coal Company, 16August 2010. Cited in Centennial Coal's Target's Statement in response to takeover bid by Banpu Minerals	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Assumed to be low based on Page 132 of Centennial Coal Takeover Target Statement says, The western mines are characterised by an extremely low methane environment
Stratford	Gloucester	0.08	$85	$85	$88.1	$88.1	Gloucester Coal - Middlemount acquisition and equity raising investor presentaion - August 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Sunnyside	Whitehaven	0.08	$60	$70	$63.1	$73.1	Whitehaven Coal (2011) Whitehaven Coal Limited Delivering Growth, Half-year Results - December 2010, 22 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Tahmoor	Xstrata	0.40	$100	$110	$116.1	$126.1	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Identified as gassy based on Envirogen's operating a waste mine gas power plant at the facility
Tarrawonga	Whitehaven	0.08	$60	$70	$63.1	$73.1	Whitehaven Coal (2011) Whitehaven Coal Limited Delivering Growth, Half-year Results - December 2010, 22 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Tasman	Donaldson Coal	0.08	$85	$95	$88.2	$98.2	Gloucester Coal (2011) Investor Presentatio- Acquisition of Donaldson coal and Monash Group And Entitlement Offer to Raise A$230M, May 2011.	See page 29 of 2008-09 Environmental Management Report which states methane drainage and ventiliation management not required

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Ulan (Underground)	Xstrata	0.08	$60	$70	$63.2	$73.2	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Identified as not gassy based on Source: Ulan Coal Mine - Annual Environmental Management Report 2008
Wambo	Peabody Energy	0.08	$50	$60	$53.1	$63.1	Peabody Energy News Release - Peabody Energy Announces Results for the Year Ended December 31, 2010 - Jan 25 2011; Thermal mines adjusted downwards from average by $10-$20/tonne and met mines adjusted upwards by $20-$30/tonne based on feedback from industry analysts	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Wambo North	Peabody Energy	0.19	$50	$60	$57.6	$67.6	Peabody Energy News Release - Peabody Energy Announces Results for the Year Ended December 31, 2010 - Jan 25 2011; Thermal mines adjusted downwards from average by $10-$20/tonne and met mines adjusted upwards by $20-$30/tonne based on feedback from industry analysts	Montrose East Underground Mine Modification Environmental Assessment May 2011
Warkworth	Coal & Allied	0.08	$75	$85	$78.1	$88.1	Coal and Allied Industries Limited 2010 Full Financial Report; Rio Tinto Coal Australia Financial Community Presentation, June 2010 - Sydney	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Werris Creek	Whitehaven	0.08	$60	$70	$63.1	$73.1	Whitehaven Coal (2011) Whitehaven Coal Limited Delivering Growth, Half-year Results - December 2010, 22 February 2011	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
West Cliff	BHP Billiton	0.48	$100	$110	$119.3	$129.3	Goodwill and Widdup (2010) BHP Billiton Divisional Analysis, coking coal sector, manganese - Structurally we like coking coalmore than iron ore, Goldman Sachs, 2 September 2011	07/08 Source: Illawarra Coal 2008 Sustainability Report
West Wallsend	Xstrata	0.40	$100	$110	$116.1	$126.1	Ker, Hanano, Davis (2011) Xstrata Plc Delivering growth and cost savings, UBS Investment Research, 8 February 2011	DCC (2008) National Greenhouse Accounts (NGA) Factors January 2008; Lukas Weber (2010) Australian Treasury Freedom of Information Release - Email from Lukas Weber to Matthew Brine, dated 11 October 2010.

Mine	Operator	tCO2/ tCoal	Costs w/o carbon price		Costs with $40tCO2 carbon price		Costs data source	Emissions data source
			Low	High	Low	High		
Wilkie Creek	Peabody Energy	0.04	$50	$60	$51.7	$61.7	Peabody Energy News Release - Peabody Energy Announces Results for the Year Ended December 31, 2010 - Jan 25 2011; Thermal mines adjusted downwards from average by $10-$20/tonne and met mines adjusted upwards by $20-$30/tonne based on feedback from industry analysts	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Wilpinjong	Peabody Energy	0.08	$50	$60	$53.1	$63.1	Peabody Energy News Release - Peabody Energy Announces Results for the Year Ended December 31, 2010 - Jan 25 2011; Thermal mines adjusted downwards from average by $10-$20/tonne and met mines adjusted upwards by $20-$30/tonne based on feedback from industry analysts	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia
Yarrabee	Yanzhou	0.04	$70	$80	$71.7	$81.7	Felix Resources 2009 Annual Report	DCC (2009) National Greenhouse and Energy Reporting System Measurement - Technical Guidelines for estimation of greenhouse gas emissions by facilities in Australia

8. Glossary

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
Al	Aluminium
Alumina	Aluminium oxide, the raw material produced from bauxite and used to produce aluminium
AUD	Australian dollars
Bauxite	The principal ore of Aluminium metal
Billet	A long, rectangular or cylindrical unfinished bar of iron or steel
Black coal	A lower water-content form of coal
BPD	Barrels per day
Brown coal	A higher water-content form of coal
BTU	British Thermal Units
Carbon leakage	The effect when production in one country is replaced by that in another country due primarily to increased costs from a carbon price, with no reduction in global emissions
Carbon price	The cost of emitting carbon into the atmosphere. It can be a tax imposed by government, the outcome of an emissions trading market, or a hybrid of taxes and permit prices
CIF	In relation to cement: Cement Industry Foundation
CIF	In relation to a price of a commodity: Price including cost, insurance and freight – i.e. the price at the port where goods are imported – compare to FOB
Clinker	The precursor to cement, made by heating a mixture of limestone, sand and clay
CO_2	Carbon dioxide
CO_2 equivalent	A measure used to compare the emissions from greenhouse gases based upon their global warming potential
CO_2-e	See CO_2 equivalent
Coking coal	See ‘metallurgical coal’

CPI	Consumer Price Index
CPRS	Carbon Pollution Reduction Scheme – the label the government has applied to its emissions cap-and-trade scheme
EAF	Electric Arc Furnace
EBIT	Earnings Before Interest and Taxes – profit taking into account the amortised cost of capital equipment, although positive EBIT may not provide sufficient return on capital to justify investment
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortisation – pure cash profit of a business without regard to the cost of capital equipment
EIA	Energy Information Administration
EITE	Emissions Intensive Trade Exposed
Electric Arc Furnace	Furnace for producing steel by recycling scrap iron and steel by melting it with an electric arc
Emissions intensity	The amount of greenhouse gas produced per unit of production
FOB	Price for goods free on board – i.e. the price at the port where goods are exported from, and excluding the costs of international insurance and freight – compare to CIF
Free permit	A certificate created under an emissions trading scheme that the holder does not pay for, and which entitles the holder to emit a specified amount of greenhouse gases
Garnaut Report	An independent study conducted by economist Professor Ross Garnaut, commissioned by Australia's Commonwealth, State and Territory governments in 2007
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GJ	GigaJoule
Greenhouse gas	The atmospheric gases responsible for causing global warming and climate change
GST	Goods and Services Tax
IAI	International Aluminium Institute
IBF	Integrated Blast Furnace
IEA	International Energy Agency

Blast Furnace	Furnace for producing steel by converting iron ore and metallurgical coal into pig iron and then steel using a heat-intensive furnace
Kyoto Protocol	an international agreement linked to the United Nations Framework Convention on Climate Change, adopted in Kyoto, Japan on 11 December, 1997
LNG	Liquified Natural Gas
Metallurgical coal	Coal used in steel making
Methane	A greenhouse gas, estimated to have a global warming effect twenty-one times that of the same weight of carbon-dioxide
Mtpa	Million tonnes per annum
MWh	Megawatt hour
OECD	Organisation for Economic Co-operation and Development
Sequestration	The removal of atmospheric carbon dioxide, either through biological processes (eg. photosynthesis in plants and trees) or geological processes (eg. storage in underground reservoirs)
t	tonne or in LNG t denotes a liquefaction train – which is a large block of liquefaction capacity
Thermal coal	Coal used in power generation
USD	United States Dollars
Windfall gain	A benefit accruing to a company without any effort on their part as a result of government regulation
WTO	World Trade Organisation

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