A price floor for Australia's emissions trading scheme?

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Summary

A price floor could help Australia's transition to a lower-carbon trajectory by reducing the downside risk for investments in low-emissions assets.

- Turning around Australia's emissions trajectory will require major investments in coming years.
- Investment decisions with large and long-term carbon implications, especially in Australia's power sector, have been delayed or taken with inefficiently short time horizons because of carbon price uncertainty.
- The main rationale for a price floor in Australia would be to provide assurance that permit prices will not drop to exceedingly low levels. This can help with risk management and firm up market expectations, and thereby promote investment.
- Putting in place provisions for a price floor would have immediate effects on investment decisions, regardless of whether the price floor is later triggered or not.

A price floor could be of particular benefit in the early phases of emissions trading following a fixed price period, in the context of evolving international emissions markets.

- While international emissions markets mature, market fragmentation is possible, with some segments trading at lower prices than domestic prices in major carbon pricing schemes.
- A price floor would act as a safeguard against the possibility of significantly lower than expected permit prices. It could thus help achieve a smooth transition from fixed to floating permit price.
- A price floor allows upholding a domestic price at a given level, while allowing the use of cheaper international offsets or permits towards Australia's target.
- Price floors feature in current carbon pricing proposals in the United Kingdom and the United States.

Price floor provisions simplify investment decision making and risk management, but involve some additional complexity in policy design and implementation. With appropriate design, any extra administrative burden is small, and impacts on the operation of domestic emissions markets minimal even if the price floor is active.

- A suitable option for implementation would be a reserve price in auctions of domestic permits. This would be coupled with arrangements to support the floor price for imported offset credits or permits.
- International emissions credits or permits would be subject to a fee on conversion to an Australian unit. Emissions markets would function in exactly the same way as without a price floor.
- Alternatively, international trading could be channelled through a government gateway, with government on-selling to domestic emitters.
- Under either option, government would receive revenue from the difference between domestic and international prices.
- Arguments have been made against price floors relating to market interference, policy uncertainty, administrative complexity, international linking, inter-temporal flexibility, and financial instruments. With correct design, most of these issues are not material, and none is a fundamental obstacle to a price floor.

The level of a price floor could be set with reference to Australia's fixed price or to carbon price levels in other countries.

- The price floor could be set as a percentage of the fixed price at the time of transition, increasing annually at a percentage rate.
- Alternatively the floor price could be tied to carbon price levels in other countries. For example, it could be set with reference to a weighted index of prices in major carbon pricing schemes.
- A price floor starting in the low \$20s/tCO_2 at the transition to emissions trading would likely be significantly below future carbon prices in the EU emissions trading scheme.

1 The rationale for a price floor

Australia's Multi-Party Climate Change Committee is currently considering options for the design of a carbon pricing scheme for Australia.

Australia's low-carbon investment choices

Australia's underlying emissions trajectory is on a continued upward trend, in the absence of further mitigation policies. According to Treasury modelling, carbon prices above the $20-30/t$CO_2$ range that is in the current debate will be needed just to keep domestic emissions stable, let alone to reduce them.

Turning Australia's emissions trajectory around would be a useful benchmark of successful climate policy. To get this underway, what matters most is a solid expectation of medium term carbon prices (Jotzo 2011). The proposed model of a fixed price permit scheme converting to a market-based carbon trading scheme can achieve this, if the parameters are set correctly.

Investment decisions with large and long-term carbon implications, are at stake, particularly in Australia's power sector (Garnaut 2011b). The choice between coal, low-efficiency gas, high-efficiency gas and renewables to a significant extent depends on expectations about future carbon prices, and the risk profile around these expectations. Investment decisions have been delayed because of carbon price uncertainty, or taken with inefficiently short time horizons leading to more costly investment choices (Nelson et al. 2010).

A price floor in Australia's emissions trading scheme would make investments in lower-carbon options more attractive, by reducing downside price risk. It would begin to have this effect immediately on putting price floor provisions in place, whether or not the price floor is later triggered or not.

Confidence for low-emissions investments

A price floor is a *minimum price under emissions trading*, guaranteed by government. It is an element of 'hybrid' schemes of combined quantity and price control of emissions. Hybrid schemes can improve economic efficiency when there is uncertainty about emissions reduction costs, by bringing global abatement closer to the optimal level (Roberts and Spence 1976, Philibert 2009, Fell et al. 2010).

In the national context, providing greater *confidence for investment in low-emissions assets* is the main argument in favour of a price floor (Wood and Jotzo 2011), or as McKibbin et al (McKibbin et al. 2009) put it, to "limit the downside risk for investors in low carbon technologies". The qualitative argument has been confirmed in quantitative modelling, for example Brauneis et al (2011) find that a price floor could significantly speed up investment in low-carbon options in the power sector.

The level of a floor price could be set below expected market prices, as a *safeguard* against inadequately low permit prices. This is appropriate given the intention to manage the ambition of Australia's contribution to global mitigation through the quantitative target. Setting a relatively low floor price would imply that it is most likely that the actual price will be determined by the market most of the time; while setting the floor price at a relatively high level implies that it would be likely to determine the actual price most of the time.

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Emissions levels and economic cost

If a floor price is exercised, it *increases the amount of domestic abatement*, relative to the situation without floor price. This does not necessarily amount to a more stringent national emissions target, however. The reason is that with international trading of permits, the floor price would not be expected to change the level of national emissions net of trading: more domestic abatement means less imports of international emissions offset credits or permits.

Setting the domestic price above prices in international markets is not the lowest cost way of complying with a given net national emissions target at one point in time. However it may be desirable in terms of its *dynamic efficiency*. A higher domestic price could achieve emissions reductions at lower national cost over the long term if international permit markets are imperfect, with some international units trading at prices below those in the main carbon pricing countries.

A price floor could also result in significantly more efficient long-term investment choices if financial risks prevent the least cost domestic investments in long lived assets that already face significant cost uncertainty, such as power generation capacity. Reasoning along these lines is behind the UK proposal to introduce an emissions fee for the power sector, in addition to emissions trading (HM Treasury 2010). A higher permit price now could also reduce the risk of future fiscal risks if the need arose to subsidise the refurbishment of high-carbon plants in order to achieve more stringent emissions reductions.

Implementation

While a price floor simplifies investment decisions and risk management, it requires additional regulatory provisions and so may result in increased *complexity*. It also potentially alters or limits the operation of markets. The costs of these effects have to be weighed up against the expected benefits, and design of a price floor needs to take these concerns into account.

There are ways to implement price floors that limit the extent of additional complexity, and that leave markets to operate normally. Appropriate design can address the arguments that have been made in the recent Australian debate against price floors on grounds of implementation issues.

Other elements of scheme design such as *screening* international emissions units for quality, and allowing *banking* of emissions permits, have an important role for maintaining the quality of abatement in the Australian scheme, and to limit permit price variability over time. These options should be implemented whether or not provisions for a price floor are in place, but they are generally not well suited for implementing a price floor.

A price floor meanwhile can provide an *unambiguous statement about the minimum price* that investors can expect. Such clarity could be desirable in particular in the early phases of an Australian emissions trading scheme. It could help facilitate a successful transition to a floating price while emissions markets are still maturing.

A price cap?

It could be argued that investors should be protected not just from the downside risk in carbon prices, but also the upside risks, by combining a price floor with a price ceiling, sometimes called a ‘price collar’. Indeed, a price cap was a proposed temporary feature under the proposed Carbon Pollution Reduction Scheme.

While sound in theory and if applied consistently across many countries (as in analyses by McKibbin et al, Philibert, and others), a price cap provision is not easily feasible, and probably not necessary, for Australia.

Feasibility is hampered by the fact that a price cap precludes banking of emissions permits and presents a severe obstacle to full linking of emissions trading schemes between countries. The same is not true for a price floor (see Section 4 below). And importantly, a price cap is unlikely to be necessary in practice, because the EU emissions trading scheme – or potentially future large schemes in other countries – provide a backstop supply of permits to Australia.[2] Australia's likely demand for international emissions units is small relative to emissions volumes in the EU scheme, so the EU price is effectively a price cap for Australia.

2 Responding to low prices in international emissions markets

Integration with international markets with a floating price is a key advantage of the planned shift to permit trading, as it allows efficiencies through international trading. Australia is highly likely to need to rely on international emissions trading to fulfil its emissions target cost-effectively.[3]

The transition from fixed price to emissions trading however ought to be contingent on international emissions markets, considering "the availability, integrity and price of international units" as noted in the MPCCC (2011) paper on scheme architecture.

Dealing with possible access to cheap international emissions units could be the most likely application of a price floor in the Australian scheme. A price floor could provide confidence to low-emissions investors that the Australian permit price will not fall below a prescribed level, irrespective of international emissions market conditions.

It could thereby assist in the transition from fixed price to internationally linked emissions trading, and allow such a transition even if international markets are still maturing.

Possible fragmentation in evolving international emissions markets

A global or near-global system of carbon trade can be expected to emerge in years to come, based on the Copenhagen pledges which imply reductions relative to business-as-usual for most large countries (Jotzo 2010), and given that trading is in the interest of both potential buyers and sellers. And as Garnaut (Garnaut 2011a, p.21) noted, opportunities for trade "may exist in substantial quantities, liquidity and stability" in advance of a full global climate agreement, including through regional agreements.

Ahead of a system of strongly integrated national schemes however, there may not be a single international carbon price. Market fragmentation can arise if major buying countries recognise different types or sources of international offset credits, or if buyers limit the overall amount of international units that can be used in their domestic schemes.

[2] The only caveat is that theoretically, the EU or other countries could refuse to sell permits to other countries, however this appears an unlikely scenario.

[3] Modelling analysis (Treasury 2008) indicates that Australia is likely to rely on imports of international emissions units (offset credits or other countries' permits) for meeting any target in the range of –5 to –25 per cent (2020 over 2000), under assumptions about international prices and the domestic abatement response.

Some types of emissions units would then trade at lower prices than the market prices in major developed country schemes. This is because the prices for credits that are ineligible for use in some developed country markets (for example the EU) will be determined by demand in remaining buyers' countries markets. Where international credits are able to be generated at low costs and in large volume relative to demand, this could be reflected in low supply prices.

The market for offset credits from the Clean Development Mechanism (CDM) is likely to be subject to such fragmentation. The EU as the major buyer already excludes certain project types, is putting a limit on overall use that may be triggered from 2013 onward, and foreshadowing that only CDM credits from least developed countries might be accepted in future. Similar buyers' constraints might apply in future markets for other types of emissions units, for example from reduced deforestation (REDD) and sectoral crediting schemes.

Appendix 1 provides details.

A price floor for imports of emissions units

A price floor would prevent the domestic Australian permit price being determined by the lowest-cost recognised emissions units for sale in international markets, while allowing Australia to reap gains from international permit trading.

If the price floor were exercised, this would increase Australian abatement relative to the situation without a price floor, because the Australian permit price would then be higher than the price of the cheapest available recognised international units.

In a static analysis, this means a higher cost for achieving a given net emissions target. However, upholding a minimum domestic price could be dynamically efficient, as discussed in Section 1 above.

Implementation options for a price floor on international emissions permits or offsets are discussed further in Section 5 below. They include a fee on acquittal under the Australian scheme that brings the total cost of international units up to the floor price; or trading of international units through a government gateway with on-selling to the domestic market.

Both approaches allow the use of cheap international emissions units while upholding a higher domestic Australian floor price. The difference in prices becomes revenue for the Australian government (see Figure 1). This is appropriate as the difference represents the economic rent arising from to differences in regulation in different markets. The extra fiscal revenue can be used to achieve the broader objectives of the scheme.

Other elements of scheme design

Excluding certain types of international emissions units from eligibility in the Australian scheme may become necessary in order to uphold quality standards, irrespective of prices. For example, the Australian regulator may choose to exclude credits from certain project types, mechanisms or countries, in a comparable vein to EU policy which has banned certain project types and is restricting new projects to least developed countries (see Appendix 1). Screening for quality would need to occur even when a price floor is active.

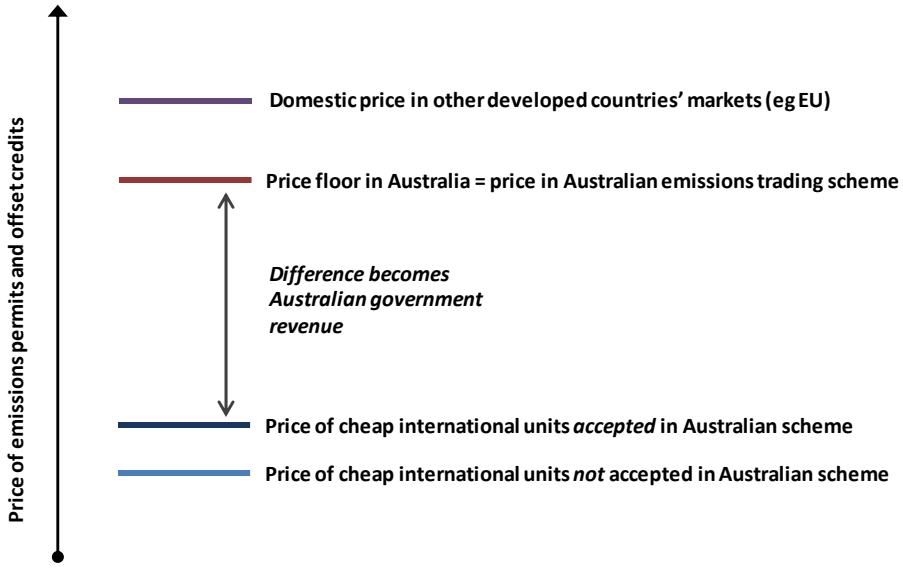
Using the exclusion approach is not well suited as a primary instrument to uphold a minimum permit price in Australia however. Firstly, there may be international units that are of acceptable quality but come at very low cost. Secondly, the discretionary nature of the

exclusion approach could create market uncertainty and implementation difficulties.[4]

Gearing the acquittal of international units would improve the environmental effectiveness of using international offset credits, as more offset credits would be acquitted in return for a tonne of emissions in Australia. Thus the cost advantage from cheap emissions offsets would be converted to greater expected global abatement effort, or to a higher level of confidence that claimed emissions reductions are in fact achieved.[5]

As in the case of the exclusion approach however, gearing is unlikely to be a suitable instrument for upholding a minimum price in the Australian scheme.

Figure 1: A price cap for imports of emissions units



3 Responding to lower than expected abatement costs

The traditional economic analysis of hybrid schemes emphasises the role of price floors in overriding a quantitative emissions target in the event of lower than expected abatement costs. This could occur, for example, as the result of unanticipated technological breakthrough, or because emissions markets tend to be more effective at reducing emissions than forecast, as experience has shown (MPCCC 2010).

This perspective is relevant when considering a global emissions target that is fixed for a long time, and that can be overridden by way of internationally harmonised price floors. In practice, technological surprise could be dealt with by adjusting emissions targets. Also, well-functioning emissions markets would dissipate short-term and localised effects of technological surprises on abatement costs.

[4] For example, the decision to exclude a class of emissions units that fluctuates around the floor price would not be clear cut. If units acquired before the exclusion are made ineligible this would disadvantage investors; yet if such emissions units continued to be eligible for acquittal, this could lead to Australian prices falling in line with international prices.

[5] This is relevant in particular for project-based offset credits, for example Schneider (2008) found that 40 per cent of CDM projects in a random sample would have happened anyway.

Low abatement costs in Australia

If Australia is integrated in international emissions markets, then a fall in abatement costs in Australia results in more abatement being undertaken in Australia, and less emissions units imported. The (internationally linked) permit price would be slightly lower, reflecting the impact of Australian demand or supply in global markets. Thus with fully functioning international markets, an Australian price floor would have no effect in response to lower than expected domestic abatement costs.

If there was not international trading however, lower abatement costs mean that a given national target would be achieved at a lower permit price. A price floor would then be effective to increase Australia's abatement, and achieve a more ambitious national emissions target.

Low abatement costs globally

If abatement costs the world over were lower than expected, for example because of technological breakthrough, then the price of permits in individual countries and in international markets would be lower also.

This is the classic case for operation of a floor price, which would raise the global abatement effort in response to lower costs. However, this would require an internationally coordinated price floor. Whether such a coordinated price floor may arise is an open question.

It would not be in Australia's interest to maintain a price that is significantly higher than that prevailing in other major permit pricing schemes over the long run. This suggests that an Australian price floor should be subject to periodic review, and that the level of a price floor should be informed by the expected future level of domestic carbon prices in other major emissions pricing schemes.

Targets and banking

Unless there is an internationally harmonised carbon price floor, the desirable global response to a permanent reduction in abatement costs is for countries to agree more ambitious emissions reduction targets.

If banking of emissions permits is allowed, markets function well and there is trust in future policy regimes, then a drop in abatement costs will be reflected in a relatively small downward shift in the forward price curve over many years, rather than a large drop in near-term permit prices. If there also is an expectation that future targets will be tightened in response to lower costs, then emissions markets would translate lower abatement costs into greater amounts of abatement, with the extra abatement banked for future use.

These conditions may however not be fully in place, especially early on in the emissions trading scheme. A price floor could serve as a backstop.

4 Arguments against a price floor

A number of arguments against the option of a price floor have been made in the recent discussion, including in the Australian policy debate. They are briefly described and assessed in turn.

Market interference

The most fundamental argument against price floors is that they amount to undue interference in markets. Such arguments overlook that permit markets are created by government regulation in the first place, and the market price is a reflection of the policy settings. Price floors (or the absence of them) are one of many elements of design and parameters of an emissions trading scheme.

Direct involvement in the operation of markets can be avoided almost completely, depending on the design chosen for a price floor (Section 5).

Costs of achieving a given target

A price floor, if exercised, would create a permit price and levels of domestic abatement above the levels that would be necessary to achieve a given target, thus increasing the cost of achieving this target.

As discussed above, the most likely effect of a price floor when exercised is to increase the share of domestic abatement and reduce the share of imported permits in fulfilling a given emissions target. This does raise overall costs to the extent that the extra domestic abatement comes at a higher cost than the purchased emissions units would have. However, costs may not be higher over time, if extra early action reduces costs in later years.

Policy uncertainty

It can be argued that price floors could itself create uncertainty, as it might become the focal point of political pressure.

Policy uncertainty is an inevitable feature of a carbon pricing scheme, and the overriding policy uncertainty relates to the possibility of a future government rescinding the scheme or altering key parameters. The credibility of a price floor provision depends on its parameters and its design. If a price floor was set unrealistically high, or unsuitable implementation options were chosen, credibility could be low. However as outlined below there are suitable implementation options, and basic objectives of a price floor could be achieved at floor price levels well below the expected permit price in a trading scheme.

Secondary permit markets

It has been argued that price ceilings and floors limit the emergence of secondary permit markets (Garnaut 2011, p.24).

It would appear that this is an issue only if price floors increase policy uncertainty. Provisions for a price floor can be implemented without impeding the operation of forward markets, and markets would continue operating even if the floor price was triggered.

Inter-temporal and international flexibility

It has further been argued that price ceilings and floors limit inter-temporal flexibility (banking and borrowing permits from one year to the next) and international flexibility (trading with other countries), and hence on balance do more damage than good (Garnaut 2011, p.24).

These issues are of clear concern for a price ceiling (Jotzo and Betz 2009), but not for a price floor. A price ceiling, when active, reduces the stringency of a country's commitment, while a price floor increases it – the international credibility is increased rather than compromised. A price floor does not preclude international market linkage if the right design is chosen. It also poses no problems for permit banking, again as opposed to a price cap.

The only inter-temporal issue with price floors is the possibility of excessive borrowing against future permits, in the expectation that the government would rescind on its commitment to the price floor.

Administrative complexity

Introducing additional features to the carbon pricing scheme obviously increases complexity, and potentially increases administrative burdens in its operation. These need to be weighed against the advantages that price floors might bring.

The following section identifies options for implementation of price floors that minimise complexity and the extent of intervention in markets.

5 Implementation

A price floor can be implemented in a variety of different ways, and within each there are options for the specific design. Wood and Jotzo (2011) provide a detailed analysis of various options and their effects.[6]

A price floor model for Australia

The approach that appears most suitable for implementing a price floor in Australia's emissions trading scheme is to set a reserve price at auction of domestic permits, coupled with arrangements to support the floor price for imported offset credits or permits. The approach is summarised in Table 1, and described below.

Australian permits: reserve price

Government issues permits at auction with a reserve price equal to the chosen floor price. No bids are accepted below the reserve price. This option is administratively very simple, and does not interfere with the trading of permits in the market. The market price could dip below the reserve price subsequent to an auction, however the reserve price will be a close proxy of the minimum price in the market if a large share of permits is auctioned.

[6] Analysis of properties of a wider range of hybrid mechanisms, including price caps and variants thereof, can be found in Grüll and Taschini (2011).

Table 1: Selected price floor implementation options

	Instrument	Prices and effects when price floor is active	Prices and effects when price floor is *not* active
Domestic permits	Reserve price at auction	Permits sold at floor price Market price approximately equal to floor price Domestic markets operate same way as without price floor	Permits auctioned at market price Domestic markets operate same way as without price floor
Inter-national emissions units (offset credits or other countries' permits)	Option 1: Fee on conversion to domestic emissions units	Fee = floor price minus international market price Market price approximately equal to floor price Difference in prices becomes government revenue Domestic markets operate same way as without price floor	Fee = zero Domestic markets operate same way as without price floor
	Option 2: Government gateway	Government buys international units, and sells domestically at floor price Difference in prices becomes government revenue	Government buys international units, and sells domestically at market price Difference in prices becomes government revenue

International units: fee on conversion to Australian units, or government gateway

The most challenging aspect of implementation of a price floor is to make it work in conjunction with purchases of emissions offsets or permits from other countries. International units should not be allowed to undercut the Australian floor price.

There are two alternative options to achieve this.

Option 1: Fee on conversion
Leave international trades to market participants, but require a fee on conversion of an international offset or permit into a domestic unit, if the price of international units is below the floor price.

The fee is set approximately equal to the difference between the floor price and the international purchase price (zero if the international price is above the floor price). The fee is set and announced in advance for a period of time, for example for six months or one year. The fee would be set with regard to a benchmark price in international markets, and could differ for different classes of offset credits and permits. Once the price floor no longer applies, the fee is set to zero.[7] The result in the domestic market is an approximate price floor.

International units cannot be directly used in the Australian scheme, rather they need to be

[7] The 'fee on conversion' model is broadly similar to the 'variable fee' approaches described by Wood and Jotzo (2010). The difference that the fee applies with reference to the overall market and at a time of the emitter's or investor's choosing, rather than necessarily at the time of acquittal.

converted into a domestic unit first. On conversion, government rescinds the international unit on exchange for a domestic unit. A domestic unit, once issued, is treated equal to an Australian emissions permit – it can be traded, banked and acquitted without restrictions.

Emitters and financial institutions thereby have the option to lock in their option to use an international unit at any time, by converting it to an Australian unit. Alternatively they can hold international units, retaining the option to sell these units back in the international market, but incurring the risk of a fee (or a higher fee) on conversion if the floor price is triggered (or increased) in the meantime.

This model means there is no intervention at all in emissions markets unless the floor price is triggered, and even then domestic emissions markets can operate unfettered. It requires only the monitoring of international emissions prices and setting of a fee at intervals. The 'conversion' aspect does not increase administrative burdens, as arrangements for the acquittal of international units in Australia's scheme will need to be made in any case, whether there is a provision for a price floor or not.

The 'fee on conversion' model channels arbitrage profits to government if the price floor is active, but not at other times.

Option 2: Government gateway
Channel all purchases of international units for acquittal in Australia through a government agency or independent authority. The offsets or permits are bought at going rates internationally, and sold to domestic emitters at the same price as the market price or reserve price for Australian permits. The agency could make its own buying decisions and sell international units in Australia at auction or through a 'permit shop', or it could act as a broker for large market participants.

This model achieves a very similar outcome to the reserve price system for domestic permits, ensuring a minimum issue price with relatively simplicity and no interference in subsequent market transactions. It also ensures that profits from arbitrage between international and domestic carbon prices accrue to government, rather than to emitters or financial intermediaries.

It does, however, require operation of the government gateway for all international permit purchases transactions at all times, whether or not the price floor is active.

Price floor proposals in other countries

All major proposals for emissions trading schemes in the United States – including the planned scheme in California – include provisions for reserve prices at auction.

The United Kingdom is planning an extra fee for emissions from the power sector, in addition to the permit liability under EU emissions trading. It would raise the effective carbon price in the UK power sector above that prevailing in the EU emissions trading scheme, which also covers other parts of the UK economy.

Appendix 2 provides details.

6 Price levels and timing

On the basis of the analysis above, the relevant option for Australia is to set a floor price below the expected market permit price, and to avoid the floor price permanently exceeding carbon prices in other major developed country schemes.

Two options for setting the floor price appear of particular merit:

1. Start the floor price at a level equal to a percentage of the fixed price at the end of the fixed price period. Depending on the level of the fixed price and the objectives pursued with the floor price, the floor price could be anywhere from significantly below the final fixed price level, to equalling the fixed price. The floor price would rise by a percentage each year.
2. Set the floor price equal to a percentage of benchmark domestic carbon prices applying in other countries, for example as a weighted index of prices in major carbon pricing schemes, or of effective carbon prices in countries that meet defined criteria for the ambition of their schemes. The floor price would need to be adjusted periodically.

Price levels

In Figure 2 below, the first option is illustrated. The chart shows a price floor trajectory that starts at three quarters of the final fixed price. For illustration, it is assumed that the fixed price starts at $25/t and rises at 4% real per year plus 2.5% inflation, which gives a level of $32/t (nominal) at mid-2016, and thus a starting level of the floor price of $24/t in 2016. (This illustration does not imply a judgment of the desirable levels either for the floor price or the fixed price.)

A price floor starting in the low $20s/t$CO_2$ at the transition to emissions trading would likely be significantly below the carbon prices applying in the EU emissions trading scheme.

Today's forward price for 2020 EU permits is €26/t, equivalent to $35 at today's exchange rate or between $31 and $47 using the full range of historical exchange rates. Forward prices include risk and financing constraints and are thus likely to be lower than the eventual spot market price.

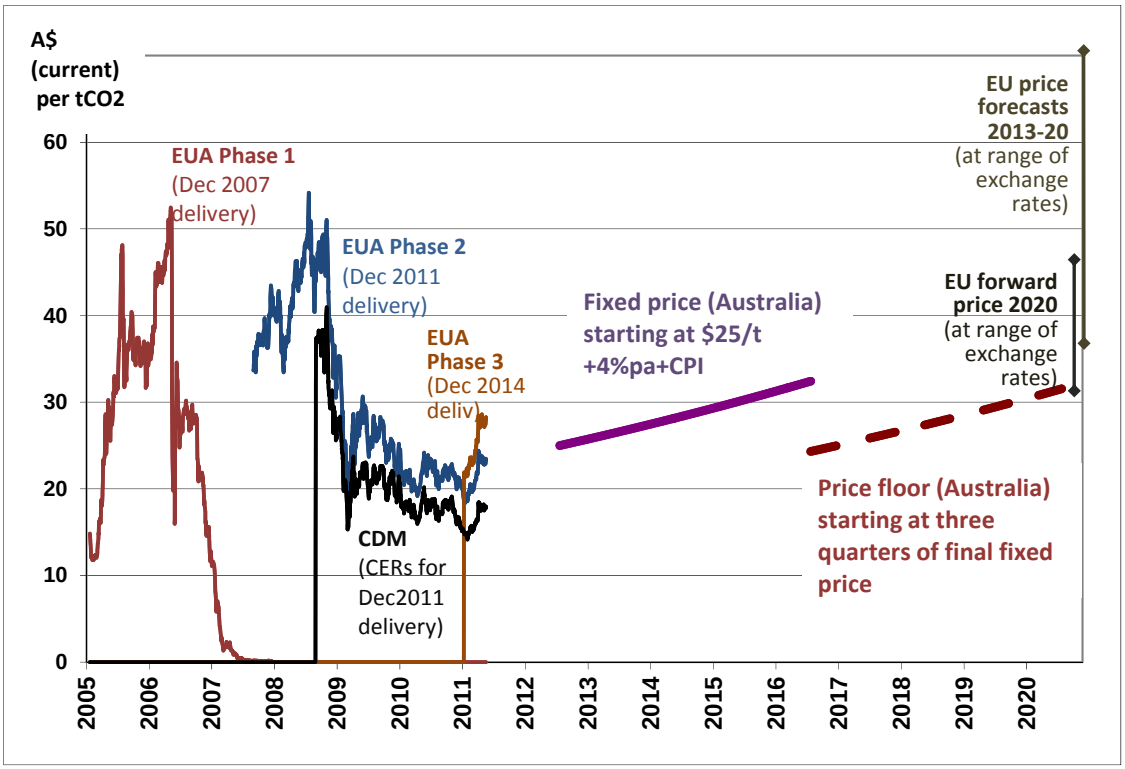
Carbon price forecasts on the basis of market analysis and investor sentiment for future EU permit prices are significantly higher than indicated by the forward market. For example, Deutsche Bank (Deutsche Bank 2011) forecasts an average permit price of €32/t over the period 2013-20, while a recent study interviewing a large number of carbon managers (Martin et al. 2011) finds an average expected carbon price of €40/t over the same period. This implies average carbon prices of between $37 and $71, for the full range of historical exchange rates. Furthermore, prices at 2020 would be expected to be higher than the average price over the 2013-20 period.

Timing

For how long a price floor provision should be in place is another matter of judgment. In order to have the desired effect of providing greater confidence to investors, a price floor would ideally need to be in place over an extended period of time. However, its most important role would be in the early phases of emissions trading, to provide confidence in the transition to a floating price.

The floor price provisions should be put in place simultaneously with any other provisions for the emissions trading phase of the scheme. If a floor price is intended, this should be announced as early as possible, so investors can factor it into their considerations.

Figure 2: **Carbon prices: Illustrative trajectories of floor price and fixed price, compared to EU ETS trading prices**



Notes:
All prices in nominal A$.
Illustrative fixed price trajectory starts in mid-2012 at $25/t and increases at 4% per year plus inflation assumed at 2.5% per year.
Illustrative price floor trajectory starts in mid-2016 at $24/t (three quarters of final fixed price at mid-2016) and increases at 4% per year plus inflation assumed at 2.5% per year.
EU ETS daily price data from PointCarbon, currency conversion using data from Reserve Bank of Australia.
Forward price: EUA for December 2020 delivery, €26 at 9 May 2011 (source: ICE ECX from barchart.com), equating to between A$31 and A$47/t assuming the full historical range of exchange rates (between of 0.56 and 0.86 €/A$).
Price forecasts: see text.

Appendix 1: Possible fragmentation in evolving international emissions markets

Divergence of prices for offset credits under the Clean Development Mechanism (CDM):

- A significant price differential already exists between EU permits (EU emissions allowances or EUAs) and offset credits from the CDM (Certified Emissions Reductions or CERs), of currently around €4/tCO_2 or A$5.30/t.[8]
- The EU has banned credits from certain types of CDM projects from use in the EU ETS.
- The EU, to date the main buyer of CDM credits, is restricting the amount of CDM credits that can be used EU emissions trading scheme from 2013 ('supplementarity' of international units to domestic mitigation action). If the limit is reached it could drive a sizeable wedge between prices for EU permits and CDM credits.
- The EU has made clear its intention to phase out CDM from advanced developing countries, and intends crediting new CDM projects only from least developed countries.

The markets for potential future types of international emissions units may also be segmented. For example:

- Tropical countries may offer reductions in emissions from deforestation and forest degradation (REDD). Where these are accepted into buying countries' schemes, there could be quantitative limitations, as well as restrictions relating to project type or originating countries.
- More comprehensive commitments, for example sector-wide crediting in developing countries, could similarly be subject to different rules in different buying countries, and hence a degree of market fragmentation.
- Prices under national targets, including under agreed arrangements among blocks of countries ('regional arrangements'), would generally converge to a common price. Again however, prices may diverge during the maturation of markets, if for example some countries were to exclude all units from a scheme where a lower price prevails, and the lower-priced scheme was a net seller in joint third party markets.

The prices for credits that are ineligible for use in some developed country markets (for example the EU) will be determined by demand in remaining buyers' countries markets. Where international credits are generated at very low costs, this could be reflected in low supply prices. As a result, there could be offset credits available in international markets at much lower prices than the price that prevails in domestic emissions markets in the EU and other major countries or regions.

[8] EUA €17/t, CER €13/t, both for delivery at December 2011, prices as of 9 May 2011, Source: PointCarbon

Appendix 2: Price floor proposals in other countries

United States: reserve prices

Reserve prices feature in the main US carbon pricing proposals.

- The Californian emissions trading scheme, slated for introduction at the start of 2012, features an auction reserve price of US$10/t$CO_2$, increasing at a rate of 5 per cent plus consumer price index per year. The floor price is coupled with an 'allowance reserve' provision that sets aside a certain number of permits to be sold at fixed levels between $40 to $50, providing a form of price cap.
- The US federal Waxman-Markey Bill (passed by the House of Representatives but not pursued in the Senate) also provided a reserve price at auction of US$10/t$CO_2$, rising at 5 per cent real per year.
- The Western Climate Initiative, an emissions trading proposal that would cover eleven States and Provinces in the US and Canada, also foresees a reserve price, at a level still to be determined.
- The US Regional Greenhouse Gas Initiative, a cap-and-trade scheme for the power sector in a group of North-Eastern States, also has a reserve price.

United Kingdom: extra fee for power sector

The United Kingdom has proposed to introduce a price floor for its power sector, from 2013. This would be in the form of an extra fee for emissions from electricity generation, in addition to permit liability under the EU emissions trading scheme. The fee would start at £5/tCO2 at 2013, and rise to £10/t in 2015. It would then be adjusted to aim for a combined effective carbon price on power producers, from the EU permit price plus the extra fee, of £30/t at 2020 rising to £70/t at 2030.

The effect would be that the UK power sector would face a higher carbon price than other parts of the UK and EU economies. It would result in faster shifts to low-carbon technologies and higher energy efficiency, but with higher adjustment costs in the interim.

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