Report to

The Climate Institute

Emissions Intensive Trade Exposed Assistance Policy

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LIST OF ACRONYMS

CPRS	Carbon Pollution Reduction Scheme
Al	Aluminium
BCA	Business Council of Australia
C	Carbon
CO_2-e	Carbon dioxide equivalent
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCC	Department of Climate Change
EITE	Emissions Intensive Trade Exposed
GHG	Greenhouse gas
GJ	Gigajule
LNG	Liquefied Natural Gas
LET	Low Emission Technology
MA	Million Amperes
MMA	McLennan Magasanik Associates
MWh	Megawatt hours
NPV	Net Present Value
O	Oxygen
PFC	Perfluorocarbons
RD&D	Research Development and Deployment
TGET	Task Group on Emissions Trading

EXECUTIVE SUMMARY

The Climate Pollution Reduction Scheme uses a cap and trade (or emissions trading) scheme as the cornerstone to achieve emissions reductions in Australia. This has significant benefits because it equalises abatement costs across the economy and thereby allows the market to find the lowest cost abatement opportunities. In this sense, emissions trading is likely to provide an efficient and cost effective way to reduce carbon emissions.

However, emissions trading is not perfect and there are a number of justifications for complementary measures to address some key shortcomings. For instance, significant issues arise in transitioning the economy from a setting where carbon pollution was free to a system where carbon pollution is priced, as well as from the need to overcome a number of market failures, behavioural barriers and to take into account equity considerations.

These shortcomings provide a strong *prima facie* case for government interventions to complement emissions trading. Such interventions may include various research, development and deployment measures for low emissions technologies, energy efficiency measures, assistance to low income households, structural adjustment assistance and assistance to trade exposed emissions intensive industries.

However, a *prima facie* case is not sufficient to justify specific interventions, since the interventions themselves will be more or less effective and can introduce substantial distortions and costs in their own right. Thus, when deploying such measures, care needs to be taken to ensure that the measures provide net benefits to the community, either in the form of addressing equity issues and/or by reducing the cost of abatement.

This report focuses on 'emissions leakage' as a rationale for government intervention and measures designed to address this problem. It does not assess the costs and benefits of providing EITE assistance for the purpose of transitional support.

Emissions leakage occurs when domestic production is reduced as a result of carbon costs but (at least some of) the reduced domestic production gives rise to additional production in another country. For example, if an Australian producer of aluminium decides to reduce production in response to a carbon price, customers can obtain aluminium from other global producers that do not face any carbon costs. In other words, unless there are global capacity constraints or other market frictions, a reduction in the production of EITE goods in Australia in the face of a domestic carbon price may not affect world output and/or consumption of that good. Thus the production loss in Australia does not lead to the full reduction in global greenhouse gas emissions associated with that production and some emissions 'leak' overseas. This provides a strong *prima facie* rationale for an EITE assistance scheme.

However, the only case where EITE assistance unambiguously improves the efficiency and effectiveness of an emissions trading scheme is when it avoids domestic production reductions that have a cost of abatement in excess of the price of carbon in Australia after accounting for emissions leakage. The analysis performed in this report suggests that the majority of assistance for the proposed schemes is not likely to be in this category. This is because leakage from domestic activity reduction is likely to be partial; the bulk of assistance would be provided to existing sunk assets; there is no test for the likely leakage (not even a test for trade exposure); and the assistance is provided with strong discontinuities in the case of the CPRS proposal and to a very large number of firms where leakage is not likely to be a problem in the case of the BCA proposal.

As the IPCC note, estimating the carbon leakage is difficult and estimates should be viewed as having a high level of uncertainty. Carbon leakage is a complex issue as companies do not choose to invest in a country solely based on energy prices. Issues such as proximity to resources, sovereign risk, political stability and access a trained labour force are also important considerations.

Given these difficulties the best any EITE assistance policy can hope to achieve is to provide a net improvement to the emissions trading scheme by approximating a solution to the leakage problem. This requires that the avoided leakage benefits outweigh the costs that come with the policy itself. Such costs and benefits are discussed in Section 3 and include: inefficiently low abatement from assisted EITE sectors; inefficiently high abatement from unassisted EITE sectors and non EITE sectors; inefficient and potentially inequitable fund transfers to some assisted EITE sectors; reduced ability of the economy to adjust to a low carbon economy; and distortions to efficient risk premiums.

The costs and benefits from the proposed CPRS and BCA EITE assistance schemes have not been assessed in a robust way. The BCA provides some analysis of the impact of the carbon price on EITEs but only for a very small set of companies (the choice of which may affect the results). This analysis is heavily dependent on questionable assumptions. In particular the report assumes that firms can pass on none of the carbon price, have no abatement opportunities and that any reduction in activity from the companies in Australia results in 100% leakage. However, as shown in Section 4, their own analysis can be used to provide evidence that leakage is likely to be limited. To further illustrate that full carbon leakage is not likely for all emissions intensive activities, even where these are highly traded, the examples of aluminium and LNG productions are analysed in Sections 4.1 and 4.2 respectively.

Another aspect of EITE assistance is that it may encourage substantial expenditure on lobbying activity and strategic behaviour given the potentially very large assistance based returns (keeping in mind that billions of dollars worth of free permits appear to be available to a relatively small number of firms). This is likely to be all the more acute if continued EITE assistance is not administered by a reserve bank style independent body with strong technical capabilities to ensure decisions are rules and evidence based.

On this basis, MMA is of the view that it is unlikely that the proposed schemes will deliver net benefits to the community. Rather, the proposed compensation schemes for EITE activities are likely to impose significant additional costs on non-EITE sectors and EITE activities that fall below the relevant thresholds. Additional, detailed economic analysis of the magnitude of the leakage problem, as well as a detailed analysis of policy design options to avoid emissions leakage is necessary before a policy program of the proportions suggested in the CPRS paper is implemented. Indeed, as argued in section 4 a better option may be to assist the traded sector to transition to a low carbon future by providing assistance to deploy low emission technologies rather than providing assistance to the most emissions intensive sectors of the economy.

The impact of getting the EITE assistance policy wrong could be substantial given the large amount of assistance proposed in the CPRS green paper. Were 30% of permits allocated freely to EITE activities as proposed in the green paper, then assuming a carbon price of $20 per tonne, the assistance could be worth around $3 billion per year. At $40 per tonne – the figure used in the BCA report – the assistance could be worth around $6 billion per year; more than half the total Australian Government spending on infrastructure, transport and energy or about a third of the total spending on education.[1]

[1] 2008-09 budget appendix G, accessed: http://www.budget.gov.au//2008-09/content/overview/html/overview_40.htm

1 INTRODUCTION

The Climate Pollution Reduction Scheme uses a cap and trade (or emissions trading) scheme as the cornerstone of emissions reductions in Australia. This has significant benefits because it allows the market to find the lowest cost abatement opportunities and hence is likely to provide an efficient and cost effective way to reduce carbon emissions. That said, contributing to global emissions reductions is a complex policy problem and there are significant issues in transitioning the economy from a setting where carbon pollution was free to a system where carbon pollution is priced as well as a need to overcome a number of market failures, behavioural barriers and to take into account equity considerations.

These issues provide a strong *prima facie* case for government interventions to complement emissions trading. Such interventions may include various research, development and deployment measures for low emissions technologies, energy efficiency measures, structural adjustment assistance and assistance to trade exposed emissions intensive industries. However, a *prima facie* case is not sufficient to justify specific interventions, since the interventions themselves can be more or less effective and can introduce substantial distortions and costs. Thus, when deploying such measures, care needs to be taken to ensure that the measures provide net benefits to the community, either in the form of addressing equity issues and/or by reducing the cost of abatement.

This report focuses on 'emissions leakage' as a rationale for government intervention and measures designed to address this problem. Section 2 defines emissions leakage and discusses the rationale for policy interventions to address it. Section 3 analyses the efficiency implications of EITE assistance and Section 4 provides a discussion of evidence for emissions leakage.

2 THE 'LEAKAGE' RATIONALE FOR EITE ASSISTANCE

Emissions trading achieves abatement by setting a limit on the amount of annual carbon emissions that is allowed in the economy and allowing market participants to trade emissions permits. To the extent that the emissions constraint is binding, companies can reduce their emissions by using less carbon intensive technologies, reducing their production and/or purchasing permits to continue emitting.

For goods that are not traded internationally (non-traded goods), the carbon price gives the 'right' signal for firms to substitute lower emissions technologies or reduce production. The signal is 'right' in the sense that emission permits are allocated to their highest value use and abatement is achieved wherever the cost of abatement is lower than the equilibrium carbon price in the economy. In other words emissions trading harnesses the price mechanism to achieve an equalisation of the cost of abatement across the economy at the exact amount needed to achieve the emissions constraint set.

However, for goods that are traded internationally (traded goods), while the carbon price *may* still give the right signal for technology based abatement, it can fail to allocate emissions rights to their highest value use and can give the wrong signal to adjust production. This is because in the case of traded goods, the adjustment in production is (somewhat) independent of demand. That is, when an Australian producer of aluminium, for example, decides to reduce production, customers can obtain aluminium from other global producers that do not face any carbon costs. In other words, unless there are global capacity constraints, a reduction in the production of EITE goods in Australia in the face of a domestic carbon price may not affect world output and/or consumption of that good.

Thus, the production loss in Australia does not lead to the full reduction in global greenhouse gas emissions associated with that production. Rather, another plant, somewhere else in the world may increase production by some amount and increase its emissions as a result. This is what is called emissions leakage – some of the emissions savings here in Australia 'leak' overseas.

To illustrate this leakage, suppose that an EITE firm decides to shut down a facility after the introduction of emissions trading and thereby avoids x tons of carbon emissions domestically at a cost of c, giving an abatement cost of c/x dollars per tonne. Further suppose that the output produced in the given facility is now produced elsewhere in the world and gives rise to y tons of emissions there. Then the resulting *leakage adjusted* abatement is $c/(x-y)$ dollars per ton rather than the lower value of c/x.[2] Thus, when emissions leakage occurs (i.e. $y>0$) the market gives a price signal that is too strong and may lead to more activity reduction than is efficient. An extreme case would be where activity moves to a place where it generates more emissions than it would have in

[2] If $y \geq x$, the per tonne abatement cost is undefined or negative in the formulation above but the key point remains, for any leakage (ie $y>0$) the market provides a price signal for acivity reduction in EITE industries that is too strong and when $y>x$ the price signal perersely encourages more emissions.

Australia. In such circumstances, the carbon price signal may perversely encourage emissions rather than reduce them.

Emissions leakage therefore provides a *prima facie* rationale for special treatment of trade exposed activities. However, it is important to note that – as for other proposed interventions designed to complement emissions trading, such as RD&D and energy efficiency measures – it is important to ensure that any intervention to reduce emissions leakage is achieving its goal as efficiently and effectively as possible. Government interventions can cause their own market distortions and costs and it is important to analyse the cost and benefits of any proposed intervention to ensure that it is likely to provide net benefits to the community.

The policy options available to deal with emissions leakage include border tax adjustments, sectoral agreements and shielding. In Australia the main policy vehicle advocated has been to provide free permits to EITE activities to 'shield' them from emissions trading related carbon price increases (eg in the Carbon Pollution Reduction Scheme green paper (DCC 2008a), the National Emissions Trading Taskforce report (NETT 2007), the Task Group on Emissions Trading report (TGET 2007) and in the Business Council of Australia report (BCA 2008)).

Given the complexity of each of the alternative policy options and the support for shielding EITE activities from emissions trading related carbon prices in the Australian debate, the remainder of this paper focuses on EITE assistance in the form of free permits only. Section 3 analyses the potential costs and benefits of EITE assistance and Section 4 discusses evidence about emissions leakage.

3 EFFICIENCY IMPLICATIONS OF EITE ASSISTANCE

Providing EITE assistance as part of an emissions trading scheme can enhance economic efficiency by avoiding emissions leakage as discussed in Section 2. The question is, to what extent can the proposed government intervention (or another set of interventions) ameliorate emissions leakage and if so, at what cost?

To address emissions leakage fully and without introducing other distortions (discussed below) the government intervention would need to be targeted so as to provide the assistance necessary when, and only when, it avoids emissions leakage.[3]

However, given the complicated and judgement-based nature of investment location decisions and difficulties in ascertaining exactly how emissions intensive increased global production would be, such 'optimal' intervention is impossible and can at best be approximated. This implies that there will be some false positives and some false negatives.

- **False positives** arise when: 1) firms receive EITE assistance despite the fact that the assistance would not have altered their production or investment location decisions and 2) firms may increase production in Australia after the introduction of emissions trading combined with EITE assistance relative to a world without emissions trading.
- **False negatives** arise when firms do not receive the assistance required to stop inefficient emissions leakage

In order to assess the net benefits to the economy from introducing a particular EITE assistance scheme it is therefore important to understand its benefits in terms of avoided leakage and the costs.

- For false positives such costs include:
  1. Reduced abatement from activities in receipt of assistance, even when the cost of abatement from such activities (after accounting for leakage) is lower than abatement undertaken elsewhere in the economy. This reduces the efficiency of the ETS by not allowing abatement costs to be equalised at the margin throughout the economy – this is essentially the mirror image of inefficiencies arising from leakage itself.
  2. Cost of funds. Transfer from the public (and hence the rest of the economy) to the shareholders of assisted entities requires raising revenue, which creates its own inefficiencies. Those could arise in two ways. If the transfers are funded through taxes, then those taxes distort investment and consumption decisions,

[3] That is, assistance would have to occur in circumstances when the emissions leakage from an activity is sufficient to tip the cost of reducing that activity per tonne of abatement (after accounting for leakage) above the equilibrium carbon price in the economy and be set so as to exactly bring the price signal back to the equilibrium price.

giving rise to the so-called marginal excess burden of tax. If the transfers are 'funded' by issuing free permits, as proposed in the Green Paper, they give rise to additional costs of meeting a given carbon constraint – which are probably higher than the marginal excess burden of taxation. For example, if the revenue from emissions permits were used to reduce the most distorting taxes in the economy rather than to be given for free to 'false positive' EITE activities, this would enhance the efficiency with which the economy operates beyond the avoidance of the distortions that providing assistance gives rise to directly.

iii. Subsidy-related distortions. Providing 'false positives' with assistance encourages these activities in just the same way as any other subsidy does. It creates so called deadweight losses in the economy by interfering with the price system to encourage more activity from the subsidised sector than is efficient. So while a subsidy that encourages additional activity from a sector where a distortion exists (such as the existence of emissions price differentials between Australia and its trading partners) can enhance efficiency, providing assistance to 'false positives' removes no distortion and simply adds another one.

iv. Dynamic efficiency costs – risk premiums. Industry players have raised the issue of 'sovereign risk'. The concept of sovereign risk captures the fact that investors require an additional risk premium on their return to operate in countries where their assets are subject to political risk. The classic example would be a government that nationalises private assets. Having done this, such a country would find it difficult to attract much private investment because firms would put such a high risk premium on investments that few investments would pass the required hurdle rate.

The link to emissions trading is that it imposes a cost on emissions intensive firms that these *may* not have built into their investment decisions, leading to a loss in shareholder value. Indeed, for some emissions intensive investments (often with high debt to equity ratios) shareholders may see their investment value destroyed altogether. This may reduce the propensity for investors more generally to invest in Australia and raise the risk premium on investment in Australia. If this risk premium serves no purpose, then it simply raises the cost of doing business in Australia and reduces the competitiveness of the Australian economy.

However, to the extent that the risk premium does serve a purpose, trying to keep it down adversely affects the efficiency with which the economy operates. For example pharmaceutical companies do not get compensation when a drug that is found to have 'unacceptable' side effects is banned (even after firms have invested in plant and equipment and hence end up with stranded assets). Indeed, they are even liable for any damages created while the drug was on the market. This raises the risk premium for investment in pharmaceutical activity, but it would be foolish to ague that reducing the risk premium would enhance dynamic efficiency.

Of course, the case of imposing a carbon price is different, but the question remains, does imposing a risk premium on investments that are affected by policy action enhance or reduce dynamic efficiency? The answer is that it depends on the legitimacy of government policy. If the Government decided one day to change the rules without a strong policy rationale, then any resulting risk premium imposed on investments would be inefficient. However, in the case of climate change there is a legitimate concern about the impact of greenhouse gas emissions on global temperatures and it is desirable for investors to incorporate an appropriate risk premium into their cost of capital and/or a reasonable forward carbon price when making investment decisions. Thus, providing assistance to reduce risk premiums arising from legitimate Government intervention sends the wrong signals to investors – not to take into account potentially detrimental effects of their activities – and is likely to reduce rather than enhance dynamic efficiency.

v. Dynamic efficiency costs – economic structure. The introduction of a carbon price changes relative prices in the economy and leads to a restructuring of the economy over time. Removing the activity related incentive to abate (as opposed to the incentive to reduce emissions per unit of output) for some activities through EITE assistance also removes the signal to restructure in those sectors. Indeed this can even give an incentive to expand. This has adverse efficiency implications and raises the cost of abatement for the broader economy and may lead to a need for structural assistance down the track when EITE assistance is phased out.

- For false negatives such costs include:

i. Too much activity related abatement from EITE activities. The (leakage unadjusted) marginal cost of abatement is equated to the local abatement achieved rather than actual global abatement. This leads to a price signal for abatement that is distorted, and at the extreme, provides a signal to reduce emissions intensive production in Australia while actually increasing total world emissions.

ii. Dynamic efficiency costs – risk premiums. In the case of false negatives, the policy rationale that justifies intervention – namely emissions reduction – is not actually met, and therefore lacks legitimacy. In other words, a poorly targeted emission trading scheme may entail a loss in asset values for some EITE activities, for no environmental purpose. While such costs may be inevitable if no efficient policy can be found to address leakage, the sovereign risk argument has some merit for false negatives.

iii. Dynamic efficiency costs – economic structure. Without EITE assistance the carbon price signal encourages too much activity based abatement from false negatives and thereby provides for too much structural adjustment in those sectors. This leads to stronger than efficient structural adjustment in a period when the economy is already facing significant adjustment costs.

It is important to understand the magnitude of these costs and benefits as well as the impact on these costs and benefits of government assistance to address emissions leakage. As discussed in Section 4 there is little evidence about the magnitude of emissions leakage from the introduction of emissions trading and little analysis of the likely efficiency and effectiveness of the proposed EITE assistance policies.

In addition to the direct cost and benefit tradeoffs discussed above (in terms of false positives and false negatives), EITE assistance schemes have the potential to interfere with the abatement incentives faced by EITE firms beyond purely activity based abatement.

The CPRS green paper is careful to point out the importance of maintaining technology based abatement incentives for EITE firms. That is, the assistance is supposed to remove incentives to achieve abatement through reduced output when (part of) such output than simply happens in competing countries and produce emissions there but to maintain incentives to improve technology to achieve less emissions intensive output.

To this end, the EITE assistance scheme proposes to provide assistance to existing assets on the basis of historic emissions and to new investments on the basis of industry best practice emissions. To ensure technology based abatement incentives are aligned, the CPRS green paper also proposes that free allocations be based on industry average emissions. These are all important and well thought through design features that achieve the goal of retaining technology based abatement incentives to a significant extent. However, the precedent set by the use of historic emissions as a basis for assistance coupled with five yearly reviews of EITE assistance weaken the abatement incentives, especially for activities that have emissions intensities close to the thresholds. This is an issue because many emissions intensive activities are relatively concentrated, calling into question the reliance on competition to provide abatement incentives at the margin.

Nonetheless, the design features discussed above go a long way to providing technology based abatement incentives for EITE industries. Overall, it is therefore likely that the main inefficiencies of the scheme relate to reduced activity based abatement incentives among activities where activity reduction would be efficient. There will also be flow-on effects to the rest of the economy in terms of their additional abatement burden, exchange rate effects and consumption and input mix decisions biased toward EITE outputs that do not include appropriate carbon prices.

Another aspect of EITE assistance is that it may encourage substantial expenditure on lobbying activity and strategic behaviour given the potentially very large assistance based returns (keeping in mind that billions of dollars worth of free permits appear to be available to a relatively small number of firms). This is likely to be all the more acute if continued EITE assistance is not administered by a reserve bank style independent body with strong technical capabilities to ensure decisions are rules and evidence based.

4 EVIDENCE OF EMISSIONS LEAKAGE

The impact of getting the balance of false positives and false negatives wrong could be substantial given the large amount of assistance involved in the EITE assistance policy proposed in the CPRS green paper.[4] Were 30% of permits allocated freely to EITE activities as proposed in the green paper, then assuming a carbon price of $20 per tonne, the assistance could be worth around $3 billion per year. At $40 per tonne – the figure used in the BCA report – this would increase to around $6 billion per year; more than half the total Australian Government spending on infrastructure, transport and energy or about a third of the total spending on education.[5]

Very little evidence was provided as part of the green paper or any of the previous major reports, including the National Emissions Trading Taskforce (NETT 2007), the Task Group on Emissions Trading (TGET 2007) and the Garnaut (2008) reports, to underpin the policy case or the specific policy design. This seriously undermines confidence that the right balance of costs and benefits from intervention has been struck.

The CPRS green paper proposes two emissions intensity thresholds to allocate EITE assistance. With the exception of activities with 'significant physical barriers to trade' such as electricity generation, any activity which gives rise to more than 2000 tonnes of CO_2-e emissions per $million of revenue would receive permits covering 90 per cent of the sum of the average direct and indirect electricity related emissions associated with the production from that activity. Activities which give rise to between 1500 and 2000 tonnes of CO_2-e emissions per $million of revenue stand to receive 60 per cent and those below 1500 tonnes stand to receive no assistance. In addition the total amount of permits available for EITE assistance would be restricted to 30 per cent of total permits in the economy.

Choosing emissions intensity per million dollars of revenue implies an assumed strong correlation between emissions intensity per dollar of revenue and emissions leakage. Evidence of such a correlation has neither been presented nor is evidenced in the literature. Further, it is unlikely that there would be a strong correlation given that most investments are not marginal on carbon prices.

There is no test for trade exposure or indeed for the likelihood that an activity would in fact give rise to leakage in the proposal. For example, no distinction is made between new investments and existing assets even though existing assets are much less likely to relocate – and hence give rise to emissions leakage – given the large sunk fixed costs associated

[4] As discussed in Section 3: **false positives** arise when: 1) firms receive EITE assistance despite the fact that the assistance would not have altered their investment location decision and 2) firms may set up in Australia after the introduction of emissions trading combined with EITE assistance despite the fact that they would not have set up in Australia in the absence of emissions trading; **False negatives** arise when firms do not receive the required assistance to stop inefficient emissions leakage (i.e. where leaked emissions are sufficiently large to make the cost per tonne of actual avoided emissions *after accounting for leakage* larger then the equilibrium price of emissions in the economy).

[5] 2008-09 budget appendix G, accessed: http://www.budget.gov.au//2008-09/content/overview/html/overview_40.htm

with existing emissions intensive assets. It is difficult to estimate the false positives that implementing the proposed EITE assistance policy would give rise to without detailed analysis. However, it would not be surprising if such analysis found that the emissions leakage avoided was below the level compensated for by a very large margin.

This is not to say that the proposed assistance is *necessarily* excessive even at the high threshold. It is simply to point out that only one variable was chosen to determine the likelihood that activity reduction would give rise to leakage, namely emissions intensity per $million of revenue. It might appear that the argument for providing assistance to the most emissions-intensive activities is sound given the likely correlation between emissions intensity and leakage (through a larger cost impact for any given cost of carbon). However, that correlation is far from perfect given that most investments are not marginal.

The potential for excessive (and hence economically damaging) assistance amongst highly emissions intensive activities is problematic, but so is the potential for significant leakage from activities with low emissions intensities. Again, it would not be surprising if a detailed analysis of leakage found that highly traded activities with less than 1500 or even 1000t CO2-e/$million were giving rise to a significant fraction of emissions leakage. Giving EITE assistance to the most highly emitting activities will increase leakage from less emitting activities by increasing the cost of carbon in the economy as well as indirectly through exchange rate effects.[6]

None of the proposals provide an assessment of the emissions leakage that is likely to take place in the absence of assistance or of the likely reduction in leakage if the proposed scheme were to be introduced. Thus, the effect on the key policy target remains unknown.

The BCA provides some analysis of the impact of the carbon price on EITEs but only for a very small set of companies (the choice of which has not been documented and is not likely to be representative of EITE industries) and is underpinned by unrealistic assumptions. For example, it is assumed that firms can pass on none of the carbon price, have no abatement opportunities, that there is no carbon price risk in competing countries and that any reduction in activity from the companies in Australia results in 100% leakage.

However, these assumptions overstate the problem. Indeed, the BCA's own analysis of the impact of carbon pricing on EITE industry investment decisions (BCA 2008) shows that leakage is likely to be partial. Figure 4-1 shows the relevant graph presented in the BCA report (BCA 2008, Exhibit 3.19 on page 71).

[6] Raising output from the highest emitting import competing and exporting EITE activities through assistance will increase the value of the Australian dollar relative to the case where no assistance is given to these sectors. This renders other trade exposed industries less competitive and aggravates the leakage problem for non assisted EITE activities.

Figure 4-1 Impact of carbon pricing on EITE industry investment decisions (adapted from BCA 2008)

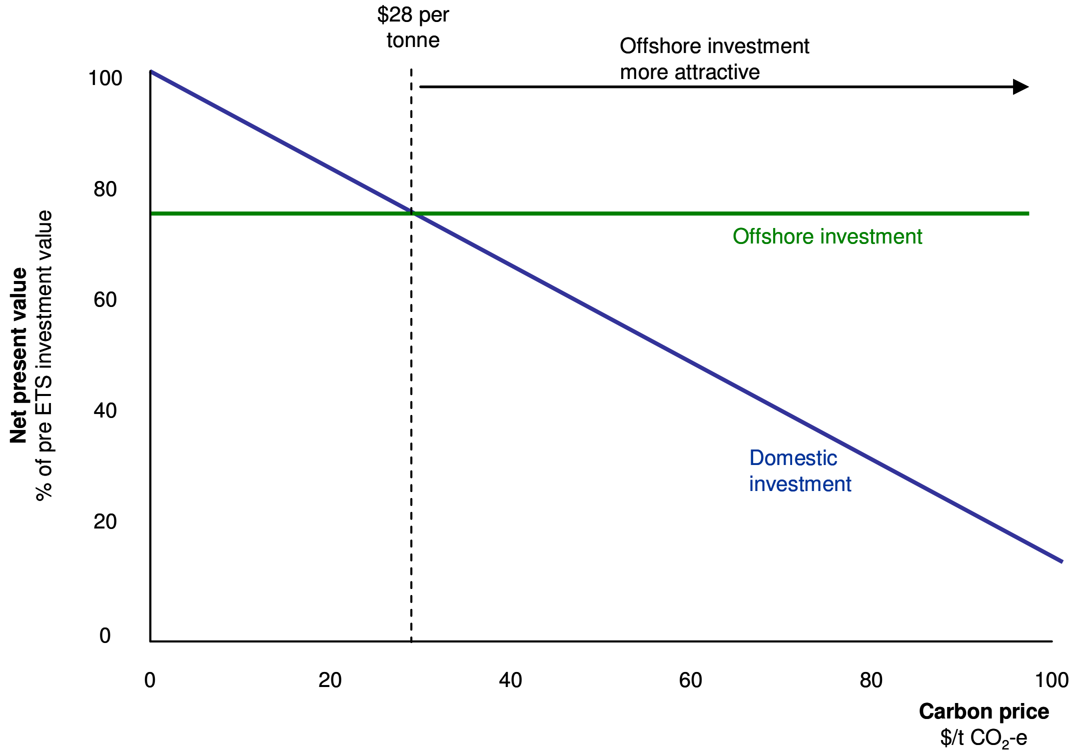
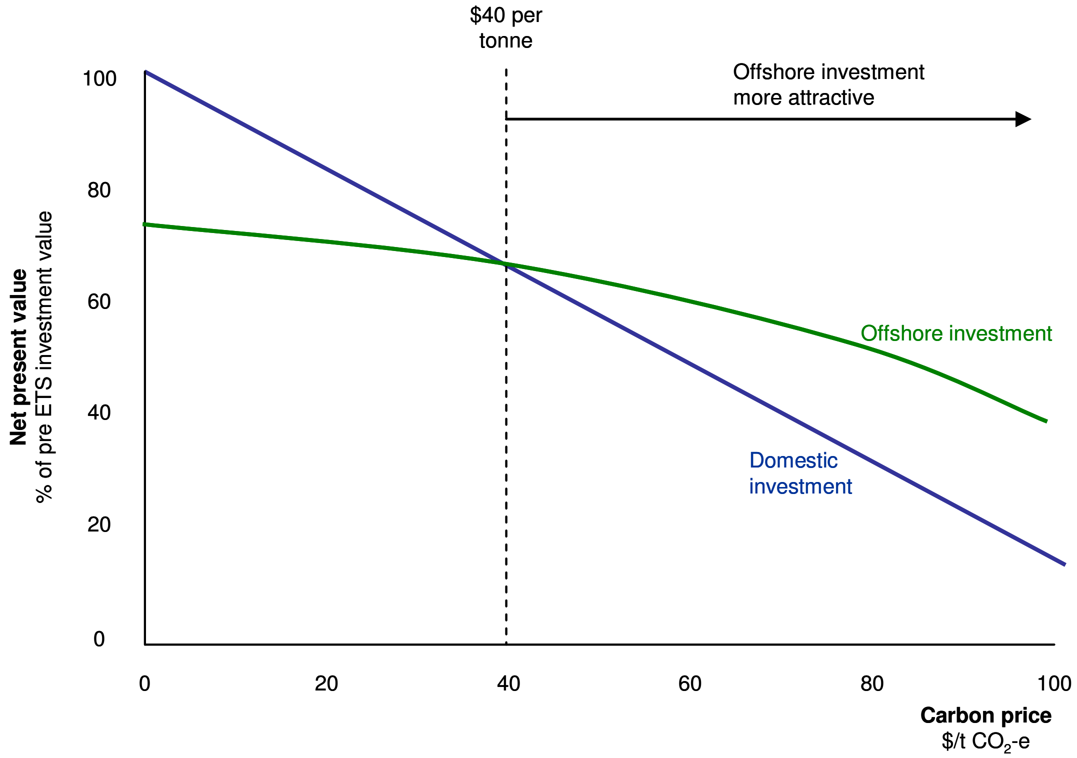


Figure 4-1 highlights that, even with the assumptions made, the offshore investment only becomes more attractive than the Australian investment option at carbon prices above $28 per tonne. In other words, in the example provided by the BCA, *no* leakage would occur at carbon prices below $28 per tonne.

However, the assumption that there is no carbon price risk for offshore investments is not likely to hold for high carbon prices in Australia since the Australian Government has made it clear that Australian emissions reductions will be a function of what happens overseas. Thus, for domestic prices to rise to up to $100 per tonne in the BCA example without any carbon price risk overseas is unrealistic. Figure 4-2 modifies the BCA graph to highlight the effect of this assumption.

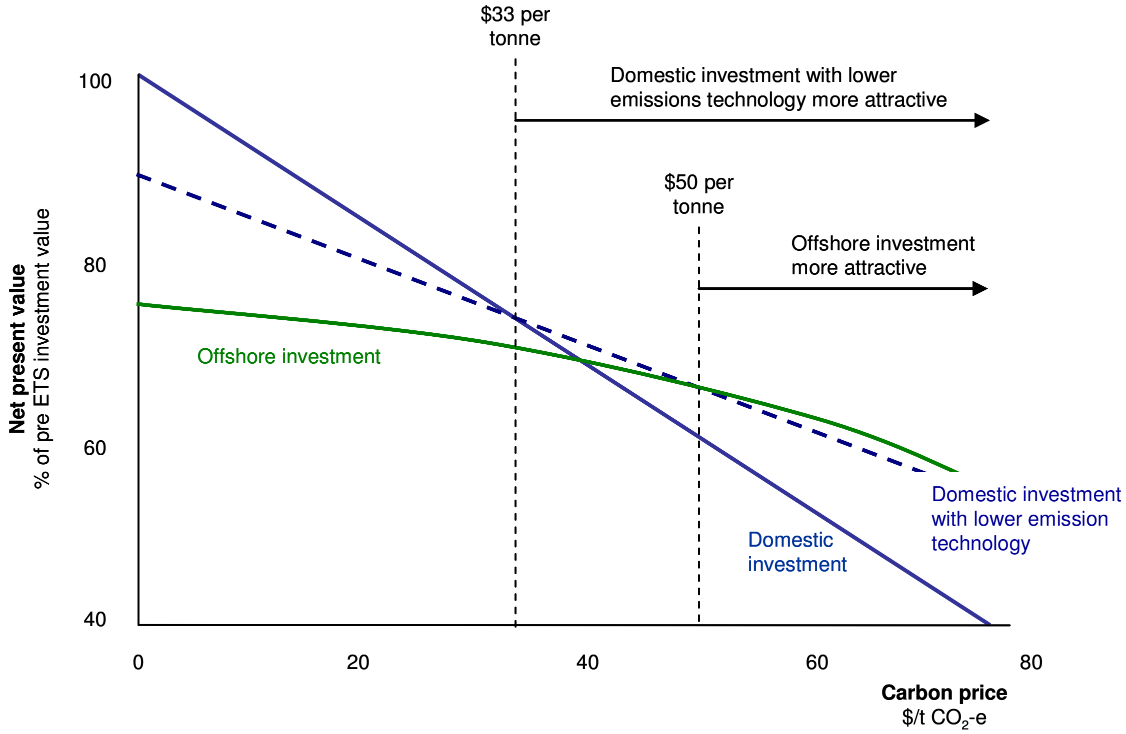
Figure 4-2 Effect of including offshore carbon price risk on the impact of carbon pricing on EITE industry investment decisions



This shows that even if investors only place a small carbon price risk premium on offshore investments, the domestic carbon price at which offshore investment is more attractive rises significantly, in the illustrative case provided in Figure 4-2 it rises to $40 per tonne.

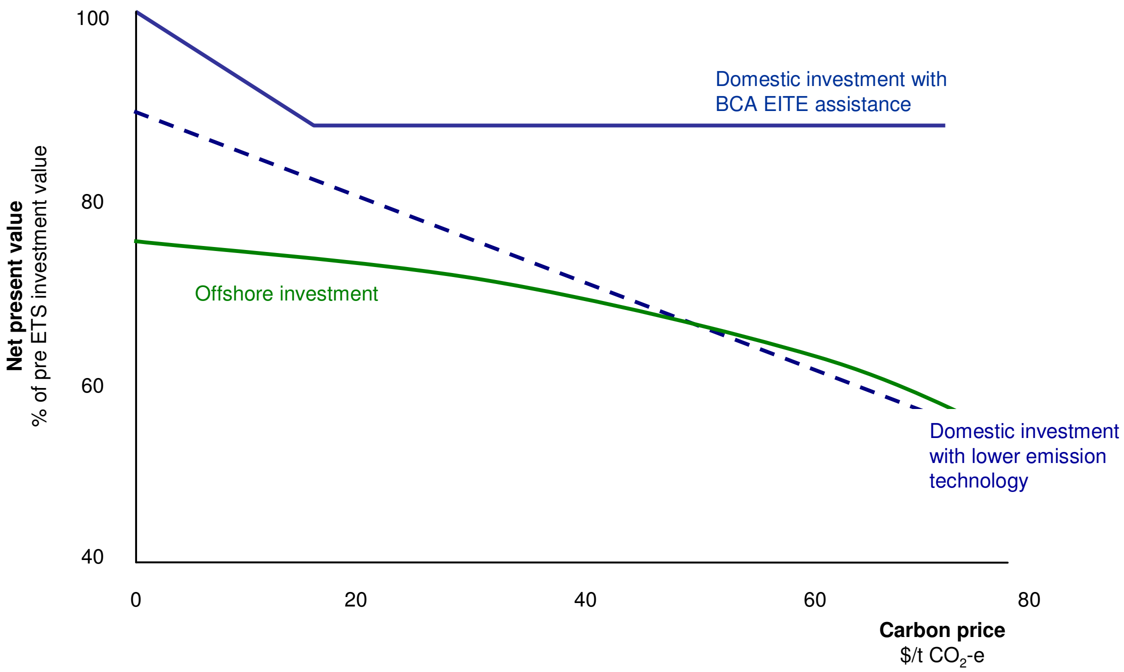
In many cases, firms have a choice about the technologies they use to produce their outputs. The domestic investment line shown in the figures above is built on the underlying assumption that the technology that provides the highest net present value when there is no carbon pricing continues to be the best technology to use regardless of carbon prices. For many investments, this is not realistic. To illustrate what the availability of alternative technologies may do, Figure 4-3 shows an illustrative case where an alternative (lower emission) technology is available. In the illustrative case provided, the alternative technology reduces the NPV of the pre ETS investment value by about ten per cent. However, because it is less emissions intensive, the lower emissions technology looses less of its NPV as carbon prices rise and becomes more profitable at carbon prices above $33 per tonne. Thus, the offshore investment only becomes more attractive than domestic investment at carbon prices over $50 per tonne in the illustrative example provided in Figure 4-3.

Figure 4-3 Effect of including low emissions technology options on the impact of carbon pricing on EITE industry investment decisions



This example is illustrative only and such lower emissions technologies may not be available for all investments. The BCA did not provide the background as to which industry this example was chosen from and it is therefore impossible to assess the likely technology based abatement opportunities that may exist for this particular case. Nonetheless, the illustrative example highlights the danger of using the BCA EITE assistance proposal because it provides full compensation for any carbon price impact beyond 3 to 5 per cent of industry value add. Thus, as illustrated in Figure 4-4, companies do not obtain benefits from implementing lower emissions technologies beyond the threshold.

Figure 4-4 Effect of BCA EITE assistance on low emissions technology deployment



This results in more emissions intensive production even when the price of carbon is high enough to make the lower emission technology more cost effective. In other words, the BCA proposal does not preserve technology based abatement incentives within EITE activities. This contrasts with the CPRS proposal where firms obtain assistance on the basis of industry averages rather than the firm's actual emissions. The CPRS proposal therefore provides significant incentives for technology based abatement in EITE industries. However, the CPRS may not preserve the technology based abatement incentives fully because firms may have an interest in keeping industry emissions intensity above the relevant assistance thresholds to continue receiving assistance after the five yearly scheme reviews. This applies mainly in the context of industries that have few players and (absent collusion across the industry) where the emissions from one firm's activities are large enough to significantly change industry average emissions.

The discussion above highlights two important points, one is that leakage may not occur even for new investments until domestic carbon prices get quite high (at which stage global carbon prices will also be quite high) and the second is that the proposed BCA EITE assistance scheme removes some technology based abatement incentives for EITE activities. Of course, both the CPRS and BCA schemes reduce activity based abatement incentives to avoid emissions leakage. However, as discussed in Section 3, this may come at a high price in terms of large transfers to firms where leakage would not have been a problem (false positives in the language of Section 3) and with significant efficiency implications.

For these reasons and from the results of the analysis provided in the following two sections – which describe the relative emissions intensity of aluminium production (Section 4.1) and liquefied natural gas production (Section 4.2) to assess the extent of likely leakage from these industries – the proposed schemes are not likely to enhance the efficiency of the ETS.

The analysis in Section 4.1 below shows that aluminium production is likely to be significantly more emissions intensive in Australia than globally due to the fact that around 55% of global aluminium production is done using hydro-electricity (International Aluminium Institute) and a large proportion of the remainder is produced using gas and nuclear power, whereas electricity production in Australia is dominated by coal. New smelters with combined capacity in excess of Australia's total capacity are currently being built in the Middle East using the latest combined cycle gas generation and smelter pot technologies. The relative GHG emissions intensity of natural gas as compared with black coal (using the lower emission factors associated with black coal in NSW) is less than 60%. The relative GHG intensity of these facilities when compared to average Australian facilities is further enhanced by the fact that the generation facilities are on-site, avoiding transmission losses. Thus, even where a reduction in aluminium production occurs as a result of emissions pricing in Australia and is taken up by production elsewhere in the world, emissions leakage is well below one for one and is likely to be below 50% on average.

For liquefied natural gas production (Section and 4.2), emissions leakage from reduced production in Australia may not occur at all, given that global resources available for development of such facilities are currently limited and that all natural gas resources that are economically exploitable are either being exploited or under development.

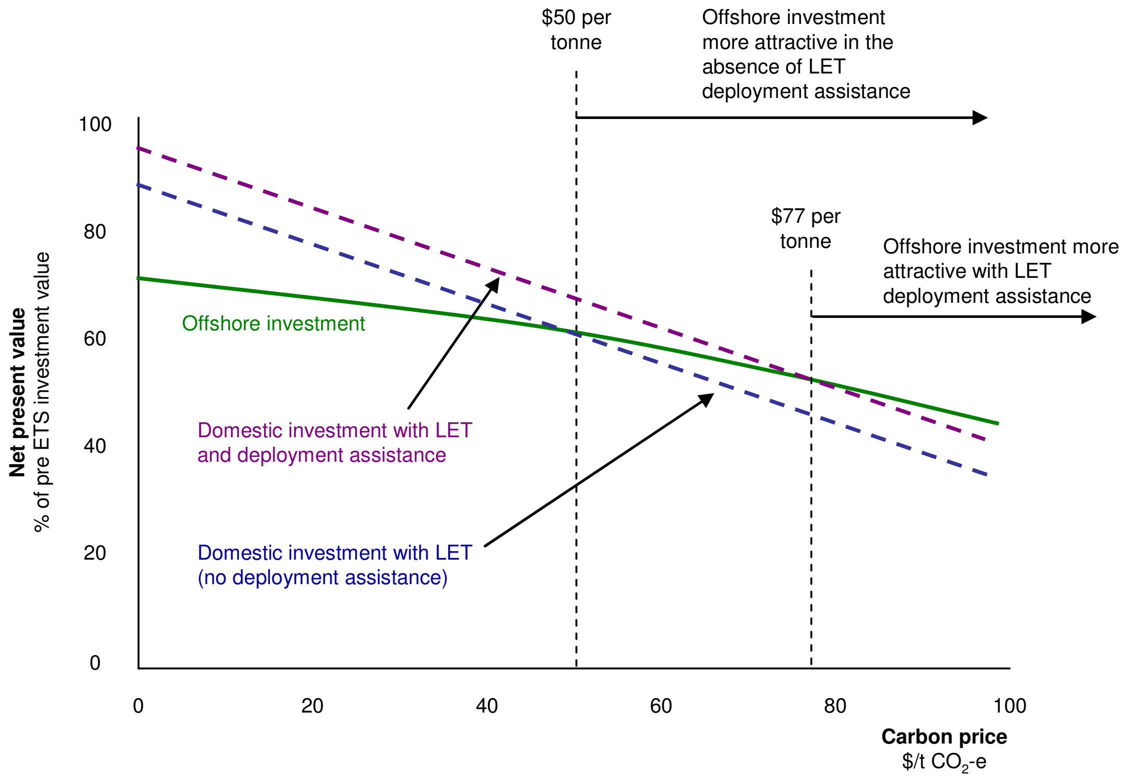
On balance, MMA is of the view that without detailed economic analysis of the magnitude of the leakage problem, as well as a detailed analysis of policy design options to avoid emissions leakage there is little confidence that the proposed schemes will deliver net benefits to the community. Rather the proposed schemes are likely to impose significant additional costs on non EITE sectors and non assisted EITE activities.

As discussed above, the ability of the proposed EITE assistance schemes to deliver improvements to the efficiency of the emissions trading scheme by reducing leakage is, on balance, doubtful. The emissions leakage related justification for assistance to existing emissions intensive activities is even weaker given the large sunk and immobile assets associated with existing assets. However, the proposed schemes are likely to provide the bulk of free permits to precisely such activities given that the vast majority of EITE production over the coming years is from existing assets.

To the extent that assistance to existing emissions intensive activities is desired for reasons other than emissions leakage, for example to 'smooth the transition' to a carbon constrained economy, this case needs to be made separately and explicitly. Transitional assistance is beyond the scope of this report but the case for such assistance, especially given its magnitude, has not been made. The EITE assistance scheme proposed in the CPRS green paper rightly limits available free permits to avoid imposing excessive costs on the rest of the economy but the proposed assistance still amounts to billions of dollars without a robust justification either in terms of emissions leakage or in terms of transitional assistance.

Given these issues, a more desirable option may be to assist the traded sector to transition to a low carbon future by providing assistance to deploy low emission technologies. Figure 4-5 shows the effect of providing low emission technology deployment assistance for the illustrative case discussed throughout this section. By subsidising the deployment of low emission technology, the NPV of the investment illustrated in Figure 4-5 rises pushing the carbon price at which the offshore investment is more attractive from $50 per tonne to $77 per tonne. In other words, in the illustrative example provided here, the deployment assistance would ensure that no leakage occurs until the domestic carbon price reached $77 per tonne.

Figure 4-5 Effect of low emission technology (LET) deployment assistance on the impact of carbon pricing on EITE industry investment decisions



This option is unlikely to stop all leakage because there may not be lower emissions technologies available for some sectors but it would reduce the impact of the EITE assistance on the rest of the economy and provide a strong drive to achieve a competitive low emissions economy as a reasonable global emissions reduction effort unfolds. In order to assess the extent to which this option is worth implementing and how is beyond the scope of this report. However, it highlights the need to undertake a proper cost benefit analysis of the options provided before large sums are committed to EITE assistance.

4.1 Aluminium

The production of aluminium gives rise to greenhouse gas emissions both directly through the production process and indirectly through the consumption of electricity. Primary aluminium production currently accounts for approximately 1% of global GHG emissions (International Aluminium Institute, no date). In 2007, Australian aluminium production produced 31.6Mt of CO_2-e emissions comprising of (Australian Aluminium Council, 2007):

- 0.50 Mt CO2-e of direct PFC emissions,
- 3.16 Mt CO2-e of direct process emissions,
- 0.29 Mt CO2-e of other site-level emissions, and
- 27.69 Mt CO2-e of indirect emissions from electricity production.

Aluminium smelters use electrolysis to extract aluminium from alumina (aluminium oxide) in a cryolite bath using the Hall-Heroult process. Alumina is added to the bath where it dissolves and decomposes into oxygen and aluminium. The molten aluminium is attracted to the negatively charged cathode at the bottom of the bath and is periodically tapped off while more alumina is added. The oxygen combines with carbon from the anode and escapes as carbon dioxide. The basic chemical reaction is described by the following equation: $2\ Al_2O_3 + 3\ C = 4\ Al + 3\ CO_2$

This reaction requires large amounts of electricity and is performed in pots (or cells). An aluminium smelter consists of “pot lines” typically containing hundreds of pots that are wired in series and run at low voltages, typically 4 to 4.5 volts, and high amperages, modern pots running at upward of 250MA. The temperature in the pots is around 970°C and. Most of the energy is lost as waste heat.

During the process the carbon anodes are consumed and hence need to be replaced periodically, typically every two weeks. Older pots used “Söderberg” anodes which were continuously fed into the process as a paste and baked by the heat resulting from the electrolysis. Modern pots invariably use pre-baked anodes which are prepared in a separate facility (generally at the same site) and allow for better control over the process.

The efficiency of the process is largely determined by the distance between the cathode and anode. The high amperages induce strong electrical fields that can cause waves in the molten aluminium at the bottom of the pot, and the size of these waves determine the minimum achievable distance between the cathode and anode; the smaller this distance, the less energy is required and the more efficient the reaction . Waves can also be induced through the tapping of the molten aluminium, replacement of the anodes and adding of alumina. The stability of the molten pool of aluminium is dependent on the precision of the control of the process and the design of the pots. Modern pots attempt to minimise effect of the magnetic field through strategic positioning of the bus bars which deliver electricity to the pot and induce their own magnetic field and novel mechanisms for controlling the height of the anodes, tapping off the molten aluminium and adding of alumina. They also attempt to minimise heat loss through sealing of the pot, reducing the loss of hot gasses, and the recovery of waste heat.

As well as the reaction described by equation 1, there are many other reactions that take place inside the pot which produce various gasses, some of which have can be damaging to the environment and some of which are potent greenhouse gasses. When the amount of bauxite in the pot runs too low the voltage rises sharply, causing an undesirable chemical reaction known as an "anode effect". This reaction is essentially the electrolysing of the cryolite and produces perfluorocarbons (PFCs); in particular tetrofluormethane and hexofluormethane. 1kg of these gasses are 6500 and 9300kg of carbon dioxide respectively. In 2005, these made up about 30Mt of the 140Mt of direct CO_2-e emissions attributed to Aluminium production (International Aluminium Institute).

Aluminium smelters have reduced the frequency and duration of anode effects significantly over the last two decades such that the emissions per tonne of aluminium decreased by over 80% between 1990 and 2006 (International Aluminium Institute, 2008). This has eventuated through improvements and innovations in pot design. Many of these innovations can and have been applied as upgrades to existing plant.

Opportunities for direct process GHG abatement through improvements to existing technologies are, however, running out. The most promising opportunity for significant abatement currently envisaged within the industry is the development of inert anodes (Woodrow, 2005). These offer the potential to fundamentally change the chemical reaction used in aluminium smelting (equation 1) such that much of the carbon dioxide production is replaced by the production of water, oxygen and/or other less potent or short lived greenhouse gasses. It will not, however, make significant reductions to the energy requirement of the process, which is the major source of emissions when thermal electricity is used as the power source.

An anticipated technological advance that may reduce the energy requirements of aluminium smelting by 10 to 15% is the "drained cathode cells" technology which is being developed by CSIRO and Rio Tinto Alcan. This technology will allow reduction of the anode to cathode distance and reduce energy requirements by 10 to 15% (Kaye, 2007). However, this technology is not ready for production as yet.

It is more economic to implement cutting edge technologies while constructing new facilities rather than upgrading older ones. This is true, for instance of the drained cathode cells, which is enabled by quite different pots to those currently in use. The world's most efficient aluminium smelters are the newest ones. The world's most efficient aluminium smelter is located in Africa, which uses approximately 14,300MWh per tonne of aluminium. The global average is 15,500MWh and the Australian average is approximately 15,050MWh[7].

[7] African and Global averages from (International Energy Agency, 2007) and Australian average derived from (Australian Aluminium Council, 2007).

Where thermal electricity is used to power the plant, the GHG emissions from the production of this electricity are generally much larger than the direct emissions produced by the physical process of smelting aluminium. For example, the Bell Bay smelter on the Tamar River in Tasmania is run on hydro-electricity and produces 2.51 tonnes of CO2-e per tonne of aluminium (Rio Tinto Aluminium, 2008), whereas the national average (including Bell Bay) is over 16 Tonnes CO2-e per tonne of aluminium (Australian Aluminium Council, 2007). Of course, the opportunity cost of hydro-electricity, including any loss in potential for carbon sequestration arising from flooding wilderness, must be taken into account when considering these relativities. However, in many regions around the world, aluminium is smelted in areas where this opportunity cost is demonstrably low. Globally, at least 55% of primary aluminium production is done using hydro-electric power (International Aluminium Institute, no date).

Due to the abundance of natural gas available in the Middle East, several new smelters and co-generating gas fired power stations are being built in that region. Since natural gas creates less GHG when used to generate thermal electricity, these smelters will also be less is GHG intensive than for equivalent smelters running on coal fired electricity. Using tables 1 and 2 of the National Greenhouse Accounts Factors (Department of Climate Change, 2008b) we can get some idea of the relative GHG efficiency of natural gas and black coal (the dominant fuel source for power generation in New South Wales and Queensland). The scope 1 emission factor for natural gas is 51.3 kg CO_2-e/GJ and for black coal is 89.3 kg CO_2-e/GJ in NSW. These factors imply that the relative GHG intensity of electricity generation in the Middle East compared to NSW will be at most[8] 51.3/89.3*100 = 57.4%.

4.2 Liquefied Natural Gas

Liquefied Natural Gas (LNG) is natural gas that has been liquefied through freezing. Natural gas is mainly methane but typically contains a variety of other hydrocarbons and other contaminates when extracted. The volume of LNG is approximately 1/600th that of natural gas and is hence suitable for export.

The process of liquefying natural gas is performed by passing the gas through a series of heat exchanges and gradually reducing its temperature until it undergoes a phase change and condenses to liquid. This is an energy intensive process. Liquefaction facilities are generally powered by on-site gas fired power stations that typically consume approximately 10% of the gas arriving at the facility. More modern facilities tend to be more efficient than older ones regardless of where they are located and hence the greenhouse gas intensity of production can be assumed to be positively correlated with age, regardless of location.

[8] These emission factors relate to direct combustion only and given that aluminium smelters in the Middle East typically generate their electricity on site and Australian aluminium smelters draw their electricity from the grid, efficiency comparisons based on these factors will be very conservative. For example, the full cycle emission factor for indirect emissions arising from purchase of electricity from the grid in NSW is 249 kg CO_2-e/GJ, implying that the relative intensity of electricity production used for aluminium smelting in the Middle East compared to NSW may be as low as 51.3/249*100 = 20.6%.

During transport, the LNG warms up and changes back into natural gas at around the rate of 5% a day. This gas is often used to power the ship used for its transportation, though it may be more economical to re-liquefy the gas and power the ship purely on bunker-fuel. In either case, the longer the journey, the larger the loss of LNG and hence the higher the emissions per delivered unit. It can be seen in Table 4-1 that Australia is a long way from countries that are currently able or developing the capacity to import LNG compared with most LNG producers and as such, export of LNG from Australia may be more greenhouse gas intensive than the global average[9], depending on where our markets develop[10] and where alternative facilities may develop.

Table 4-1 – Shortest path distances from countries with liquefaction plants to countries with re-gasification plants

Country	Count	Mean distance
Norway	1	6,120
Russian Federation	3	6,460
Algeria	6	7,668
Iran	4	7,774
Libya	1	7,879
Egypt	5	7,965
Qatar	10	8,232
Abu Dhabi	1	8,310
Oman	2	8,527
United States	1	8,667
Trinidad and Tobago	4	8,925
Yemen	1	8,927
Nigeria	9	9,131
Venezuela	1	9,253
Equatorial Guinea	2	9,701
Brunei	2	9,809
Malaysia	4	9,906
Indonesia	4	10,385
Peru	1	10,561
Angola	1	10,688
Australia	11	12,130
Bolivia/Peru	1	12,385

[9] The distances quoted Table 4-1 are straight line distances and actual shipping are likely to be longer than this.

[10] Our main markets are currently Japan and China and many of the new projects are seeking contracts with East Asia and further contracts with China (Wood, 2008).

Global demand for LNG has increased dramatically over recent years due mainly to rising oil prices, and concerns about climate change. This has caused a surge in the development of both liquefaction plants and re-gasification plants as is demonstrated in Table 4-2 and Table 4-3 (The Petroleum Economist, 2008). Globally, there are currently as many plants under speculation, in planning or under construction as there are currently operating. It is probably the case that a) global resources available for development of such facilities is currently limited and/or b) all resources that are economically exploitable are either being exploited or under development. In either case it is unlikely that reduced production in Australia will substantially increase foreign production. More likely, emissions pricing in Australia it will make some facilities that would be commercial with no carbon pricing uneconomic but without resulting in emissions leakage

Table 4-2 – Global numbers of liquefaction plants, excluding Australia

Status	Count
Existing	32
Planned and proposed	13
Speculative	9
Under construction	10

Table 4-3 – Global numbers of re-gasification plants, excluding Australia

Status	Count
Existing	58
Planned and proposed	53
Speculative	41
Under construction	21

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