Table 5.6 Regional exports and imports: 2004 and 2020

	2004US$ billion		% pa	2004US$ billion		% pa
Australia	108.7	128.2	1.04	122.9	199.0	3.06
New Zealand	27.7	31.8	0.86	26.8	40.4	2.60
China	826.3	2,461.3	7.06	707.4	1,514.4	4.87
Japan	655.7	820.6	1.41	539.4	651.9	1.19
Korea	308.9	481.7	2.82	256.1	364.1	2.22
Indonesia	87.5	175.1	4.43	76.9	147.4	4.15
Malaysia	154.9	282.2	3.82	106.3	187.0	3.59
Thailand	121.2	222.5	3.87	102.8	175.8	3.41
Southeast Asia	263.5	503.3	4.13	255.3	470.6	3.90
India	104.2	260.5	5.90	127.3	285.3	5.18
Canada	327.8	399.9	1.25	313.3	401.2	1.56
United States	1,088.9	1,398.2	1.57	1,656.9	2,286.7	2.03
Brazil	114.9	170.0	2.48	81.2	134.0	3.18
Argentina	39.1	54.2	2.07	26.7	44.4	3.25
Other Latin America	208.0	315.9	2.65	197.7	324.9	3.15
European Union	4,184.9	5,105.0	1.25	4,241.9	5,197.2	1.28
Rest of Europe	362.8	441.9	1.24	327.2	418.7	1.55
Africa	291.8	504.4	3.48	273.2	520.8	4.11
Russia	204.9	289.8	2.19	128.3	209.3	3.11
Rest of World	1,007.8	1,393.2	2.04	921.9	1,737.4	4.04

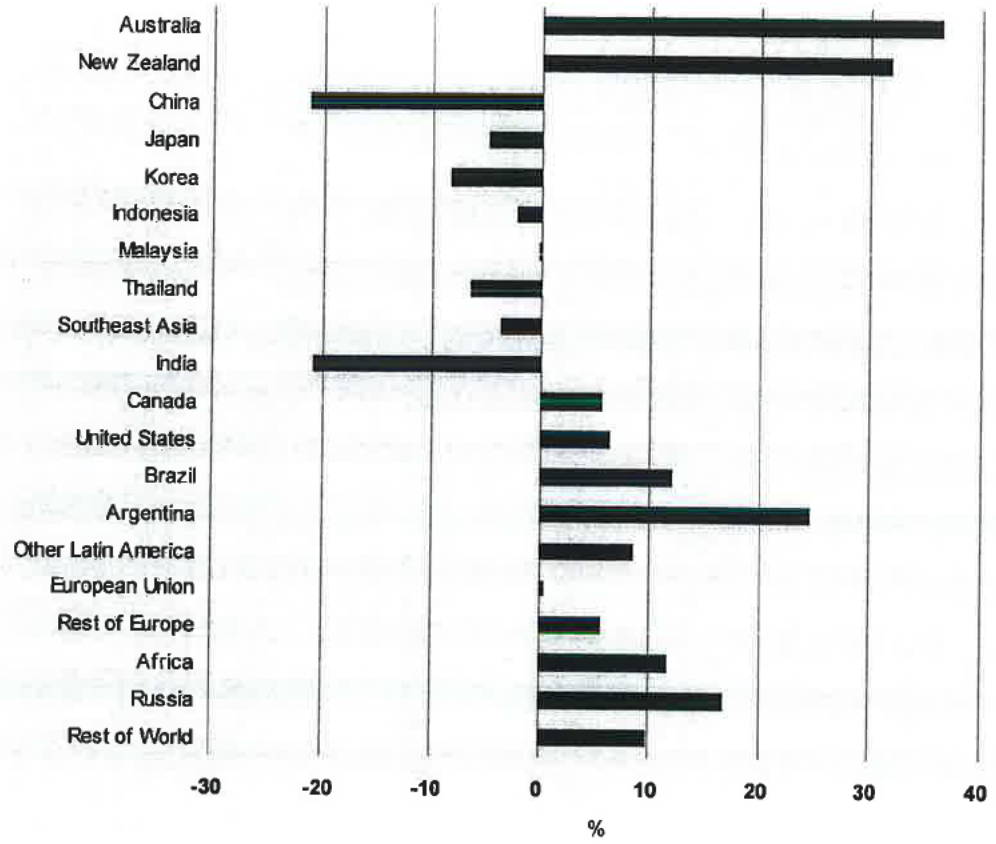
Note: Exports.
Source: CIE estimates using GTAP-E.

All Asian countries are expected to have lower terms of trade in 2020 than in 2004, while the other countries except EU will see the opposite change. European Union's terms of trade will not change and therefore its exports and imports will grow at the same rate.

It is projected that Australia's total exports will grow by 1 per cent per annum and imports by 3 per cent per annum between 2004 and 2020. Figure 5.4 reports growth rates of exports and imports by aggregated categories. Agriculture and mining, where Australia has a comparative advantage, are expected to have higher growth in exports than in imports. All other sectors including food processing are expected to have higher growth in imports than in exports. More prominently, other manufacturing exports will be falling due to competition from Asian countries.

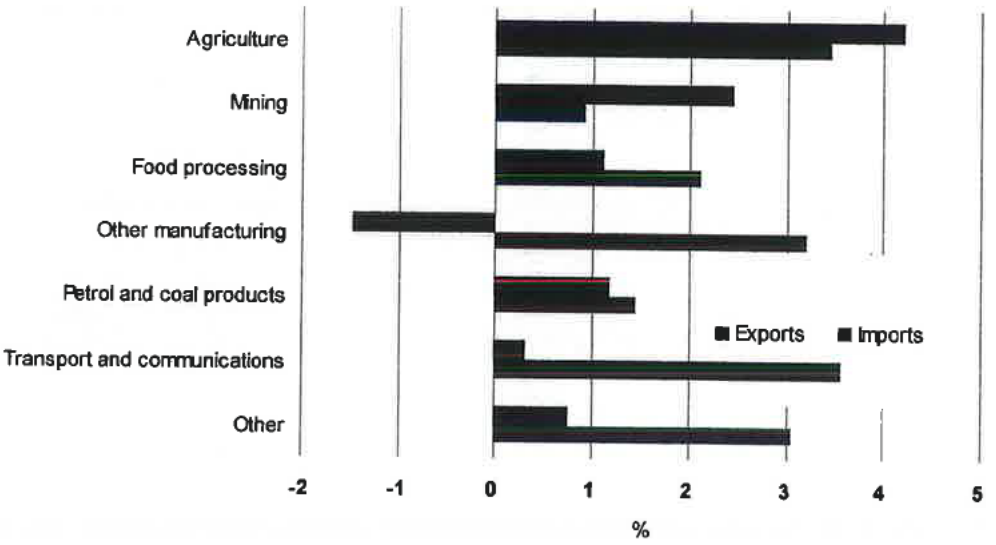
As a result, agricultural and mining shares in Australia's total exports will each increase by 5-6 percentage points while the share of other manufacturing will fall by more than 10 percentage points (Figure 5.5).

The composition of Australia's imports in 2020 is expected to be roughly the same as in 2004 because other manufacturing products dominate total imports with a share of around 75 per cent (Figure 5.6).



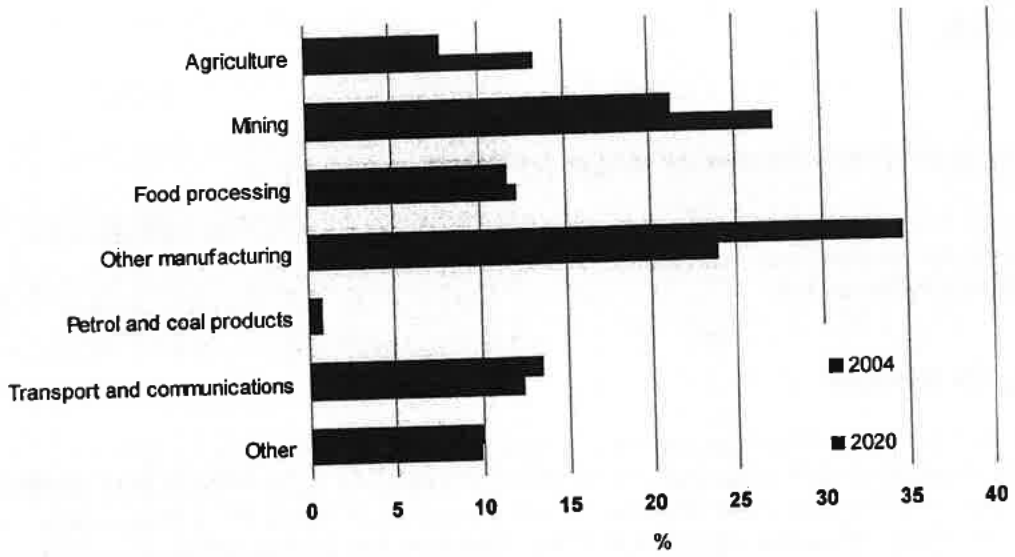
Data source: CIE estimates using GTAP-E.

Figure 5.3 Changes in terms of trade between 2004 and 2020



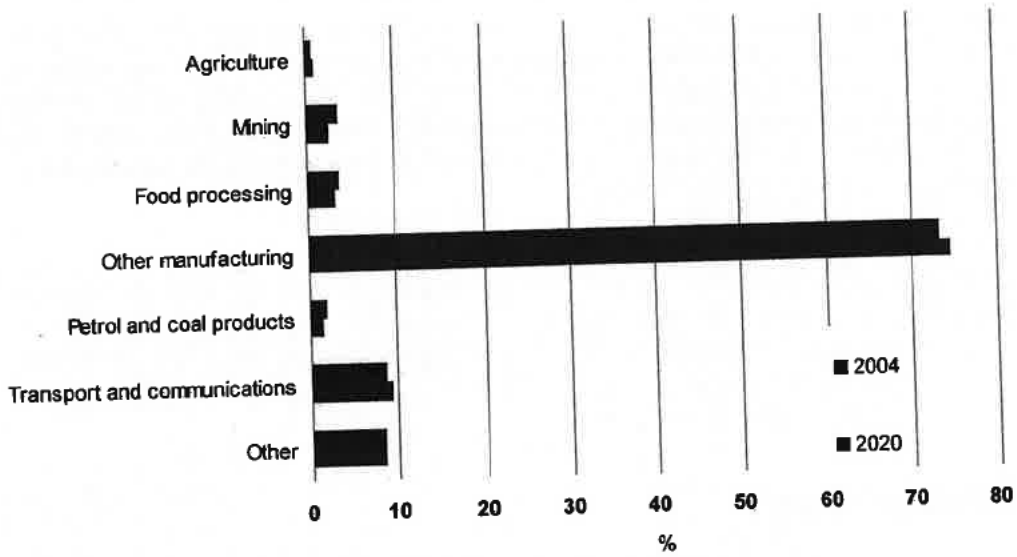
Data source: CIE estimates using GTAP-E.

Figure 5.4 Annual growth in Australia's exports and imports



Data source: CIE estimates using GTAP-E.

Figure 5.5 Composition of Australia's exports



Data source: CIE estimates using GTAP-E.

Figure 5.6 Composition of Australia's imports

6. Simulated impact of global climate policies

Modelling existing climate change policies

As noted above, Australia, New Zealand and the European Union are the only three economies that have implemented economywide climate change policies at the time of writing. In the analysis below, these policies are considered first.

Measuring the policies

Australia has set a target of unilaterally reducing its emissions by 5 per cent below the 2000 level by 2020. Australia's carbon dioxide emissions in 2000 were 349.724 Mt CO_2-e (UNFCCC 2011, Table 7, p17), a 5 per cent reduction means that allowed CO_2 emissions in 2020 will be 332.238 Mt CO_2-e. Compared to the projected baseline emissions of 395.45 Mt CO_2-e, the required reduction in 2020 emission is 16 per cent (relative to baseline levels).

The New Zealand Government estimated in its Fifth National Communication that total emissions excluding land use, land use change and forestry (LULUCF) in 2020 would be 85 828.9 Gg CO_2-e "without measures" and 76 895.7 Gg CO_2-e "with measures" (Ministry for the Environment 2009, Table 5.16, p103). The effect of the policy measures in 2020 is therefore a 10.4 per cent reduction in emissions from baseline projections.

As noted in the previous chapter, climate change policies in EU-27 before 2010 have been built into the baseline with an effect of emissions reduction in 2020 equivalent to 6 per cent of 1990 levels. It was projected by EEA in 2010 and 2011 that emissions in 2020 would be between 14 and 19 per cent below the 1990 level with existing measures. Taking into account the impact of the current economic downturn in Europe, the analysis here assumes that existing policy measures bring emissions in 2020 to 15 per cent below 1990 levels. This implies that the effect of existing policies is a 9.6 per cent reduction in emissions from the baseline in 2020.

Two scenarios are simulated[11] for these existing policies: each region achieving its *own* emissions target through its own unilateral actions; and the three regions forming a trading block (in emissions) to achieve the total emission cuts of the three regions in combination. Australia has plans to link its emissions trading scheme with the EU ETS from 2018 and is negotiating the link of the Australian and New Zealand schemes with the New Zealand government. This trading block simulates the linking of the three schemes as has been proposed.

Emissions and carbon price

With the above existing climate change policies being implemented, the carbon emission tax or permit price in 2020 is expected to be A$19.2 per tonne of carbon dioxide equivalent (t CO_2-e) in Australia, A$24.7/t CO_2-e in New Zealand and A$18.9/t CO_2-e in the European Union if no international emissions trading is allowed. If the emissions permits can be traded between these three regions, the carbon price is projected to be A$19/t CO_2-e (left panel of Figure 6.1).

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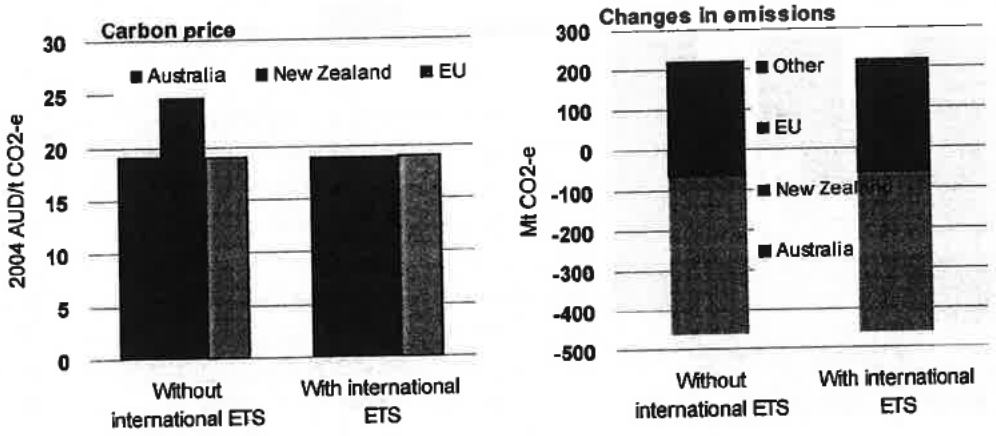
[11] For the scenarios modelled, it is assumed that no offsets generated external to the trading block are used (that includes Kyoto Protocol units such as CERs and ERUs).



Data source: GTAP-E simulations.

Figure 6.1 Carbon dioxide price and changes in emissions for existing policies

This carbon price pattern suggests that the impact of international emissions trading makes little difference because emissions in New Zealand are small, and the carbon prices in Australia and the EU are similar without an international ETS.

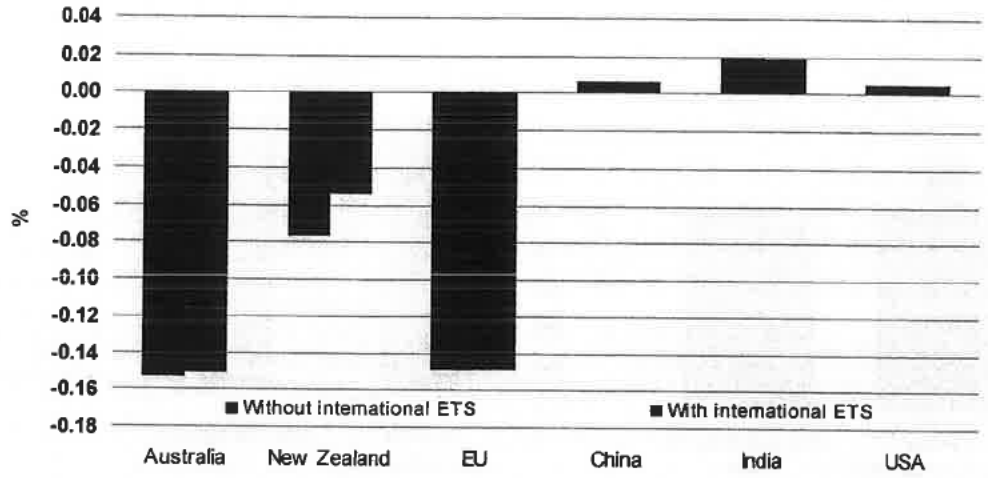
There would be serious carbon leakage through the implementation of these existing policies also because there is no control in carbon emissions by other countries. As shown by the right panel of Figure 6.1, although total emissions in Australia, New Zealand and EU will be cut by 462 Mt CO_2-e, emissions in other countries will increase by 220 Mt CO_2-e, implying a leakage rate of over 47 per cent (here the leakage rate is defined as the increase in *uncovered* emissions relative to the reduction in *covered* emissions).

The actual domestic reductions in emissions in the three economies do not differ significantly between individual action and the combined trading scheme. Domestic emissions would fall from 63.2 Mt to 62.7 Mt for Australia and from 3.7 Mt to 2.9 Mt for New Zealand, along with an increase from 395.6 Mt to 396.9 Mt for the EU.

Macroeconomic results

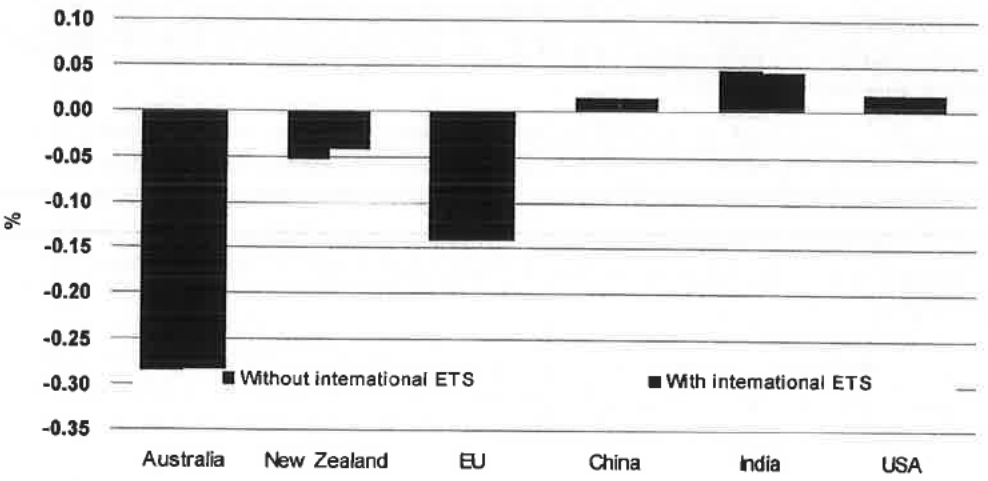
Figure 6.2 reports the impact of these existing policies on real GDP in selected economies. The impact is measured as a percentage deviation from the baseline level for each economy. The three economies implementing carbon emissions control policies are all projected to have lower GDP than would otherwise have been the case, while other three economies (China, India and United States), are projected to have slightly higher GDP.

An international ETS would make the loss in real GDP in the three economies smaller in Australia and New Zealand, while making a small difference for the EU. This is determined by their baseline level of emissions and the price differentials (between individual cuts and international ETS). For example, the price differential is the largest in New Zealand, and as a result the reduction in GDP loss is the biggest in percentage terms.



Data source: GTAP-E simulations.

Figure 6.2 Impact on real GDP of existing policies



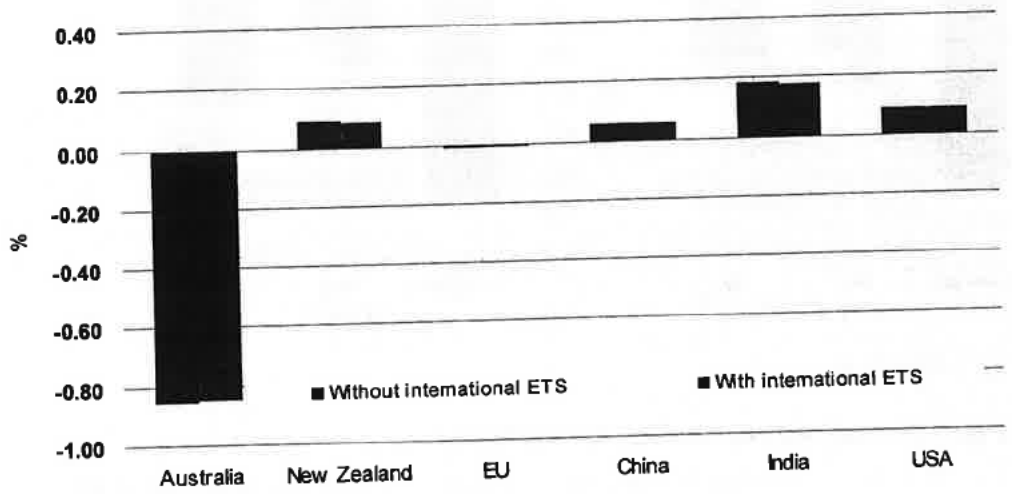
[a] Equivalent variation (EV) is a measure of how much more money a consumer would pay before a price change to avert the price change. The EV in the chart is presented as a ratio to the baseline GDP level in each region.
Data source: GTAP-E simulations.

Figure 6.3 Equivalent variation of existing policies

A similar pattern is evident for the impact on the equivalent variation (EV) as shown in Figure 6.3. EV is a summary economic welfare measure, in particular a measure of how much more a consumer would be prepared to pay *before* a price change in order to *avert* the impact of that price change. It is a measure used in the GTAP family of models to indicate the overall economic welfare change in an economy due to the implementation of particular policies. It is presented in the Figure 6.3 as a ratio to the baseline GDP level in 2020.

It is estimated that Australia's EV would fall by about 0.29 per cent of GDP in 2020, higher than the reduction of 0.15 per cent in real GDP. By contrast, the reduction in EV in New Zealand and EU is

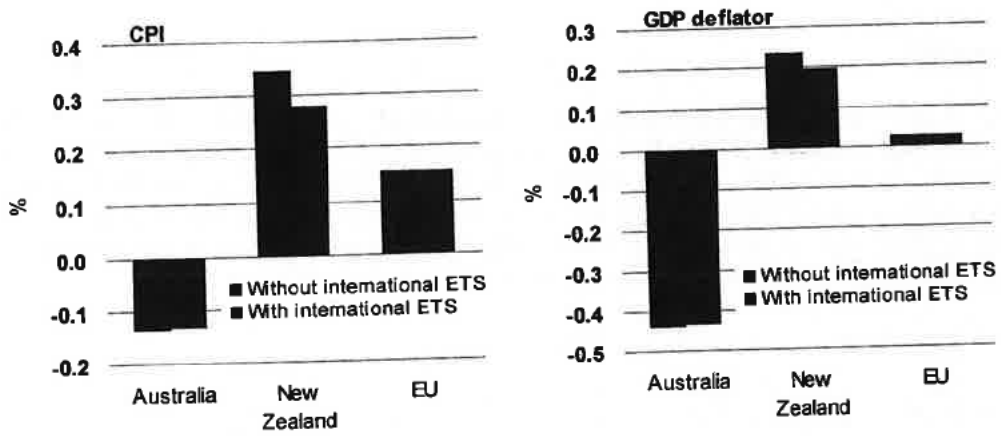
closer to the reduction in their real GDP. This is due to a larger reduction in welfare associated with the terms of trade in Australia (Figure 6.4).



Data source: GTAP-E simulations.

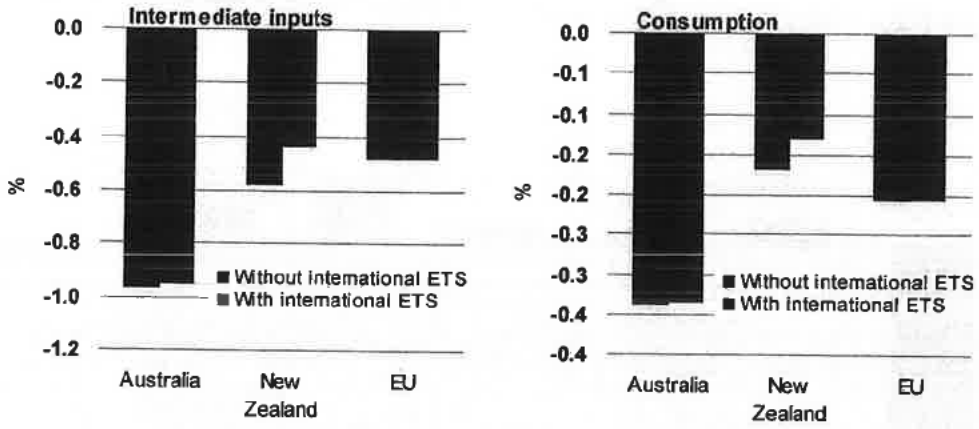
Figure 6.4 Impact on terms of trade of existing policies

The deteriorating terms of trade in Australia is a result of the fall in domestic prices in Australia (Figure 6.5), which in turn is a result of lower domestic demand in Australia (Figure 6.6).



Data source: GTAP-E simulations.

Figure 6.5 Price impacts of existing policies



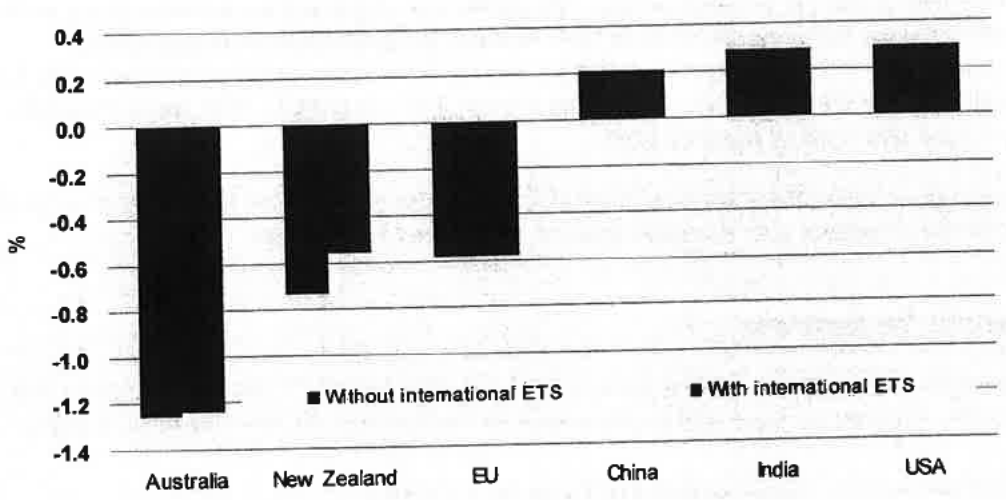
Data source: GTAP-E simulations.

Figure 6.6 Impact on domestic demand of existing policies

The projected fall in prices in Australia warrants more discussion as it appears to contradict the common perception that a carbon price will push up the general price level. It is true that a price on carbon will push up the supply cost of many products (by shifting the economywide supply curve upwards and to the left). At the same time, however, there is an offsetting effect on prices from the demand side — as a carbon price generally reduces production, ultimately leaving households with less income than would otherwise have been the case. This means the demand curve shift backwards (to the left) so that at any given price demand is lower. The level of the new equilibrium price depends on the relative magnitude of these two effects. If the cost effect from the supply side outweighs the price depressing effect from the demand side, the final price would rise, as in the case of New Zealand and the EU. In contrast, if the demand effect outweighs the cost effect, then prices will fall. This is the case for Australia in these simulations.

Impact on trade

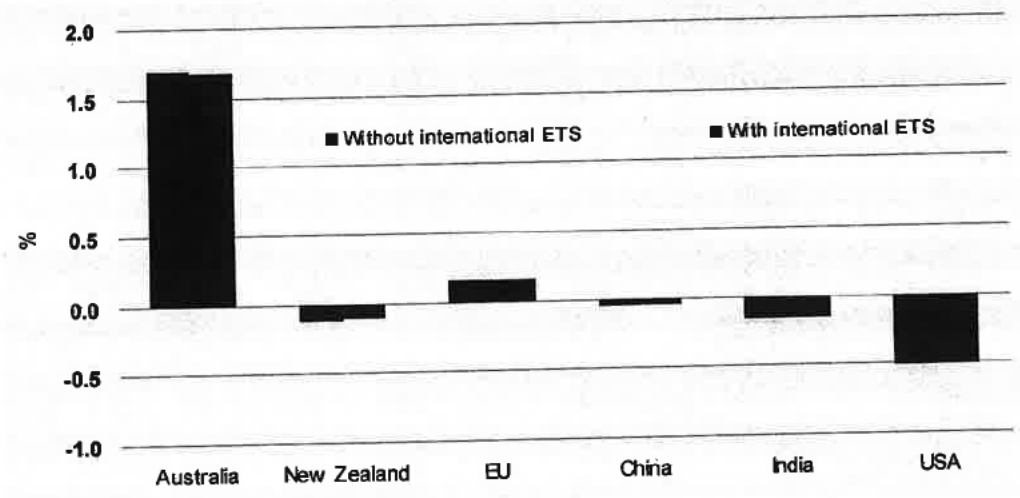
Figure 6.7 reports the impact of the existing climate change policies on aggregate imports in Australia, New Zealand, EU, China, India and USA in 2020. Consistent with the fall in real GDP and in welfare as measured by EV, Australia, New Zealand and EU demand fewer imports along with the decline in income (relative to baseline). Australia's aggregate imports would fall by more than 1 per cent, the biggest among the three regions. By contrast, China, India and USA see increases in imports due to their relative increases in GDP, leading to higher import demand.



Data source: GTAP-E simulations.

Figure 6.7 Impact on imports of existing policies

Figure 6.8 reports the impact of the existing policies on aggregate exports in these regions in 2020.



Data source: GTAP-E simulations.

Figure 6.8 Impact on exports of existing policies

Australia's exports are expected to rise by 1.7 per cent in 2020 from the baseline level. Again this seems to contradict conventional wisdom, but is a consequence of domestic demand in Australia falling due to the carbon policy, outweighing the price pressure caused by the policy. As a result, its exports become relatively cheaper, leading to an increase.

Aggregate exports in New Zealand are expected to fall by about 0.1 per cent in 2020 from the baseline level. This result is determined by opposite forces compared with the Australian case. Domestic prices are projected to be higher in New Zealand (as shown in Figure 6.5) because the price pressure effect from the supply side overweighs the forces for price reductions on the demand side. As a result, New Zealand products would become relatively more expensive, leading to lower exports.

The change in exports in the EU presents another interesting case. Although the domestic price in the EU is expected to rise for the same reason as in New Zealand, the magnitude of the price rise is smaller. The price rise in EU is smaller than that the effect on the average world price, which may be seen from its slightly deteriorating terms of trade. As a result, EU's exports in 2020 are expected to rise by about 0.2 per cent from its baseline level.

The other three regions where there are no climate change policies are expected to have lower exports than the baseline level because their domestic demand is projected to be higher.

Sectoral results for Australia

Table 6.1 reports the impact of the existing policies on Australia's sectoral output, consumption and international trade. They are all presented as percentage deviations from the baseline level in 2020.

Table 6.1 Sectoral output, consumption and trade for Australia

	%	%	%	%	%	%	%	%
Agriculture	*0.11*	*0.11*	*-0.24*	*-0.24*	*0.46*	*0.45*	*-0.20*	*-0.20*
sugarcane	0.26	0.26	-0.17	-0.17	0.42	0.41	0.04	0.04
oil seed	0.39	0.38	-0.11	-0.11	0.41	0.41	0.07	-0.07
rice	0.27	0.27	-0.16	-0.16	0.39	0.39	0.24	0.24
wheat	0.34	0.33	-0.15	-0.15	0.36	0.36	0.14	0.14
other crops	0.12	0.12	-0.15	-0.14	0.48	0.47	-0.14	-0.14
cattle	0.02	0.02	-0.27	-0.27	0.37	0.36	-0.24	-0.24
other livestock	0.15	0.15	-0.34	-0.34	0.29	0.29	-0.07	-0.07
forestry and fishery	0.04	0.04	-0.41	-0.41	0.75	0.74	-0.39	-0.40
Food manufacturing	*0.30*	*0.29*	*-0.14*	*-0.14*	*1.74*	*1.73*	*-0.91*	*-0.91*
Meat	0.40	0.40	-0.22	-0.22	2.00	1.98	-0.96	-0.95
Other	0.27	0.27	-0.12	-0.12	1.65	1.64	-0.91	-0.90
Mining	-0.53	-0.52	-15.50	-15.35	2.97	2.95	-4.86	-4.77
Other manufacturing	-0.72	-0.71	-0.79	-0.79	0.48	0.50	-1.06	-1.05
Electricity	-5.04	-4.99	-7.01	-6.94	n/a	n/a	24.18	23.87
Transport and communication	-0.39	-0.39	-0.40	-0.39	1.26	1.24	-1.08	-1.06
Other services	-0.30	-0.30	-0.03	-0.03	3.12	3.09	-1.74	-1.73
Total	*-0.39*	*-0.39*	*-0.34*	*-0.34*	*1.69*	*1.68*	*-1.25*	*-1.23*

Note: "w/t": without international ETS; "w": with international ETS.
Source: GTAP-E simulations.

Australia's agricultural and food manufacturing sectors are expected to be positively affected by existing climate change policies. Although domestic demand for these products is expected to fall, export demand rises together with a fall in imports. The overall impact is a slight increase in sectoral production.

This is primarily determined by the assumed policy coverage. Australia's agricultural sectors are exempted from the ETS, boosting their competitiveness relative to other sectors *within* the economy. In addition, one of Australia's major competitors, New Zealand, is simulated to include agriculture in its ETS, further boosting the competitiveness of Australian agricultural products in the world market.

Impacts of implementing the Copenhagen Accord targets

Measuring the Copenhagen Accord target

Table 6.2 summarises the Copenhagen targets as compiled by the UNFCCC (2011a,b) and the corresponding shocks applied to the GTAP-E model[12].

Table 6.2 Summary of Copenhagen targets and implemented shocks

		Mt	%	%	Mt	Mt	Mt	%
Australia	2000	349.7	20 [a]	25	279.8	262.3	395.5	-29.3
New Zealand	1990	25.0	10	20	22.5	20.0	35.2	-36.1
China	2005	Intensity	40	45				
Japan	1990	1141.2	25	25	855.9	855.9	1161.4	-26.3
Korea	BAU		30	30				-30.0
Indonesia	BAU		26	26				-26.0
Malaysia				Not specified				
Thailand				Not specified				
Southeast Asia				Not specified				
India	2005	Intensity	20	25				
Canada	2005	574.8	17	17	477.1	477.1	710.6	-32.9
United States	2005	6104.8	17	17	5067.0	5067.0	6181.0	-18.0
Brazil	BAU		36.1	38.9				-36.1
Argentina				Not specified				
Latin America				Not specified				
EU-27 [b]	1990	4395.7	20	30	3516.5	3077.0	4131.9	-14.9
Rest of Europe	1990	804.1	15.9	17.2	676.0	666.1	714.3	-5.4
Africa				Not specified				
Russia	1990	2498.7	15	25	2123.9	1874.0	2507.4	-15.3
Rest of the World				Not specified				

[a] Australia noted a lower target of 5 per cent reduction from the 2000 level by 2020 in its Copenhagen target. However as this is a unilateral target, and it states that it would achieve 20 per cent reduction if there will be an international agreement in place, a lower target of 20 per cent reduction is modelled.
[b] EU emissions level assumes intra-EU trade is taking place and so there is a uniform price across the EU.
Note: Applied shocks are estimated using the lower Copenhagen targets.
Source: CIE formulation based on UNFCCC (2011a,b,c).

There are three types of targets for the Copenhagen Accord. The first one is a specific or a range of reduction from the emissions level in a reference year by 2020. Most Annex 1 parties adopt this type of target. For example, Australia noted in its communication with the UNFCCC Secretariat that it will

[12] Since the Copenhagen UN climate change conference in 2009, further meetings have been held in Cancun, Durban and Doha. However, the Cancun agreements and the Durban meetings did not result in any new pledges by individual countries to specific emission reductions. Quantitative targets under the second commitment period of the Kyoto Protocol agreed to at Doha have not been finalised, and will not incorporate all countries that made commitments under the Copenhagen Accord.

cut its emissions by 5 to 25 per cent from 2000 levels by 2020. Considering that the 5 per cent target is unilateral, and that it also stated that at least 20 per cent reduction would be achieved if there is an international agreement in place, this study uses 20 per cent reduction as the lower range of its Copenhagen target. Australia's CO_2 emissions in 2000 were 349.7 Mt (UNFCCC 2011c, Table 7, p17), and a 20 per cent reduction means allowed emissions for Australia in 2020 would be 279.8 Mt. Compared to the projected baseline emissions of 395.5 Mt in 2020, this target means a 29.3 per cent reduction from the baseline in 2020.

The second type of target is a specific or a range of reduction from business as usual emissions. Brazil, Indonesia and Korea adopt this type of target. Modelling this type of target is simpler because it does not depend on baseline projection of emissions.

The third type of target is concerned with *emission intensity* rather than a specific cut in emissions. China and India adopt this type of target. As discussed in the baseline projection chapter, both China and India would see their emissions intensity target as *not binding* by 2020.

As shown in the last column of table 6.2, any binding targets are modeled as shocks to the emissions level in 2020. If a range of targets are identified, the lower bound is chosen (except for Australia), to reflect a conservative perspective on the Accord.

Three scenarios are modeled:

- individual action: each region with a binding target acts separately to achieve its own target;
- Annex 1 trading: Annex 1 parties form a trading bloc to achieve their joint target while other non-Annex 1 parties with binding targets act separately; and
- full trading: all the regions with binding targets form an emissions trading bloc to achieve their joint target.

Emissions and carbon prices

Table 6.3 reports the impact on emissions and carbon price in 2020 of implementing the above Copenhagen targets under the three scenarios. If each region takes individual actions to achieve its own target, the carbon price in 2020 varies from A$12.9/t CO_2-e for the Rest of the Europe to A$167.5/t CO_2-e for Brazil. The carbon price in Australia is expected to be A$55.7/t CO_2-e.

Table 6.3 Change in emissions and carbon price of implementing Copenhagen targets

	Mt	Mt	Mt	2004 AUD/t CO_2-e		
Australia	-115.7	-89.7	-96.4	55.7	37.8	41.2
New Zealand	-12.7	-4.3	-4.8	158.8	37.8	41.2
Japan	-305.6	-131.8	-149.4	95.9	37.8	41.2
Canada	-233.5	-130.8	-141.1	86.3	37.8	41.2
United States	-1113.8	-1094.7	-1195.8	39.1	37.8	41.2
EU-27	-615.2	-563.0	-619.9	41.2	37.8	41.2
Russia	-383.6	-657.8	-700.2	19.7	37.8	41.2
Rest of Europe	-38.4	-146.5	-157.5	12.9	37.8	41.2
Brazil	-168.9	-168.9	-60.4	167.5	166.0	41.2
Korea	-161.6	-161.6	-72.5	119.8	118.3	41.2
Indonesia	-167.6	-167.6	-118.7	68.8	68.4	41.2
China	479.2	442.3	417.8			
India	184.3	173.1	168.7			
Other	428.0	415.3	400.7			
Leakage rate	-32.9%	-31.1%	-29.8%			

Source: GTAP-E simulations.

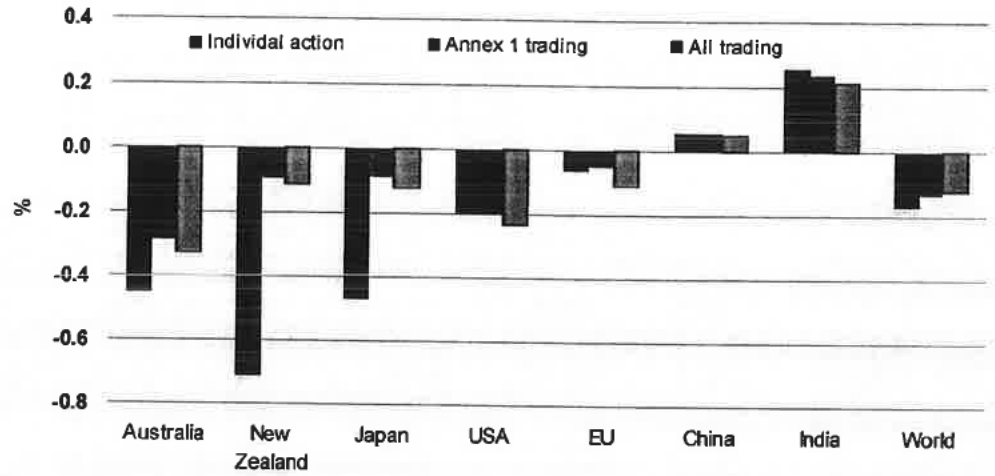
China, India and other regions without a binding carbon emission control policy are expected to have higher emissions, resulting in a carbon leakage rate of about 33 per cent.

If Annex 1 countries form a trading bloc to achieve their targets jointly, the carbon price in the Annex 1 bloc is projected to drop to A$37.8/t CO_2-e, while prices in other non-Annex 1 countries with binding targets would fall slightly. In this scenario, the carbon leakage rate is expected to fall to a little over 31 per cent.

If all countries with a binding target form a trading bloc to achieve their targets jointly, the carbon price in these countries would be A$41.2/t CO_2-e. In this scenario the carbon leakage rate is expected to fall further to under 30 per cent.

Macroeconomic impacts

Figure 6.9 reports the impact of implementing the Copenhagen targets on real GDP in selected economies. The impact is measured as percentage deviation from the baseline level for each economy. The economies implementing carbon emissions control policies are all expected to have lower GDP than it would otherwise be the case, while other economies, such as China and India, are expected to have higher GDP. Australia's real GDP is expected to fall by 0.5 per cent. Global GDP is expected to fall by less than 0.2 per cent.

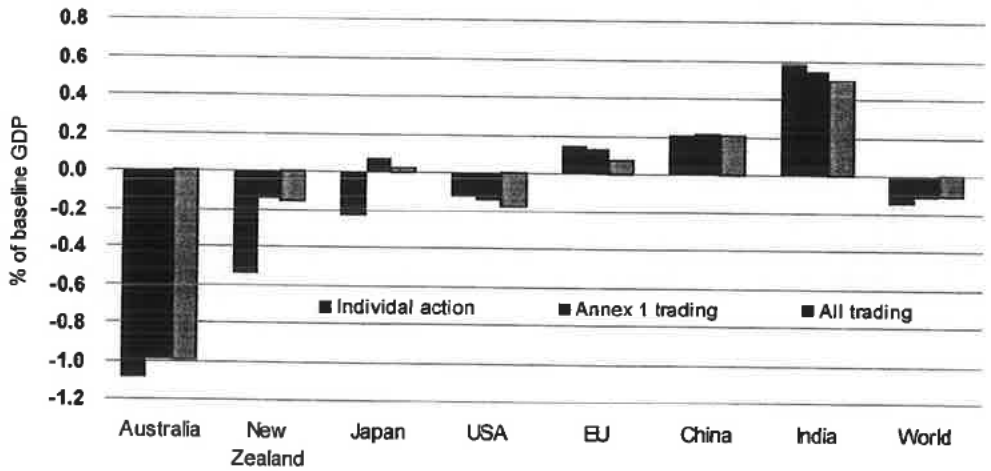


Data source: GTAP-E simulations.

Figure 6.9 Impact on real GDP of implementing the Copenhagen targets

An international ETS would generally make the impact on real GDP smaller. The GDP loss in Australia is expected to be reduced from 0.5 per cent to 0.3 per cent when Annex 1 countries form a trading bloc. There are exceptions to this, however, especially when the trading bloc is expanded from Annex 1 countries to all countries with binding targets. Although the loss in *global* GDP is expected to be smaller, in some countries such as Australia, New Zealand, Japan, USA and EU the individual GDP loss may be larger. This is mainly due to the existence of taxation related distortions which intersect with energy use in these countries.

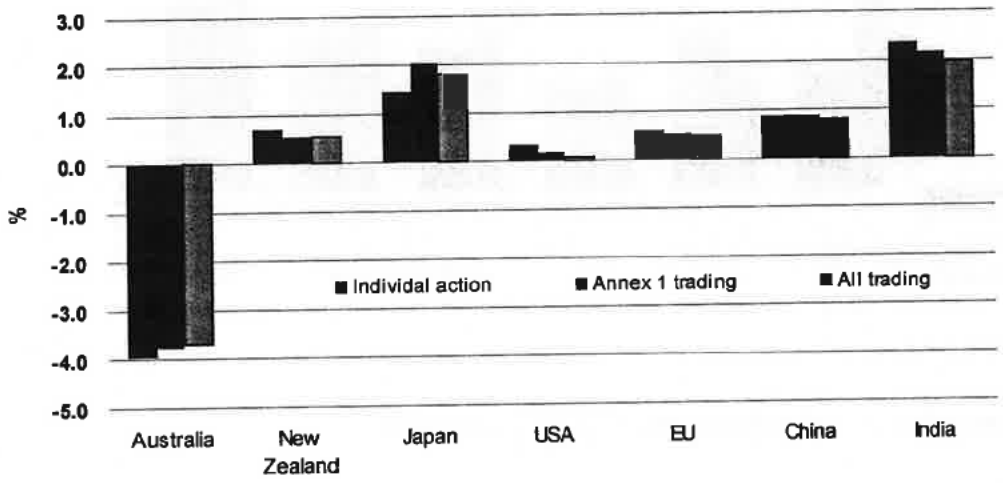
Figure 6.10 reports the welfare measure, EV, in selected economies. The measure is presented as percentage of the baseline GDP level in relevant economy.



Data source: GTAP-E simulations.

Figure 6.10 Equivalent variation of implementing the Copenhagen targets

As discussed in the previous section, Australia's welfare loss appears larger than its GDP loss due to the negative impact of carbon pricing on its terms of trade (1-1.1 per cent versus 0.3-0.5 per cent). As shown in Figure 6.11, Australia is expected to suffer a loss of about 4 per cent in terms of trade if implementing its Copenhagen target.



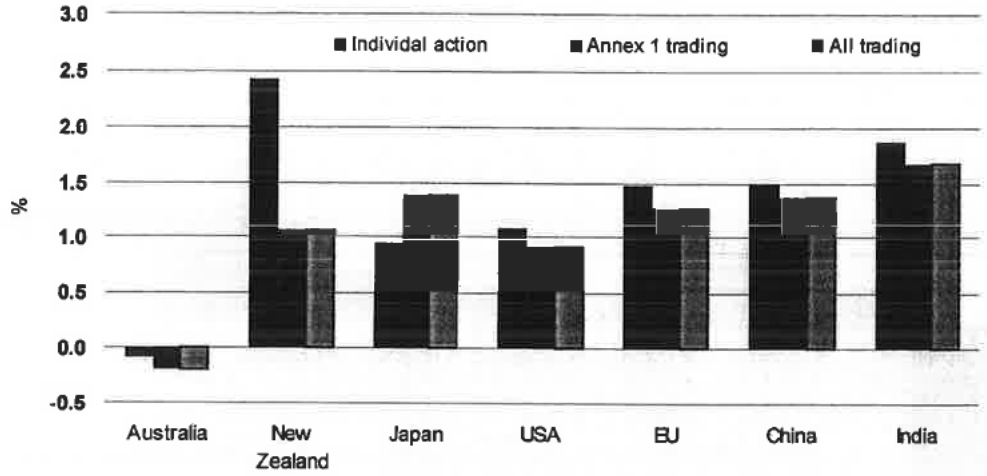
Data source: GTAP-E simulations.

Figure 6.11 Impact on terms of trade of implementing Copenhagen targets

New Zealand, Japan, USA and EU are expected to improve their terms of trade from implementing their Copenhagen targets, leading to positive terms of trade contributions to their welfare. In these simulations, the positive effect of higher terms of trade in EU overweighs the negative impact of allocation efficiency losses from the carbon tax, resulting in a positive EV. For the other countries, the positive impact of terms of trade is smaller than the negative impact of allocation efficiency losses, leading to a negative EV.

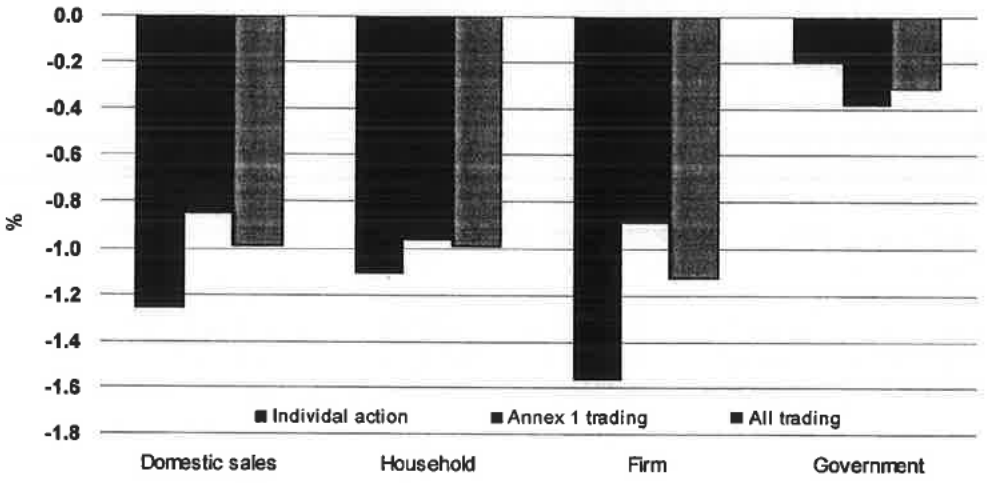
For the same reason discussed in the previous section, Australia's overall price level is expected to fall after implementing the Copenhagen targets. As shown in Figure 6.12, consumer price index (CPI) in Australia would fall by about 0.2 per cent, while rising in other economies.

Domestic demand in Australia is expected to fall (relative to baseline) after implementing the Copenhagen targets as a consequence of the reduction in GDP (relative to baseline). As shown in Figure 6.13, demand for domestic products is projected fall by 1.1 per cent for households, by 1.6 per cent for firms and by 0.2 per cent for governments in Australia (all relative to baseline) under the scenario of individual action. As a result, total domestic sales would fall by 1.3 per cent in Australia.



Data source: GTAP-E simulations.

Figure 6.12 Impact on CPI of implementing Copenhagen targets

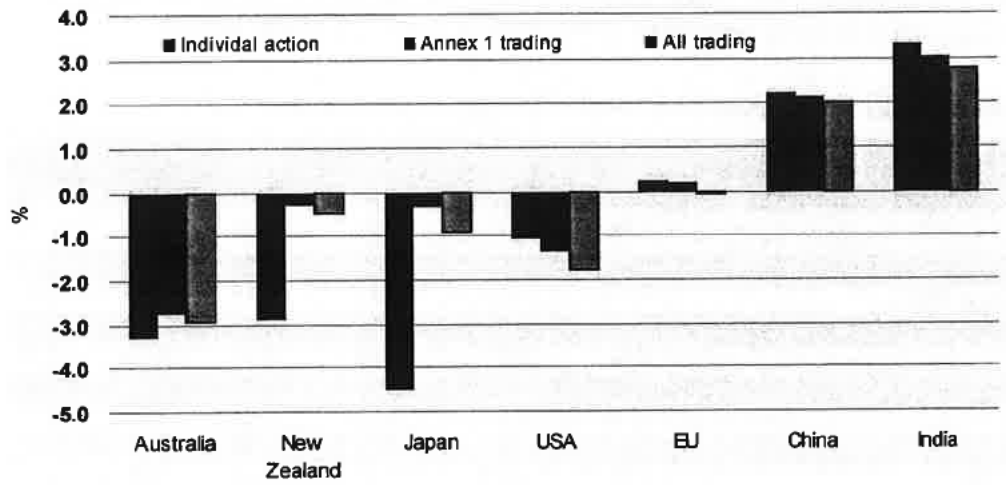


Data source: GTAP-E simulations.

Figure 6.13 Impact of implementing Copenhagen targets on Australia's domestic demand

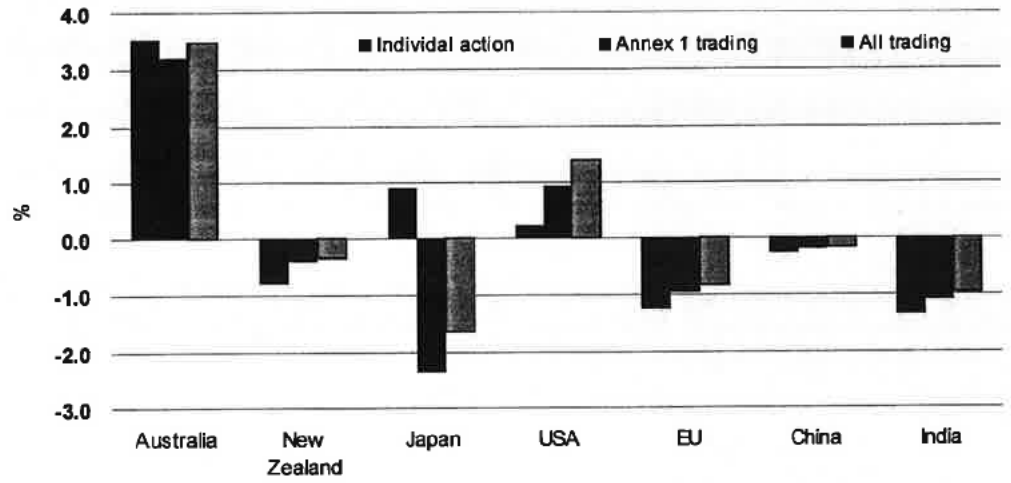
Impact on trade

The pattern of change in imports is similar to that for the existing policy settings discussed above. Countries with binding Copenhagen targets are projected to have lower imports except the EU. Because the EU is expected to be to have a relative increase in GDP, its demand for imports is higher. Australia's imports are expected to fall by about 3 per cent. In contrast, countries without any binding targets, such as China and India, would see their imports increase (Figure 6.14).



Data source: GTAP-E simulations.

Figure 6.14 Impact of implementing Copenhagen targets on imports



Data source: GTAP-E simulations.

Figure 6.15 Impact of implementing Copenhagen targets on exports

Australia is again expected to increase its aggregate exports by more than 3 per cent because its domestic demand falls, along with prices, which improves its competitiveness in the world market. The United States is also expected to have higher exports because the rise in its domestic price is less than that in the world price.

Sectoral impacts for Australia

Tables 6.4 and 6.5 show the effects on output, consumption and trade. The pattern of impact is similar to that in the case of implementing existing policies, although the magnitude is larger. Despite a fall of 0.5 to 0.7 per cent in total production, Australia's agricultural and food manufacturing sectors are expected to be positively affected by implementing the Copenhagen targets. While domestic demand

for these products is expected to fall, export demand is projected rise together with a fall in imports. The overall impact would be an increase of 0.1 to 0.4 per cent in agricultural production.

Table 6.4 Impact on sectoral output and household consumption in Australia

	%	%	%	%	%	%
Agriculture	0.39	0.11	0.09	-0.14	0.01	0.00
sugarcane/sugar beet	0.75	0.26	0.41	0.75	0.67	0.76
oil seed	0.51	0.38	0.31	0.48	0.42	0.43
rice	0.76	0.27	0.19	0.57	0.51	0.58
wheat	0.77	0.33	0.26	0.60	0.51	0.56
other crops	0.10	0.12	0.10	-0.05	-0.02	-0.03
cattle	-0.01	0.02	0.02	0.08	0.30	0.29
other livestock	1.21	0.15	0.10	0.25	0.36	0.37
forestry and fishery	0.20	0.04	0.03	-0.97	-0.59	-0.63
Food processing	0.81	0.29	0.42	0.26	0.21	0.23
Meat	0.98	0.40	0.37	-0.46	-0.32	-0.38
Other	0.77	0.27	0.43	0.21	0.19	0.19
Mining	-2.77	-0.52	-0.46	-8.98	-6.59	-7.24
Other manufacturing	-0.31	-0.71	-1.30	-0.95	0.03	-0.31
Electricity	-10.86	-4.99	-5.15	-10.85	-7.88	-8.49
Transport and Communications	-0.80	-0.39	-0.38	-1.06	-0.76	-0.86
Other services	-0.70	-0.30	-0.21	-0.87	-0.72	-0.78
Total	-0.74	-0.46	-0.55	-1.26	-0.85	-0.99

Note: IA – individual action; A1 – Annex 1 trading; All – emission trading among all countries with binding targets.
Source: GTAP-E simulations.

The pattern of impact on trade is similar to that in the case of implementing existing policies, although the magnitude is bigger. Most agricultural sectors experience and increase in exports (relative to business as usual) with the exception of other food processing.

Table 6.5 Impact on exports and imports in Australia

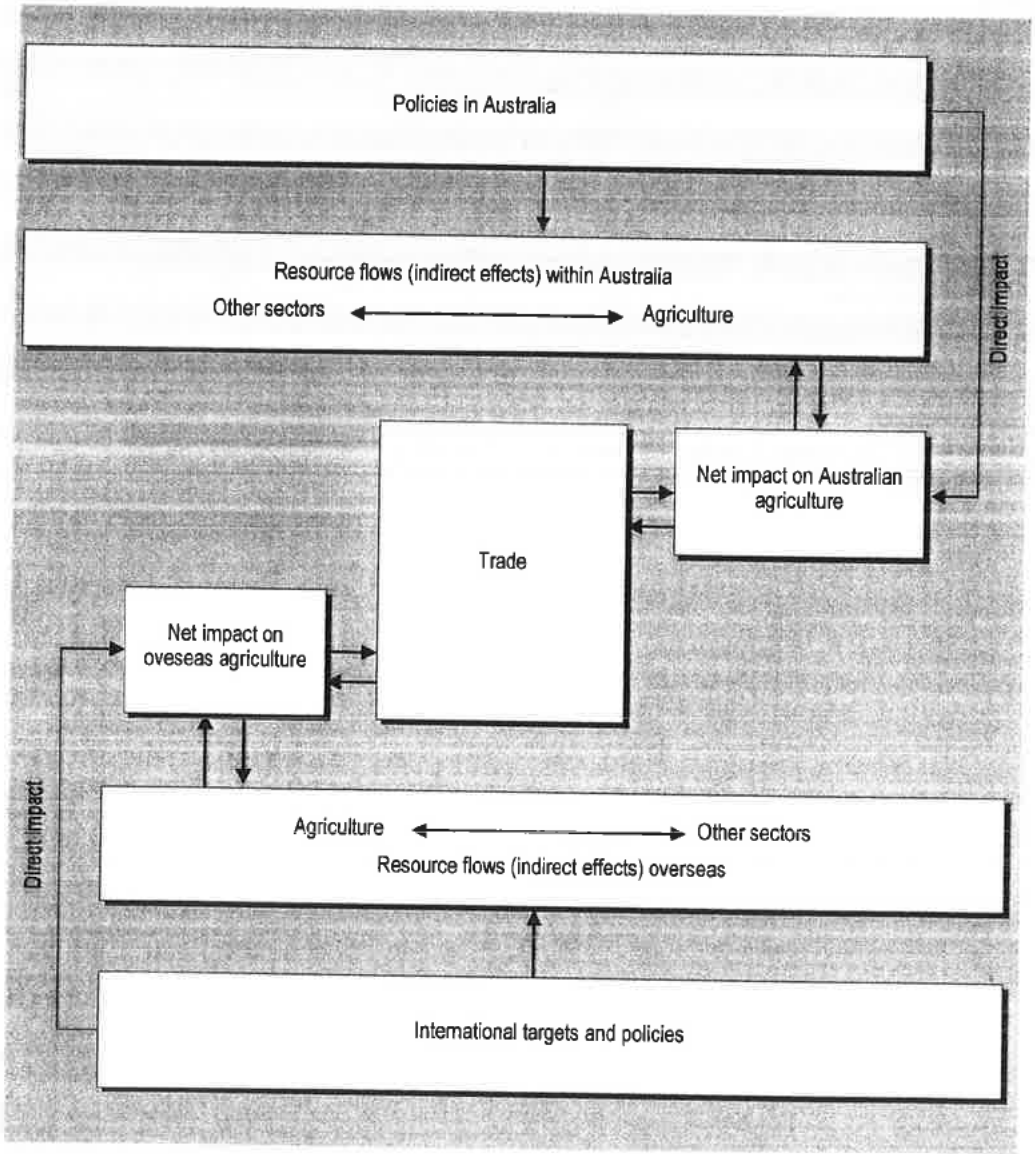
	%	%	%	%	%	%
Agriculture	1.30	0.89	1.00	-0.28	-0.09	-0.15
sugarcane/sugar beet	2.59	1.66	1.23	0.55	1.14	1.29
oil seed	0.51	0.19	0.60	-0.17	-0.03	0.02
rice	1.10	0.84	0.80	0.92	1.19	1.30
wheat	0.80	0.47	0.49	0.61	1.02	1.08
other crops	0.46	0.20	0.63	-0.25	-0.04	-0.06
cattle	0.38	0.75	0.25	-0.72	-0.44	-0.42
other livestock	2.17	1.85	1.59	0.59	0.78	0.73
forestry and fishery	2.25	1.48	1.54	-0.48	-0.41	-0.63
Food processing	4.85	4.42	4.95	-3.26	-2.86	-2.93
Meat	4.92	4.78	5.43	-3.31	-3.16	-2.95
Other	-0.91	-0.90	-1.08	-3.25	-2.82	-2.95
Mining	2.27	1.06	1.70	-8.92	-4.78	-6.29
Other manufacturing	4.01	5.62	5.48	-2.80	-2.43	-2.57
Electricity [a]	-68.71	-55.39	-57.90	57.60	36.22	39.55
Transport and Communications	5.54	5.41	5.16	-4.05	-3.59	-3.58
Other services	9.40	7.83	8.30	-5.03	-4.17	-4.31
Total	3.53	3.17	3.44	-3.32	-2.76	-2.93

[a] Low base causes big changes.
Note: IA – individual action; A1 – Annex 1 trading; All – emission trading among all countries with binding targets.
Source: GTAP-E simulations.

7. Conclusions

Links between climate policy and agricultural trade

There are a variety of economic mechanism through which emission mitigation policies may directly and indirectly affect agricultural trade prospects. Relative price changes *between* different economies are one clear and direct mechanism. Economywide interactions *within* an economy (that is, resource movements between sectors induced by changes in real wages and the real exchange rate) are another. Figure 7.1 summarises these broad interactions and illustrates the ways in which they are all interrelated.



Source: The CIE.

Figure 7.1 The variety of interactions leading to trade implications of climate policies

The two broad mechanisms (resource movements *within* and economy and relative price changes *between* economies) actually occur together and combine in complex ways to determine the ultimate outcomes of mitigation policies — including carbon pricing or related measures — that induce costs of abatement within economies. The ways in which these core mechanisms combine are likely to vary depending on the specifics of the policies adopted to reduce emissions relative to the levels they would achieve in the absence of the policy interventions.

Understanding the implications of particular policy mechanisms requires an analysis which builds up over several steps:

1. understanding what outcome may be in the absence of any policy interaction (the 'baseline' or 'business as usual' scenario);
2. understanding the implications of particular emission mitigation targets which are often expressed in many different ways for countries around the world; and
3. finding an appropriate means of representing and simulating both the core policy mechanisms and the many interactions that are likely to occur as a result of the implementation of the policy mechanism.

Key findings

The lines of research presented in this report illustrate:

- the wide diversity of proposed emission reduction targets across countries;
- the wide diversity of potential policies to achieve these targets;
- the broad lack of clarity (except in a few limited cases) surrounding the practical implementation of mitigation policies; and
- the uncertainties involved in constructing a modelled representation of these targets and policy instruments.

International climate policy formulation is complex, and the details and implications of particular policies are likely to remain uncertain in the near future. This creates a major challenge for analysing the implications — in particular trade implications — of climate policy.

The main analytical tool used here — a global economywide model — was used to represent the potential carbon price implications for the various targets proposed within the Copenhagen Accord. While not able to fully represent the full range of policies, this approach indicates a few broad conclusions:

- while carbon policies change relative prices *between* economies, the magnitude of these changes are composed of many elements and are difficult to predict in advance;
- initial changes in relative prices between economies are modified by intersectoral or economywide effects within economies. In particular, changes in real wages and the real exchange rate lead to resource movements between sectors within a particular economy, thus modifying some of the initial relative price differences between economies;
- these economywide effects may offset the initial trade implications of carbon pricing;

- the simulations presented here show that the net effect of international mitigation action is to increase exports of most Australian agricultural products (relative to the baseline or business as usual level of exports).

This last finding, in particular, does not imply that the carbon price is beneficial to the economy as a whole. Restricting emissions is costly. However, the general equilibrium effects on the agriculture sector appear to be broadly positive. These findings are broadly consistent with other recent Australian modelling results.

No set of modelling results should be taken as definitive. As noted, a number of steps are required to build up a picture of the potential impacts of mitigation policy. Nevertheless, these findings provide some broad guidance about appropriate sectoral responses to climate policy outcomes. Several possibilities emerge:

- adjustment to a carbon price requires flexibility in domestic and international markets. Factors which inhibit adjustments, such as inflexibilities or constraints in factor or product markets are likely to both increase the cost of mitigation policy and reduce the offsetting benefits for the agricultural sector;

- responses to mitigation policy could be profitably addressed towards identifying and working to remove such constraints;

- in particular, the introduction of additional trade barriers along with core mitigation policies around the world could significantly increase the cost of mitigation policies;

- less transparent mitigation policy mechanisms (those involving constraints that do not emerge as a clear price effect) may also increase the cost of mitigation and make the overall implications for agricultural trade considerably less certain.

Finally, the analysis undertaken in this report has led to the development of a modelling tool that will remain useful for ongoing analysis as the international policy situation continues to evolve.

Issues for the sector to consider

These broad conclusions imply three aspects of the evolution of Australian and international greenhouse gas mitigation policy that will remain of interest to the agricultural sector. Each of these will continue to affect the implications of mitigation policy for that sector.

These are:

- ***Transparency***. In particular, observing the continued development of climate policies including the nature and relative magnitude of policy responses to climate change. Given a commitment to abatement, transparent ***price*** measures are likely to be in the long term interest of the agriculture sector. This is particularly important as an antidote to potentially misleading measures such as food-miles which could end up being to the disadvantage of the Australian industry.

- ***Adjustment measures***. Carefully examine the development of adjustment packages, especially border price adjustments, that may emerge in the course of the implementation of climate mitigation policies.

- ***Barriers to adjustment***. Continued examination of whether there are intentional or unintended barriers to adjustment following the introduction of mitigation measures.

Each of these is considered in more detail below.

Transparency

There is an imperfect but useful analogy with international trade policy; particularly related to the subsidies, border taxes and so on that have long distorted trade in agricultural commodities. The farm sector in Australia has long argued — along with the removal of these subsidies — for improved transparency in policy. Reduced subsidies should not come at the expense of reduced transparency in how the policies are implemented and enforced. The same broad principles apply to climate policy.

One of the most challenging aspects of observing international climate policy is the difficulty in getting a fully transparent picture of country policies and their effects. Aside from the uncertainty associated with the quantity pledges of various countries, the implementation of policy — that is, the choice of instruments to achieve the pledges — is likely to have significant implications for trade (because of the different implications for the net balance of cost and demand side effects noted elsewhere in this report).

A core economic principle is that the cost of abatement will be minimised where the incentives to abate are equalised across countries (i.e., the marginal costs of abatement are set equal). This point also extends to research effort.

The evolution of international climate policy (despite the focus on flexibility mechanisms) makes achieving this objective particularly difficult. This further strengthens the case for transparency in developing international climate policies in order to understand the opportunity cost of particular policy choices.

Transparent implementation of climate policies will be essential in order to be able to understand the full implications of policies as they emerge.

Adjustment policies

Climate policy, if taken seriously, will require significant industry adjustment in many economies. The process will be more costly if the necessary adjustments are prevented in some way. Adjustment barriers may come in many forms, some of the most important could be factors preventing full transmission of price signals.

The same transparency point applies to assistance or adjustment measures given to particular sectors following the introduction of carbon prices or other forms of carbon policy. These measures have implications for both resource flows between sectors within and economy and for trade flows between economies. A particularly important part of this may be the use of border price adjustments.

Barriers to adjustment

Effective adjustment to climate policies requires:

- Flexibility in prices in response to the cost and other changes induced by climate mitigation policy measures. This includes flexibility in wages (real wages) and exchange rate settings. Without such flexibility the economic signals from carbon policy cannot be transmitted throughout the economy. Further, the compensating economywide mechanisms (from the perspective of the agricultural sector, for example) will not occur.

- The ability of consumers and producers to respond to the price signals.

- The absence of technical or technology constraints to adjustment. This is particularly important as without appropriate technical options, it will be impossible for producers or consumers to respond and change behaviour in line with the price incentives.

The extent and importance of these barriers is difficult to predict in advance. Rather, they need to be observed in the course of the implementation of international climate policy.

Appendix A: Climate change policy details

New Zealand

The primary climate change policy in New Zealand is an emissions trading scheme which started in 2010. It currently covers electricity generation, industry, liquid fossil fuels, waste, synthetic gases and forestry. The key details of the scheme are:

- The initial scheme target was New Zealand's Kyoto target (6 per cent below 1990 levels by 2008-12). Targets after 2012 are to be guided by international post-2012 targets.
- Permits have a fixed price in the transitional period (which currently does not have an end date) of NZ$25/t CO_2-e. Additionally, during the transitional period, polluters are only be required to surrender one permit for every two tonnes of CO_2-e emitted (effectively making the price NZ$12.50).
- Permit prices in the spot market in mid-September 2012 were $NZ4.20 a tonne.
- International permits (CERs, ERUs and RMUs) created under the Kyoto Protocol are accepted under the scheme. Permits under a future international scheme will also be accepted. Therefore, the long term price will be determined on the international market.
- Some free allocations are made based on emission intensity of production.
- In general, no domestic offsets will be allowed but firms in the forestry sector that choose to participate in the scheme can generate credits. These can be traded on the domestic market or converted to Kyoto units for trading overseas.
- There is currently no legislated date for when biological emissions from agriculture will be included in the NZ ETS. The Government has indicated that agriculture will have surrender obligations in the NZ ETS only if there are economically viable and practical technologies available to reduce emissions and trading partners make more progress on tackling their emissions in general.

In July 2012, a number of revisions were made to the scheme, the additional provisions include:

- introducing 'offsetting' as an option for pre-1990 forests, giving forest landowners the flexibility to convert their land to a better use, but avoid ETS deforestation costs by planting a carbon equivalent area of forest elsewhere
- introducing a power to allow the Government to increase the supply of New Zealand Units (NZUs, the primary emissions unit used within the ETS) through an auction, within an overall cap on the number of NZUs auctioned and allocated.
- not introducing a new power that specifically allows for quantitative restrictions on the number of international emissions units that can be surrendered by those with ETS obligations. This will ensure that the carbon prices faced by ETS participants continue to reflect international prices.

Links to further information:

http://www.mfe.govt.nz/publications/climate/emissions-trading-bulletin-11/index.html#summary

http://www.climatechange.govt.nz/reducing-our-emissions/government-policies.html

http://www.climatechange.govt.nz/emissions-trading-scheme/ets-review-2011/review-report.pdf

http://climatechange.govt.nz/emissions-trading-scheme/ets-amendments/index.html

https://www.climatechange.govt.nz/emissions-trading-scheme/participating/agriculture/

http://www.odt.co.nz/news/business/226151/fears-emissions-trading-scheme

United States

Federal policies

The US submitted a target to the Copenhagen Accord of 17 per cent below 2005 levels by 2020, but meeting the target would be dependent on domestic climate change legislation being passed.

Emissions trading legislation was introduced into both houses of Congress but never passed through the Senate. The proposed legislation that passed the House of Representatives (the American Clean Energy and Security Act or the Waxman-Markey Bill) had the following elements:

- Scheme cap of:
    - 3 per cent below 2005 levels by 2012;
    - 17 per cent by 2020;
    - 42 per cent by 2030;
    - 83 per cent by 2050.
- Covers seven gases (six Kyoto gases plus nitrogen trifluoride (NF_3)).
- Covered sectors would be stationary sources, petroleum producers and importers, natural gas distributors and producers of 'F-gases'.
- Permit allocation would be free for electricity and gas distributors, trade exposed merchant coal generators and oil refineries; other permits will be auctioned.
- Agriculture and forestry offsets would be eligible as well as other project based offsets (eligible activities are yet to be decided).

The rejection of this legislation in the Senate caused a shift to actions by the EPA to regulate GHGs under the existing Clean Air Act. In future, stationary sources of industrial and power facilities (heavy emitters) may be regulated by the EPA under its general New Source Performance Standards.[13]

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13 http://www.rff.org/rff/Documents/RFF-DP-10-23.pdf

The Federal government offers a range of financial support and incentives for clean and efficient energy but there are no federal regulations to mitigate climate change. Two key federal programs are the Renewable Production Tax Credits and the Renewable Energy Grants. An annual tax credit is provided for the first ten years of operation at rate of US$0.022 per kWh for wind, geothermal and closed-loop biomass and half this for other sources. Grants are provided for up to 30 per cent of costs for fuel cells, solar, small wind, biomass, landfill and geothermal waste.

There is also a federal Renewable Fuel Standard which has a target of 36 billion gallons of biofuels by 2022 (of which 21 billion gallons must be from advanced biofuels). Mandates have been set for cellulosic ethanol and other advanced biofuels from maize starch. To support the standard, there is an Alcohol Fuel Credit, Biodiesel Fuel Credit, Bioenergy Program for Advanced Biofuels, Excise Concessions for Ethanol and government purchasing agreements.

State and regional policies

There have been numerous state based and regional programs. The major ones are the Western Climate Initiative (WCI), Midwestern Greenhouse Gas Accord (MGGA) and the Regional Greenhouse Gas Initiative (RGGI).

RGGI is a cap and trade scheme that covered the power generation sector of 10 US states, although New Jersey withdrew. The overall cap is to reduce CO_2 emissions from the power sector by 10 per cent by 2018, compared to 2009. Permits under the scheme are auctioned and the price of a permit at auction in March 2011 was $1.89, down from $3.51 in March 2009. The cap is not binding at this stage.

WCI is a proposed emissions trading scheme for seven US states and four Canadian provinces. However, all US states except for California have withdrawn from the WCI[14] and California and Quebec are the only jurisdictions so far to have implemented schemes. The first compliance period of the California scheme started in 2013, after 2015 the scheme is expected to cover about 85 per cent of the state emissions.

- The scheme covers electric utilities, cement, lime, nitric acid, refineries and electricity generation that has annual emissions exceeding 25,000 tCO_2-e. From 2015 it will also include transport fuel distributors and upstream natural gas suppliers.
- Permit allocations were initially made using a benchmarking approach similar to the EU ETS as well as through auctions.
- Limited offsets use (8 per cent of obligations) is allowed from Air Resources Board offsets credits and sector based offsets credits (all generated in the US) which include forestry and agriculture credits.

Another proposed regional cap and trade scheme is the Midwestern Greenhouse Gas Accord (MGGA) which covers five states and one Canadian province. While not officially suspended, states have not pursuing the development of the trading scheme.

A diverse array of US states and Canadian provinces have formed the North America 2050 Initiative. North America 2050 is a forum for states, provinces and stakeholders to identify leadership opportunities in climate and clean energy policy.

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14 http://lawprofessors.typepad.com/environmental_law/2011/12/six-us-states-withdraw-from-the-western-climate-initiative.html