6 Conclusions and implications

Key points

- The resources committed by different study countries to emissions-reduction policies vary as a proportion of GDP.
  - In electricity generation, Germany made the largest relative resource commitment, the United Kingdom was next and Australia, along with China and the United States, were in the middle.
  - In biofuels, the US resource commitment was substantially higher than other study countries, though Germany also devoted considerable resources to this abatement policy.
- The cost effectiveness of these actions in achieving abatement, and the amount of abatement actually achieved, also varies widely, both across programs within each country and in aggregate across countries.
  - Explicit carbon pricing in the United Kingdom appears to have been a cost-effective way of achieving considerable abatement.
  - At the other end of the scale, policies to encourage small-scale renewable generation are substantially less cost effective and have led to relatively little abatement.
- The impacts of supply-side policies on product prices appear to have been modest for most countries, with the notable exception of electricity prices in Germany and the United Kingdom, where impacts of over 10 per cent are estimated to have occurred.
- The relative cost effectiveness of a price-based approach is illustrated for Australia by stylised modelling that suggests that the abatement from existing policies could have been achieved at a fraction of the cost.
- However, the estimates in this report cannot be used to determine the appropriate starting price of a broadly-based carbon pricing scheme in Australia.
- Similarly, the estimates provide only a small subset of the data required to make assessments of what assistance would be needed to avoid undue levels of carbon leakage, and competitive disadvantage. Additional countries and relevant industries would also need to be assessed.

This concluding chapter looks again at the approach taken and relevant caveats, summarises some key results and then draws out some implications for assessing comparative effort and competitiveness effects.

6.1 Recapping on the Commission's approach

If all greenhouse gas emissions were 'priced' directly, comparing prices across countries would be straightforward, but this approach is not common.

- The European Union emission trading scheme (ETS), covering both Germany and the United Kingdom, is one point of reference. But permit prices are influenced by the coverage of the scheme — which is still limited — and the cap on emissions.
- New Zealand has introduced an ETS, and the carbon price has been capped as an interim measure.
- Other countries are contemplating introducing explicit carbon pricing (Japan and South Korea, for example, as well as Australia), but there has been no firm indication of what the carbon prices will be.

When the analysis is broadened to include the impacts of the many non-price emissions-reduction measures, the analytical task becomes much more complicated. The idea that these impacts could be measured in price terms has broad appeal, but there is no clear definition of, or basis in theory for, such a measure (chapter 3).

What all emissions-reduction policies have in common is that they generally impose costs that someone must pay in order to reduce emissions. It is in this sense that the Commission has interpreted 'effective carbon price' loosely to mean the cost of reducing greenhouse gas emissions. This led to the conclusion that the best metric for comparing disparate policies was abatement costs, which in this study has been estimated by comparing the costs and associated emissions of each policy measure (or bundle of measures) with a counterfactual of no policy.

But the abatement cost results cannot be said to be carbon prices. This is because an explicit carbon price applied broadly to the economy would achieve abatement in quite different, and most likely much more cost-effective, ways. Thus for example, a country might be achieving some abatement through subsidising biofuel production, which has been shown to be a high-cost abatement option (chapter 5). Because a broad-based carbon tax would work on both the demand and supply sides of the economy and encourage the lowest cost abatement options to be taken up first, it would not need to be as high as the biofuel subsidy rate to achieve the same level of abatement. Thus, while it is possible to calculate a tax equivalent that will give the same amount of abatement as the biofuel subsidy (or any other measure that gave the same abatement), application of that tax equivalent would most likely not induce abatement through biofuels.

Measuring abatement costs

Abatement costs should ideally be measured in terms of the impacts on total economic welfare. This requires estimating the costs of inducing substitution on the supply side (the additional *resource costs* of production) as well as the costs of reduced consumption on the demand side where product prices are pushed up (*consumption cost*s).

On the supply side, the Commission estimated the subsidy equivalent for all material policy measures for which data could be obtained. The subsidy equivalent is the explicit or implicit subsidy provided to suppliers of low-emission, but high-cost, products to enable them to be competitive with high-emission but low-cost products. It is indicative of the true (resource) costs, but will generally overstate them (where marginal costs are increasing). However, as long as they do so consistently — and for similar bundles of technologies, such as biomass, wind or solar photovoltaic this is a reasonable presumption — cross-country comparisons can still usefully be made. Subsidy equivalents are also of interest in their own right, because they capture the often hidden transfers to producers.

On the demand side, the Commission estimated consumption costs for those policy measures that directly impact on firms and consumers, such as carbon taxes or fuel taxes. It also estimated consumption costs for supply-side policy measures where the subsidy is effectively paid for by firms and consumers — such as where the cost of purchasing renewable energy certificates is passed on, in whole or in part, by electricity retailers in electricity prices. This necessitated using some simplifying assumptions about demand responsiveness and cost pass-through to provide indicative results in this area.

Abatement was estimated relative to the counterfactual of what emissions would have been in the absence of a given policy. This can depend on the circumstances. In the case of electricity generation, for example, the marginal generator that is replaced when renewable energy generators are dispatched can vary depending on market circumstances, and this can have a substantial impact on the amount of abatement that can be attributed to a policy.

Some limitations

It is important to be clear about the uncertainties inherent in this analysis and the assumptions that needed to be made.

- Unsurprisingly, data proved difficult to obtain for some policy measures and some technologies, particularly in the non-English speaking countries included in the study. The Commission received valuable cooperation from most governments and many research organisations, and it employed contractors to help obtain information, but some uncertainties and gaps remain.
- As noted, the 'counterfactual' scenario can differ depending on the circumstances. Sensitivity analysis was accordingly used to capture the range of possible outcomes.
- The analysis only provides a snapshot for the most recent year for which data were available. As some programs are ramping up over time, it can be expected that, other things being the same, cost and abatement will rise. While the Commission was asked to look at 'committed' policies, in most cases there was insufficient data to estimate the cost impacts of these schemes, other than to offer a qualitative indication.
- Costs and abatement are attributed to some policies that have multiple objectives and there is uncertainty about how much might reasonably be apportioned to each. Sensitivity analysis was again used to test this. Thus, for example, the analysis of fuel taxes considered the extremes of them being solely an emissions-reduction measure or not.
- The study countries provide a useful benchmark in the sense that they include many of the largest emitters, but they are not the home to the competitors of many Australian companies (competiveness issues are taken up below).
- Some policy measures work in the opposite direction by implicitly encouraging emissions. But as these may be achieving other objectives, and/or acting indirectly, it would have been very difficult to factor these in to the analysis.

6.2 Some key results

The Commission estimated the total subsidy equivalent (as a proxy for the resource costs), and the abatement attributable to the subset of policies that are having the greatest impact in each country. Dividing the former by the latter gives the average implicit abatement subsidy, which is the proxy for the unit cost of abatement. The Commission also calculated some indicative estimates of the consumption costs on the demand side.

Electricity supply side

The implicit abatement subsidies — which are also measures of cost effectiveness — varied considerably across policies and also across countries (table 6.1), depending in part on each country's policy mix.

- The lowest implicit abatement subsidy estimate was for New Zealand, for which only one electricity-sector policy was analysed — the recently-introduced ETS.
- Despite their participation in the European Union ETS, estimated implicit abatement subsidies in Germany and the United Kingdom are relatively high. This is because of the generous subsidies that the two countries provide to renewables.
- Policies analysed in Japan and South Korea achieved very low levels of abatement, at a relatively high resource cost (mainly because of high production subsidies paid to high-cost solar photovoltaic), hence the implicit abatement subsidies are high.
- The range of the estimated implicit abatement subsidy for Australia (A$44–99) was lower than for some countries, and at the low end, comparable with China and the United States.

Table 6.1 **International comparison table — electricity generation policies**

Country	*Total subsidy equivalent*	*Total subsidy equivalent as a percentage of GDP*	*Total abatement*	*Abatement as a percentage of counterfactual electricity sector emissions*[a]	*Implicit abatement subsidy*
	A$m (2010)	%	Mt CO_2	%	A$/t CO_2
Australia	473–694	0.04–0.05	7.0–10.7	3.5–5.2	44–99
China	1 835–2 309	0.03–0.04	40.7–52.1	1.2–1.5	35–57
Germany	10 019–11 769	0.28–0.33	67.1–73.1	18.3–19.6	137–175
Japan	669–940	0.01–0.02	3.3–4.3	0.8–1.1	156–287
New Zealand	..	..	..	..	8–10
South Korea	313–379	0.03–0.03	0.9–1.4	0.5–0.7	225–401
United Kingdom	2 042–2 433	0.08–0.10	12.3–27.4	7.5–15.4	75–198
United States	2 886–3 339	0.02–0.02	66.5–66.7	2.8–2.9	43–50

[a] 2010 for China, 2009 for United Kingdom and Germany, 2008 for Japan and Korea. **..** Not applicable.

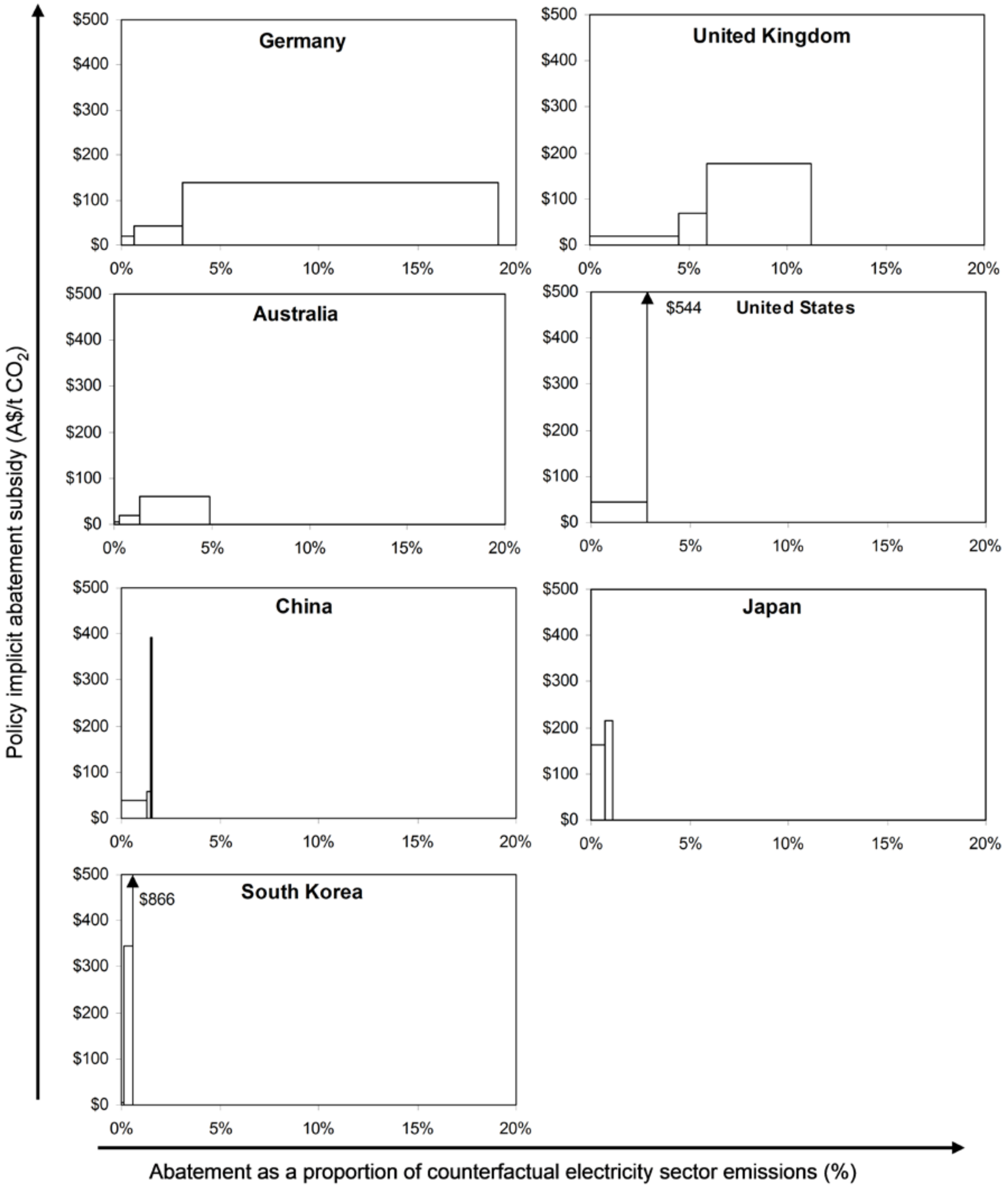
Source: Appendixes D-K

In many cases, overlaps between policy measures makes it impossible to separately report the abatement each achieves. But where they are separable (or at least can be separated into one or more groups of policies), the implicit abatement subsidy estimates can be used to compare the resource costs of different technologies for reducing emissions (figure 4.4) and the reliance of countries on particular policy measures (figure 6.1). Notable features include:

- Subsidies for solar-photovoltaic systems were found to be a relatively very costly way of achieving abatement and generally little abatement resulted. (These are visible as the very high thin bars in the charts for China, South Korea, the United States and to a lesser extent Japan.) Although a feature of the policy mix in Australia, solar subsidies were deemed to have overlapped with the large and small renewable energy targets, and hence abatement could not be separately identified.
- Germany obtained most of its abatement from relatively high-cost feed-in tariffs (the wide block at A$137/t CO_2).
- The United Kingdom had a mixed outcome, achieving low-cost abatement from fuel switching through the incentives created by the European Union ETS (the low flat bar at A$29/t CO_2) and a similar amount of abatement from its much higher cost Renewables Obligation (at A$176/t CO_2).
- The United States obtained most of its measured abatement from a combination of three policy measures, two federal tax credits and the renewable portfolio standards operated by many states (combined these are estimated to have an implicit abatement subsidy of A$43/t CO_2).
- China’s main contributor was its wind feed-in tariff at around A$38/t CO_2.
- Australia’s suite of policies (discussed later), was dominated by the combined effects of the large and small−scale components of the renewable energy target and feed-in tariffs (giving an average implicit abatement subsidy of A$62/t CO_2).

Figure 6.1 **Marginal abatement costs — electricity-generation sector[a]**

Graphs show the Commission's 'central' estimates of abatement (as a proportion of counterfactual electricity-sector emissions) and implicit abatement subsidies



[a] The vertical axis was truncated at A$500/t CO_2. Where the estimated implicit abatement subsidy for a policy was above this level the implicit abatement subsidy estimate is shown on the graph.

Source: Productivity Commission estimates.

Road transport supply side — biofuels

Analysing the key policies for each country indicates that Australia's implicit abatement subsidy for biofuels was similar to the United Kingdom, Germany and New Zealand. However, costs and abatement vary widely across these countries (table 6.2).

- The United Kingdom, Germany and the United States — all with fuel content mandates — had high estimated total subsidy equivalents and abatement.
  - Germany stands out for having the highest abatement when measured against counterfactual emissions for the transport sector (3.6 per cent) at an implicit abatement subsidy of A$310/t CO_2-e, which was at the lower end of the results for all countries.
  - The United States stands out for substantial abatement but at very high cost (the implicit abatement subsidy was estimated to be in the range A$604–A$672/t CO_2-e).
- New Zealand committed a very small amount of resources to biofuels and hence was achieving very little abatement.
- Japan and South Korea had relatively high cost biofuel schemes, with minimal abatement.

The results for China suggest that only under the most favourable assumptions could its biofuel policies have been achieving net abatement. Under most plausible scenarios, the net abatement was negative. This amounts to China having effectively subsidised emissions rather than abatement. This result appears to be due to the high application of fertiliser to grow feedstock for ethanol, and the emissions intensity of refining processes in China.

In summary, while the results for biofuels vary and are particularly sensitive to assumptions about life-cycle emissions intensities, most biofuel policies are high-cost means of achieving abatement. Cost per tonne of abatement — as measured by the implicit abatement subsidy — is typically A$300–A$600/t CO_2-e and possibly as high as A$800/t CO_2-e. This cost is substantially higher than for most supply-side measures in electricity generation (though broadly comparable with solar subsidies).

Table 6.2 **International comparison table — biofuel policies**

Country	*Total subsidy equivalent*	*Total subsidy equivalent as a percentage of GDP*	*Total abatement*	*Abatement as a percentage of counterfactual road transport emissions*	*Implicit abatement subsidy*
	A$m (2010)	%	Mt CO_2-e	%	A$/t CO_2-e
Australia	144	0.011	0.4	0.6	364
China[a]	1 998	0.03	..	..	..
Ethanol	..	..	-1.4 to +0.8	-0.4 to +0.2	-6 105
Biodiesel	..	..	0.2	0.06	592
Germany	1 711	0.05	5.5	3.6	310
Japan	57	0.001	0.1	0.04	617–653
New Zealand	3	0.002	0.01	0.06	391
South Korea	196	0.02	0.2–0.5	0.3–0.6	415–831
United Kingdom	680	0.03	2.0	1.7	335
United States	12 470–17 477	0.08-0.11	19-26	1.2–1.7	604–672

[a] Results for China are presented separately for ethanol and biodiesel due to the negative abatement result for ethanol. Only a central estimate is given for the implicit abatement subsidy for ethanol; this estimate reflects negative abatement (not cost). **..** Not applicable.

Source: Appendix N.

Road transport demand-side analysis

Of the biofuel policies analysed, the Commission has only explored the demand-side impact of fuel mandates because these are the only type of biofuel policy likely to affect retail prices. Fuel mandates were analysed for the United States, Germany and the United Kingdom. These mandates tend to increase fuel prices because they require petrol and diesel to be blended with more costly biofuels. However, the Commission’s results suggest that the mandates appear to have had only a modest effect on prices, with at most an impact of around 1-2 cents per litre on retail prices of petrol and diesel.

By comparison, if regarded as emissions-reduction measures, the various taxes on fuel, such as excise taxes, (but excluding broad based consumption taxes) may be preventing emissions from road transport being much higher than they would otherwise. As for electricity, the Commission had to make some simplifying assumptions about demand responsiveness. In this case, these are even more speculative given the much larger tax-induced changes in price. But even if demand is only mildly responsive to price, it is likely that fuel taxes have led to substantially lower emissions relative to the counterfactual of no fuel taxes. For example, the high estimate for Germany indicated that abatement relative to the counterfactual was approximately 41 per cent. The consumption costs associated with this also appeared to be relatively modest.

But in most countries these taxes have been used for general taxation purposes and/or as quasi 'road-user charges'. Therefore, any abatement could be considered to be incidental. In some cases, such as the United Kingdom, recent adjustments to fuel taxes have been justified in part on emissions reduction grounds, but so far these increments are small relative to the pre-existing tax rates, and some countries have made no such distinction. But if anything these results point to the added effect a carbon tax could have on top of existing fuel taxes.

6.3 Implications for 'effort'?

There is significant interest in understanding the relative effort of different countries in mitigating climate change. 'Effort' implies some sort of sacrifice that a country is making to achieve a given level of abatement. But sacrifice is difficult to define. For example, some see it as meaning that each country should reduce its emissions by the same proportion, others that countries should suffer the same proportionate losses in national income. The different commitments made by parties to the Copenhagen Accord illustrate diverse views, with some countries committing to absolute reductions from a past base year, others advocating reductions against some business-as-usual projection, and yet others advocating decreases in emissions intensity.

The economic impacts will vary according to the approach taken and the characteristics of each economy. Even if all countries had identical carbon taxes, it could not be said that each was making the same *abatement* effort.

Given the problems of defining and measuring effort, this study can only provide some circumstantial evidence of relative effort. There are two ways it does this: through an overview of the breadth and depth of the policy action each country is taking; and scaling costs and abatement achieved by GDP and (counterfactual) emissions, respectively.

Policy actions

Most study countries have adopted a large and diverse range of emissions-reduction policies. For example, the Commission identified more than 300 significant state and federal policies in the United States, and around 120 in the United Kingdom. And Australia itself has around 200 policy measures (chapter 2). These include ETSs in some countries (or regionally), and a range of less direct measures, such as mandatory renewable energy targets, feed-in tariffs, energy efficiency measures and capital subsidies for constructing or installing renewable energy technologies.

Of course, sheer numbers of policies say little in themselves about the materiality or effectiveness of the aggregate response made by governments. Australia and the United States have many policies in place partly because they are federations and their states are active in environmental policy. New Zealand, on the other hand, which has a unitary system of government and a natural endowment of hydro power, has achieved a more focused policy mix centred around explicit carbon pricing.

Some of the breadth in the policy mix can be explained by the use of complementary policies that are intended to address market failures other than the externality associated with greenhouse gas emissions (for example, energy efficiency policies that address information asymmetries). It can also be explained through the rebadging of existing policy instruments. (For example, fuel taxes are increasingly being seen as ways of discouraging fossil-fuel consumption and hence greenhouse gas emissions).

But it is also evident that there is much overlap and inconsistency in the policy mix of most countries. Different levels of government can be supporting the same project, not adding to abatement but adding to cost (for example, the US Federal Government subsidies for renewable energy and state mandatory renewable energy targets). Even at the same level of government, overlaps exist. For example, the United Kingdom and Germany are part of the European Union ETS — which covers electricity generation — yet the United Kingdom has continued to employ a mandatory renewable energy target and Germany has continued to employ very generous feed-in tariffs. Perversely, Germany’s high level of support for renewable electricity reduces the emissions-reduction burden that must be borne by the rest of the European Union, lowering ETS permit prices, and leading to increases in emissions in other EU countries at Germany’s expense (Traber and Kemfert 2009).

One feature of the policy mix of most countries is that they are in a state of flux. With the European Union ETS now well established and its coverage growing, New Zealand’s fledgling ETS, some regional schemes in North America, and other countries such as South Korea, Japan and China intending to trial or adopt such schemes, explicit carbon pricing appears to be coming to the fore. But it is not clear if this will lead on to the rationalisation of other, more costly mechanisms.

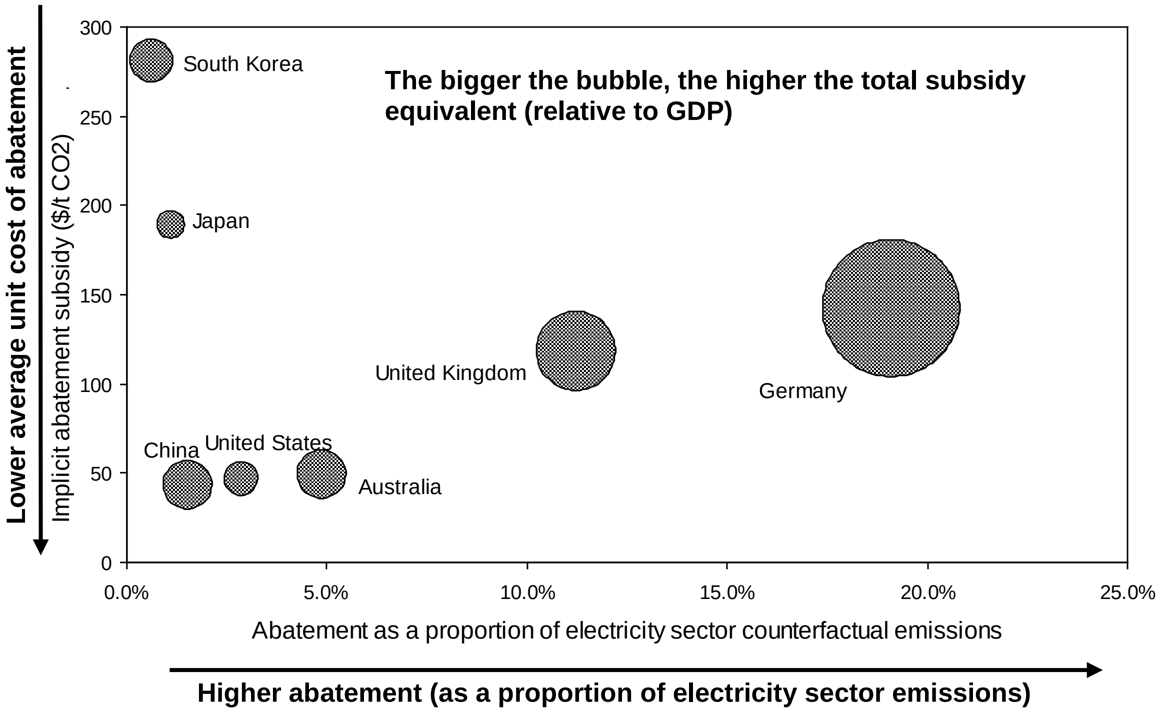
Cost and abatement being achieved

The other way this study can shed some light on effort is by relating the cost incurred by each country in reducing emissions to the size of their economies, and comparing abatement to their sectoral emissions (table 6.1 and 6.2).

Electricity generation

When the total subsidy equivalent of each country's abatement policies was 'scaled' by expressing it as a proportion of GDP, Australia's commitment of resources (measured by the size of its bubble in figure 6.2) was much the same as for South Korea and China. But relative to South Korea, Australia's suite of measures was much more cost effective and produced proportionately more abatement, and relative to China they were about as cost effective, but achieved greater proportionate abatement. Australia achieved more proportionate abatement than the United States at about the same cost effectiveness, but devoted more of its GDP to achieving this outcome.[1] The United Kingdom and Germany are again shown to have devoted substantial resources to achieving abatement. Germany achieved substantially more abatement than the United Kingdom but at a slightly higher average cost. Japan's resource commitment was smaller than most other countries, the unit cost was high, and abatement small.

Figure 6.2 **'Effort' and reward — how countries compare**
Electricity generation — central estimates



Source: Appendixes D to K.

1 But as noted in Chapter 4, of all study countries, the results for the United States are more likely to be underestimated due to the possible omission of other material policy interventions.

Some care needs to be taken in interpreting the data. Other things being the same, average costs of abatement would be expected to rise as abatement increases. This might be expected if policy makers have targeted assistance at the lowest-cost abatement options first. Indeed, if South Korea and Japan are excluded, the results for all other countries exhibit this trend. However, other things are clearly not the same. There are likely to be some large differences in the costs of the same renewable generation technologies, if for no other reason than that some countries will have different endowments of wind or solar resources (for example), and the different mixes of policies will influence average costs.

Biofuels

Using the same approach for biofuels reveals that, as a proportion of GDP, Australia's commitment of resources to achieving abatement is less than for most other study countries, but that cost effectiveness appears comparable to Germany and the United Kingdom, being roughly in the range of A$300-A$400/t CO_2-e (figure 6.3). But Australia is achieving relatively less abatement when measured as a proportion of transport-sector emissions. Germany is devoting considerable resources to biofuels, but is achieving the highest proportionate amount of abatement. The United States stands out in this analysis for having by far the highest commitment of resources relative to GDP, for only moderate proportionate abatement and hence low cost effectiveness.

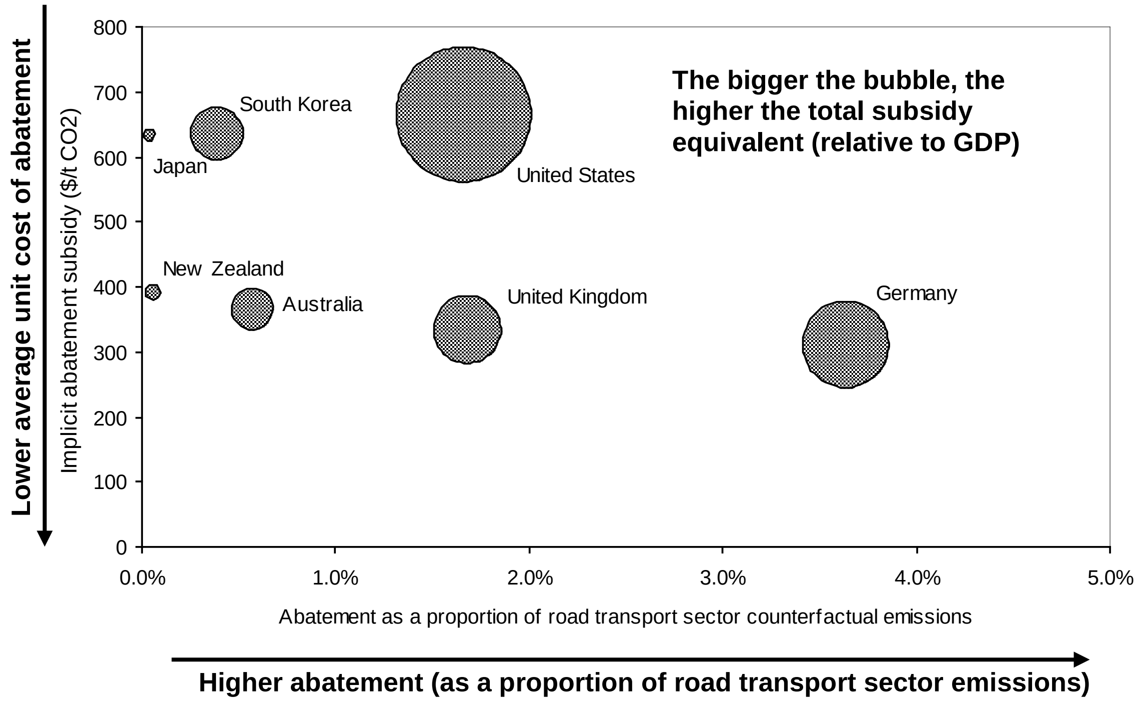
Demand-side abatement and consumption costs

The demand-side abatement results discussed above could also be considered to shed some light on effort, as indicative as they are. The impacts on UK and German consumers of electricity and road-transport fuels stand out in this regard. Both countries have costly policy measures supporting low-emissions generation, which in combination with the European Union ETS, are estimated to have raised retail electricity prices by over 10 per cent. In road transport, the impacts of fuel taxes on abatement and hence consumption costs for most countries are considerable. Germany and the United Kingdom stand out, with fuel taxes of A$0.78 and A$0.96 per litre respectively (table 5.16), with Australia mid-range at A$0.36 per litre.[2] But if these taxes are considered to be primarily for other purposes, such as funding roads or as a revenue-raising measure, it is not valid to attribute high-tax countries with additional effort.

2 These are weighted averages of the rates applying to different road transport fuels.

Figure 6.3 **'Effort' and reward — how countries compare**

Biofuels — central estimates



Source: Appendix N

In summary, such analysis can tell us relatively little about comparative effort per se, other than that some countries have devoted proportionately more of their national resources to achieving abatement than others, though with varying cost effectiveness. The results also illustrate the traps in using simple metrics to indicate effort.

- A relatively high implicit abatement subsidy does not necessarily indicate that a country also experiences a greater proportionate impact on its economy, or emissions, than other countries.
- A country that adopts high-cost abatement opportunities should not be given greater credit than a country that achieves the same abatement at lower cost. Indeed, the more cost effective the abatement policy, the greater the abatement that becomes possible for a given cost.

Least-cost abatement

As noted above, the cost effectiveness of a country's policy measures in aggregate can be put into perspective by estimating the explicit carbon price (from either a carbon tax or emission permits) that would achieve the same amount of abatement when applied on an economy-wide basis.

This can be illustrated using a (hypothetical) marginal abatement cost (MAC) curve that shows all feasible abatement options in ascending order (including by reducing relatively low-value consumption) (figure 6.4).

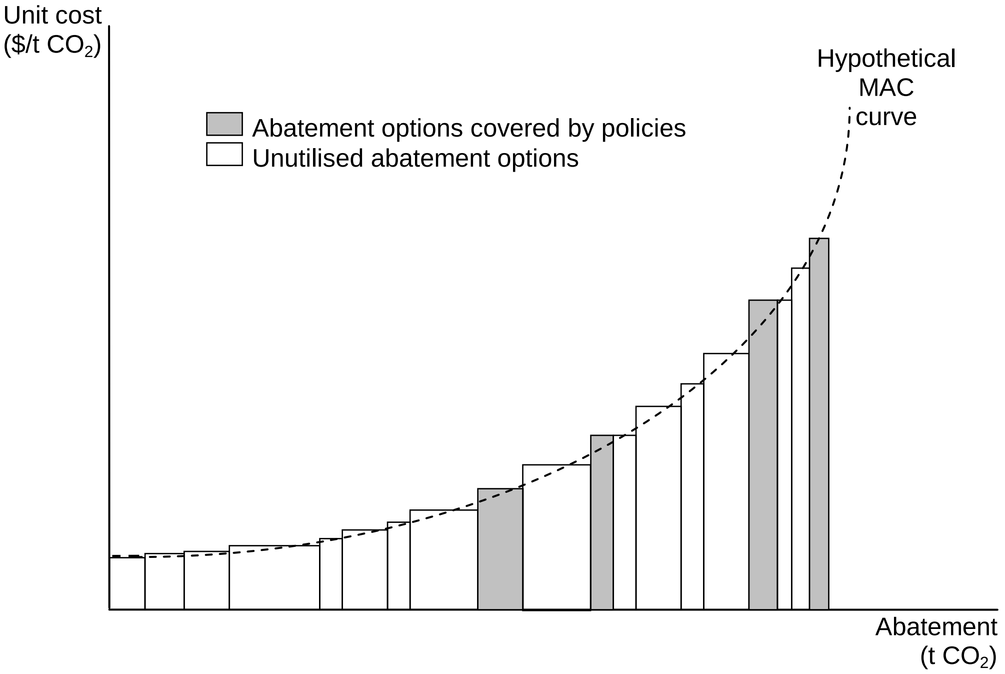
- For various reasons, governments have found it difficult to implement the lowest-cost options first, meaning they may support a suite of relatively high-cost options (shown as the ‘Policy MAC curve’).
- If instead, all abatement options were considered and adopted in order of lowest to highest cost, the same amount of abatement could be achieved at a lower (marginal) cost (P_2 versus P_1).
- Conversely a much greater level of abatement could be achieved at the same (marginal) cost (A^{**} instead of A^{*}). (Note that total cost is measured by the area under the respective MAC curves, and the average cost of abatement will be less than the marginal cost.)

The abatement costs of the three existing policy measures analysed in this study for Australia have been plotted in figure 6.5 to create, in effect, an Australian ‘policy MAC curve’ for electricity. (The demand-side effect is shown separately and labelled ‘electricity consumption costs’). The central estimates of abatement for these policies comes to around 12.5 Mt CO_2.

Stylised modelling using an ‘off-the-shelf’ version of the MMRF model of the Australian economy suggests that a carbon tax or ETS permit price would have achieved the same abatement at much lower cost. For example, according to the modelling, if applied only to the electricity sector, an explicit carbon price of about A$9/t CO_2 (corresponding to P_2 in figure 6.4) is required.

This equates to about 11 per cent of the almost A$500 million estimated cost of the existing policies. Alternatively, for the same aggregate cost, more than twice the abatement could be achieved. One of the reasons an explicit carbon price would be expected to be more cost effective at such low levels of abatement is that, as modelled, it captures a considerable amount of low-cost abatement on the demand side.

Figure 6.4 **Marginal abatement cost (MAC) curves and cost effectiveness: a hypothetical illustration**



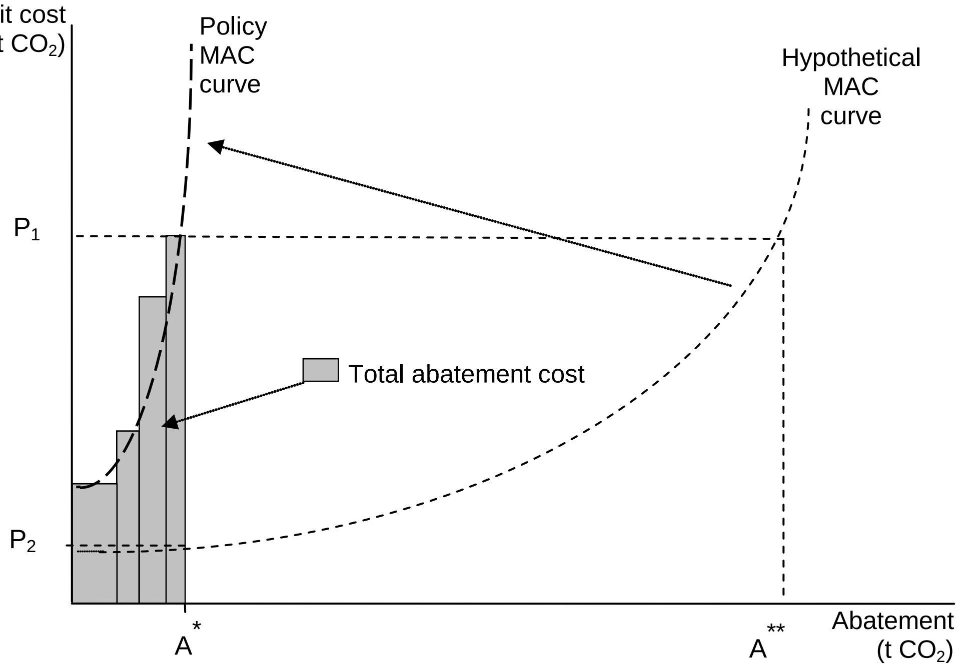
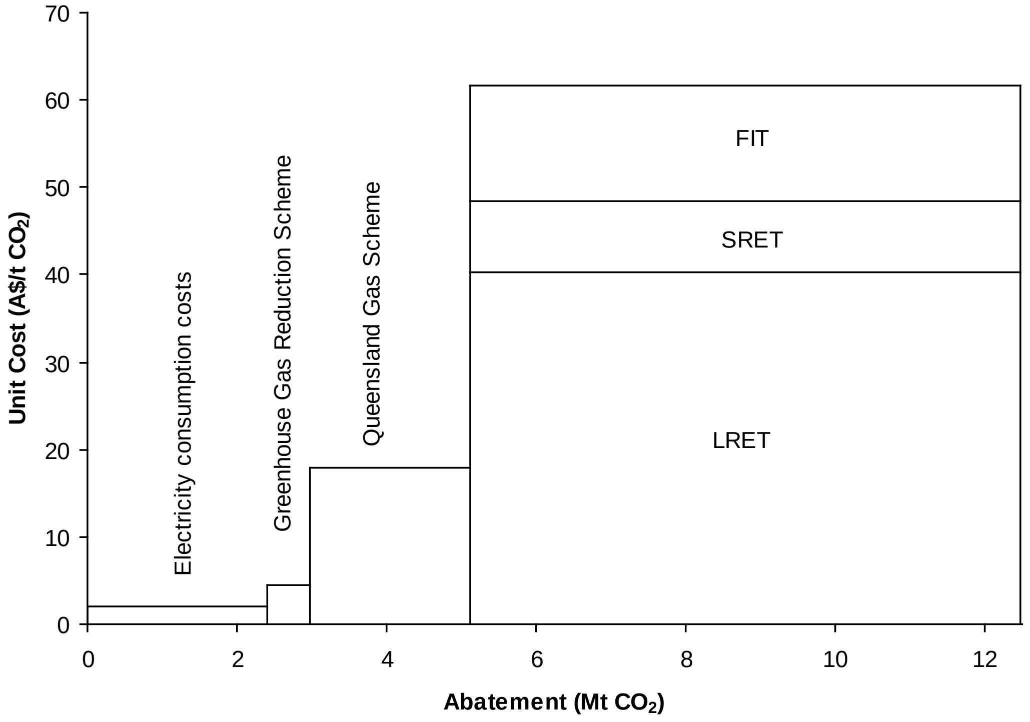


Figure 6.5 **Marginal abatement costs, Australian electricity**
'Central' estimates, 2009-10



Source: Productivity Commission estimates.

This worked example is relatively simplified and cannot be used to infer what the explicit carbon price would need to be to achieve Australia's abatement objectives (something that the Australian Treasury model is better equipped to address). But it illustrates how much more cost effective abatement can be if, in place of other more costly measures, an explicit carbon price is applied to both the demand and supply sides of a broader set of emissions-reduction opportunities within the electricity sector. Extending such a price across the economy would make it even more cost effective. By the same token, a carbon price in combination with other measures will generally be less cost effective than one operating on its own.

6.4 Implications for competitiveness?

When governments intervene to encourage the provision of low-emissions but high-cost production in place of high-emission, low-cost production, they can obviously have an effect on the competitiveness of businesses using that production as an input. The potentially more vulnerable firms will be those that are energy intensive and trade exposed. In the context of this study, those firms would be the larger users of electricity and/or road transport fuel.

But the actual impact on a firm's costs will depend on how the government chooses to intervene.

- Explicit budget subsidies decrease the costs of the low-emissions producers, enabling them to be competitive at prevailing market prices. While businesses using these products will not have to pay for the subsidies via higher prices, taxes will need to be higher (or government spending lower elsewhere), with ramifications throughout the economy.
- Implicit subsidies to low-emissions producers will generally be passed on via higher prices to consumers and user industries, reflecting higher average costs of production.
- Explicit carbon taxes or trading schemes will directly increase product costs according to their emissions intensity, with these costs being passed on to consumers and user industries.

In this study, the Commission has estimated the impact of a sample of emissions-reduction policies on the retail prices of electricity and transport fuels. With the exception of taxes on road-transport fuels, the estimates are illustrative or at most indicative, for the reasons explained (section 6.1).

But even if these impacts were known with certainty, this information would still be of limited use in assessing impacts on the competitiveness of individual firms. This would require detailed information for particular firms and industries, including knowledge of the cost functions for the comparable industries in the competing countries, relative energy intensities, the net impacts of other policy measures affecting the cost of production, and the ability to pass on costs. Moreover, Australian firms may compete with firms in a wide range of countries — in many cases including countries other than those in this study — and the position would change as market conditions and exchange rates change.

The results for the electricity-generation and road-transport sectors vary considerably and need to be considered separately. In road transport, the Commission looked at support for biofuels as replacements for fossil fuels, and the impact of taxes on fuel prices.

Road-transport fuels are used widely in all economies for private consumption purposes, and as an input to business. Increases in the price of fuels could therefore have wide and diffuse impacts on the economy, with some businesses more affected than others.

- All countries impose substantial taxes on transport fuels, which can increase the cost of doing business. But the degree to which increases in fuel taxes might impair competitiveness will vary according to how much firms can claw back through tax credits or income tax deductions.
- Most biofuel policy measures are budget funded and (pre tax) fuel prices are determined in international markets and hence there are no direct effects. The only policies that do have impacts on retail prices seems to be the fuel mandates operated in Germany, the United Kingdom, and the United States, where they are binding. But even in these cases the impacts on fuel prices seem to be very modest to date (less than A$0.02 per litre).

In the case of electricity generation, the results are a little different, partly because electricity is generally not traded internationally and the industry can pass on cost increases to some extent. As this study has shown, most countries have some very costly policy measures, such as feed-in tariffs for renewable electricity, which are paid for by firms and households. The cost per unit of electricity from these schemes might be high, but to date the overall amount of electricity generated through these measures has, for most countries, been quite small. Hence, there has only been a relatively small impact on product prices to date. For example, the price impacts for Australia appear to have been of the order of 1 to 2 per cent in 2010. But there are exceptions, including Germany and the United Kingdom, where the impacts on retail prices appear to have been of the order of over 10 per cent. This would be an issue for firms in those countries that consume large amounts of electricity (and would work to the advantage of energy-intensive Australian firms competing against those firms).

The finding that average abatement costs are not particularly useful in assessing competiveness means that they are also not particularly useful for setting assistance for emissions-intensive trade-exposed firms. The analytical framework for considering assistance issues under the mixed bag of policies that apply in most countries is perhaps even more challenging than it would be under explicit carbon prices.

In summary, while the overall impacts of the policy measures analysed appears to be relatively small for most countries, the consistent finding from this study is that much lower-cost abatement could be achieved through broad, explicit carbon pricing approaches, irrespective of the policy settings in competitor economies.