# A Solution in Search of a Problem: The Shergold Report on Emissions Trading

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## 1. Introduction

The Prime Ministerial Task Group on Emissions Trading was asked to "advise on the nature and design of a workable global emissions trading system in which Australia would be able to participate." In response to the report, the Prime Minister announced on July 17 that a "cap and trade" system would be introduced in Australia. Whilst details have yet to be announced, reports suggest that the system will cover around 55 per cent of total emissions.

In advocating the policy action of establishing a carbon dioxide ($CO_2$) emissions trading system, the report argues that such a system will minimize the costs of achieving any given emissions reduction target. Even if this is true, however, it does not automatically follow that emissions should be reduced in the first place, let alone by the significant amounts that are being contemplated in various policy circles.

As far as policy is concerned, what matters is not so much the costs to Australia of higher average global surface temperatures, but the costs and benefits of various *policy actions* which are aimed at addressing the possible undesirable effects on Australia of higher average global surface temperatures.[1] This is a subtle but important distinction. Any policy contemplated by the Australian government should be focused on the net benefits to Australia of that particular policy. Only a full economic cost-benefit analysis of emissions reductions versus alternative policies can shed light on these issues for Australia. No credible economist (or anyone else, for that matter) has demonstrated that there are significantly positive total benefits (let alone significantly positive marginal benefits) to Australia from the policy of reducing our $CO_2$ emissions. There is a very good reason for this: since Australia's emissions are so small, any benefits (both in total and at the margin) of emissions reductions are likely to be extremely small – almost certainly zero. The report therefore constitutes a solution in search of a problem.

## 2. Background: Australia is Still a Small, Open Economy

The Earth's temperature is determined by balance of incoming solar radiation ("insolation") energy and outgoing terrestrial infrared radiant energy emitted by the planetary surface and atmosphere. Any gas which partially "traps" outgoing terrestrial radiation is classified as a greenhouse gas (nitrogen and oxygen, which together make up over 99 per cent of the dry atmosphere, are passive in this respect and are not greenhouse gases). Thus, water vapour is a greenhouse gas (indeed, it is the most important one). The natural "trapping" of terrestrial long-wave radiation by these stocks

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[1] Essex et al (2006) show that the "average" temperature of an out-of-equilibrium climate system is not a well-defined physical concept, and that the calculation and widespread use of the simple mean temperature to address global climatological questions is completely arbitrary from a physical point of view. Just as it is possible to define and compute an infinite number of social welfare functions in order to compute a "social" or "aggregate" ranking over various policy alternatives in economics, it is also possible to define and compute an infinite number of average global temperature statistics.

of gases leads to surface temperatures some 30 $^{\circ}$ Celsius higher than they would otherwise be in the absence of an atmosphere.[2] This is the greenhouse effect.[3]

Greenhouse gases are therefore responsible for providing livable conditions on earth. In the familiar terminology of economics, the marginal benefits of greenhouse gases are obviously positive over some range. In addition to its "trapping" properties, carbon dioxide (a naturally occurring greenhouse gas) is vital for photosynthesis and encourages plant, tree and marine growth. Nevertheless, the greenhouse effect may be enhanced by additional man-made greenhouse gases, with possible undesirable effects.

In understanding the relative contribution of these anthropogenic greenhouse gases, it is important to distinguish between stocks and flows. For example, $CO_2$ cycles naturally through the earth's atmosphere, land mass and oceans. The stock of carbon contained in atmospheric $CO_2$ is around 730 Gigatonnes of carbon (GtC), and the annual gross flow or exchange of carbon to and from the earth's surface and the atmosphere is estimated at 120 GtC. Between the oceans and the atmosphere the estimated gross flow or exchange is 90 GtC.[4]

In contrast, the annual flow of carbon dioxide into the atmosphere resulting from human activities (fossil fuel burning and land-use change) is just over 7 GtC.[5] This is just over 3 per cent of the natural annual gross flows, and less than 1 per cent of the total atmospheric $CO_2$ stock.

The Shergold Report takes a rather strange view of the desirability of a policy of emissions reductions. A "cap and trade" system involves setting a cap or a target, but nobody knows for sure what this cap should be, or whether an upper bound even makes good scientific or economic sense for Australia. Indeed, the report admits as much on page 21:

> "The goal of the United Nations Framework Convention on Climate Change, to which Australia is a party, is to achieve 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system' (United Nations, 1992). *Understanding of the complex environmental, economic and social impacts of climate change is currently not sufficient to identify confidently what this level should be*." [emphasis added]

Instead of acknowledging these issues or trying pin down what an appropriate "cap" might look like, the Shergold Report takes the following "risk management" view regarding emissions reductions:

> "Addressing climate change is a risk management issue on a global scale. While there are costs in acting now, the consequences of inaction are potentially large for many countries. Given the potential for significant costs arising from climate change in the future, a prudent risk management approach suggests that steps to reduce emissions should be undertaken now."

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[2] This naïve calculation ignores a number of important factors. See, for example, the discussion in Lindzen (1994).

[3] Diffuse radiation from clouds can provide an additional indirect component to radiation received at the earth's surface. For example, Mason (2002) estimates that if the constitution of the atmosphere remained as it is now, in the absence of clouds the mean global surface temperature would be 4 degrees Celsius higher than its present value.

[4] See, for example, Kininmonth (2004), page 130.

[5] Around 4GtC of these emissions are taken up again by the land and oceans.

This "insurance policy" argument was also made by the Prime Minister on 18 July:

> "A prudent conservative knows we are but temporary stewards of the environment. The Burkean sentiment -- that society is a partnership between those who are living, those who are dead, and those who are yet to be born -- comes as second nature.
>
> In the face of risk, a prudent conservative takes insurance. We should, in the words of Rupert Murdoch, give the planet the benefit of the doubt given the potential dangers of climate change." [6]

With respect to emissions reductions by Australia, as a matter of science, economics and logic this "insurance policy" analogy is completely inappropriate and indeed grossly misleading. As far as Australia's $CO_2$ emissions reductions are concerned, the entire "risk management" argument simply cannot be sustained. Australia's $CO_2$ emissions comprise around 1.5 per cent of total global emissions from human activity.[7] This fact suggests that even if we assume that all of Australia's emissions currently remain in the atmosphere and add directly to the global stock of $CO_2$ each year, a policy of completely eliminating our $CO_2$ emissions would have a negligible effect on the total global atmospheric $CO_2$ stock. This is true no matter what actions are taken by other countries.

The marginal benefit of a policy action is the change in total economic benefit with respect to a change in that action, holding everything else constant. In many economic problems encountered by policymakers, the marginal benefit of an action is inherently uncertain or may depend on the actions taken by other economic actors. That is simply *not* the case here. The contention that the marginal benefits of a reduction in emissions by Australia are so small as to be negligible, irrespective of the actions taken by other countries, involves very little - if any - uncertainty.

Simply put, as far as the benefits of emissions reductions are concerned , there is no "risk" for Australia to "manage". A policy of emissions reductions is like taking out an "insurance policy" in which there is never any positive payoff. It is doubtful that Edmund Burke would have regarded such an action as particularly prudent.

Perhaps the best that we can hope for with respect to emissions reductions is an international "signaling" effect, whereby our emissions reductions generate goodwill and encourage major emitters to take action. But there is little evidence that this "signaling" effect in international affairs works, particularly when it comes to reducing $CO_2$ emissions. After all, Australia has thus far gone very close to meeting its Kyoto emissions targets, and yet this does not seem to have had any "signaling effect" on the rest of the world – particularly on European countries, many of which have consistently failed to meet their Kyoto targets, or on China, which is now the largest $CO_2$ emitter.

The Shergold Report's (rather meagre) discussion of the advantages of cap and trade systems over taxes, subsidies and other regulatory measures in situations of uncertainty [and the associated literature beginning with Weitzman (1974)] is therefore completely beside the point. If the total and marginal benefits of emissions reductions for Australia are trivially small in all possible states of the world, it does not matter how emissions reductions by Australia are ultimately brought about. All policies will be welfare destroying. There is no tax, subsidy or "cap" in existence which will equate

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[6] See Howard (2007).

[7] In 2005 Australia's total greenhouse emissions were 559 megatonnes in carbon dioxide equivalent terms (Shergold Report, page 28). 74.3 per cent of this is carbon dioxide (Shergold Report, p 30), giving total $CO_2$ emissions of 415 megatonnes. The ratio of the molecular mass of CO2 to that of carbon is 3.66419, so this equates to about 113 megatonnes of carbon, or 0.113 GtC. Dividing this by global anthropogenic carbon emissions of just over 7 GtC gives the 1.5 per cent figure.

the marginal benefits of emissions reductions with marginal costs of emissions reductions in any state of the world.

### 3. The Simple Economics of Cap and Trade Schemes

Page 44 of the Shergold Report, presents and discusses a simple example of how a "cap and trade" scheme works. The example is also particularly useful for illustrating some other properties of these schemes.

Two companies, A and B, each emit 100,000 tonnes of $CO_2$-equivalent per year. The government wants to reduce total emissions by 5 per cent (10,000 tonnes in total). To this end, each company is given a tradeable "allowance" to emit 95,000 tonnes (different initial allocations are possible). Thus, A and B can either each reduce emissions by 5,000 tonnes or "buy" up to 5,000 tonnes of allowances from elsewhere.

Suppose current market price for emissions permits is $10 per tonne, and that A can reduce its emissions for half this cost ($5/tonne). Suppose that for B, making reductions is more expensive, at $15 per tonne.

Let us assume that A cuts its emissions by 10,000 tonnes. This involves a cost to A of $50,000. But recall that under the cap and trade scheme, A has 95,000 permits and is only obligated to reduce emissions by 5,000 tonnes. This means that A would have 5,000 tonnes of "surplus" emissions permits. If A can sell these surplus permits at the current market price it would receive $50,000, thereby offsetting the cost of reducing its emissions. A would be no worse off as a result of this arrangement.

On the other hand, company B is assumed to be a relatively high cost emissions reducer, and would be better off purchasing permits from the market instead of reducing its emissions. In particular, B could continue to emit 100,000 tonnes by purchasing the 5,000 tonnes of surplus allowances on offer from company A, at a cost of $50,000. (The alternative action - company B reducing its emissions - would cost it $75,000). Note that permit trading involves a transfer of emissions reductions from high to low cost emissions reducers, and a transfer of wealth in the opposite direction. Table 1 below summarises the example.

**Table 1: A Simple Example of Emissions Permit Trading**

| Scheme | (i) Firm A | (ii) Firm B | (iii) Government Revenue | Total Cost [(i)+(ii) + (iii)] | Total Benefit |
|---|---|---|---|---|---|
| Cap and Trade | -$50,000 +$50,000=$0 | -$50,000 | $0 | -$50,000 | ??????? |

The Shergold Report concludes the example by arguing that "the end result is that both firms are better off by $25,000 compared to their costs without trading." This conclusion is true, but in terms of overall economic costs and benefits, it is misleading and incomplete. After all, B (and the entire economy) is worse off than it would have been in the absence of *any* emissions reductions!

What is missing in this simple example (and the rest of the report) is any serious attempt to assess whether the overall welfare reduction (B worse off by $50,000) is offset by any economic benefits. At the end of the day, the overall effect of the scheme has been for A to reduce its emissions by 10,000 tonnes and for B not to reduce its emissions at all, and become $50,000 worse off.

Suppose that the economic benefits of reducing emissions are $1 per tonne. Then the overall welfare effect of this scheme is to achieve benefits of $10,000 at a cost of $50,000, which is a net

economic loss of $40,000. In other words, it would be better if the scheme was not introduced at all for these two firms!

Indeed, in this simple scenario, the scheme is only worthwhile if the economic benefit of reducing emissions is at least $5 per tonne on average. If there are no such benefits, then the emissions trading scheme will in fact be welfare-destroying. The only saving grace is the fact that economic welfare is destroyed in a low-cost fashion - hardly a ringing endorsement!

This simple example illustrates some very important points. "Cap and trade" emissions trading schemes are no panacea. Their overall economic impact and desirability depends (among other things) on whether the level of the "cap" makes economic sense. Moreover, one of the arguments used to justify these schemes is that the government doesn't know firms' individual costs of reducing emissions. But if individual costs are unknown, aggregate costs of emissions reductions must be unknown as well. So how can we know for sure what the appropriate overall level of the cap is?

We do not have very good estimates of what the economic marginal effects of carbon dioxide emissions are – are they positive or negative? If the economic effects are positive, a cap makes no sense. According to the logic of the report, the appropriate option in this case would be to force firms to produce more emissions. In either case, as discussed in section 2, because Australia is such a small emitter, the marginal benefit to us of altering our emissions is very close to or equal to zero, while the costs are non-trivial. The Shergold report avoids these key issues.

The example also shows that the initial distribution of permits might matter. Suppose, for example, that B is allocated all 190,000 permits. Remember, the market price of permits is $10. If A wants to produce at all, he must now buy permits from B. But the example assumed A can reduce emissions at a cost of $5 per tonne -so why would A want to purchase emissions permits at $10 per tonne? Now, A's least worst option is to completely eliminate its emissions and shut down completely. On the other hand, B must either (i) offer permits at a lower price to A (ii) use the surplus permits itself, or (iii) try to sell them on the permit market to another firm whose cost of emissions reduction is at least $10. The point is that the final result may be very different, and the way in which permits are initially distributed matters.

Another hidden assumption is that cap and trade schemes only "work" if A can indeed freely reduce its emissions in a low cost fashion. Suppose, for example, that the cheapest way that A could reduce its emissions was by building a nuclear power plant. If political realities or the costs of complying with regulations make this impossible, then A cannot buy any permits and the whole rationale for the scheme fails.

Finally, why the obsession with tradable permits? In the above example, exactly the same outcome could be achieved with a tax. Suppose that the government announces that all emissions above 90,000 tonnes will be taxed at a rate of $10/tonne. Company A can reduce emissions for $5/tonne, and so can avoid the tax by doing so. A would then be worse off by $50,000. B would rather pay the tax than reduce emissions, and would pay tax of $100,000. B is worse off by $100,000 but the government collects this revenue and so B's cost is offset by a revenue gain. Exactly the same outcome in terms of overall and individual emissions and aggregate costs is achieved. The aggregate welfare effects are the same: the economy is worse off by $50,000. Note that there are many other tax schemes that achieve the same outcome. (eg a tax of $7, $8, ...)

The same outcome could also be achieved by the use of an emissions reduction subsidy - just pay firms $10/tonne to reduce all emissions above 90,000 tonnes. A would be willing to do this and would reduce emissions by 10,000 tonnes, gaining a net benefit of $50,000. B would not be willing to reduce emissions. Taxpayers would pay A $100,000, and the economy is again worse off by a total of $50,000. The equivalence of these schemes is summarised in Table 2 below. The only difference between them is the distributional consequences – but note that company B is always relatively worse off than company A.

**Table 2: The Equivalence of Permit Trading, Taxes and Subsidies**

| Scheme | (i) Firm A | (ii) Firm B | (iii) Government Revenue | Total Costs [(i)+(ii) + (iii)] |
|---|---|---|---|---|
| Cap and Trade (Permits Given Away, Distributed Equally) | $0 | -$50,000 | $0 | -$50,000 |
| Tax of $10 on each unit of emissions >90 ktonnes | -$50,000 | -$100,000 | +$100,000 | -$50,000 |
| Subsidy of $10 on each unit of emissions >90 ktonnes eliminated | +$50,000 | $0 | -$100,000 | -$50,000 |

There are good reasons (relating to uncertainty) why a permit trading schemes might be preferred to a tax or subsidy (or vice versa). But the report does not discuss these reasons in any great detail. In any case, all schemes depend on there being positive marginal benefits from reducing emissions. If these don't exist, then there is no case for any of these schemes. The key point is that no matter what Australia does, the effect on global emissions will be negligible. For Australia, a cap and trade scheme s a solution in search of a problem.

## 4. Towards an Optimal Policy for a Small Open Economy

Does it automatically follow that nothing should be done about the possible undesirable effects of global warming? Absolutely not! The Shergold Report and the entire current debate offers us a false choice between reducing $CO_2$ emissions on the one hand, and doing nothing on the other. But these are not the only two choices available to us. Different kinds of "insurance policies" - policies which at least offer the *possibility* of a positive payoff - exist.

Parish (1972), following arguments similar to those made by Coase (1960), points out that welfare improvements can be made by either reducing pollution or mitigating its possible undesirable effects.[8] Recall that the marginal benefit of an action is defined as the change in total benefits *with respect to a change in that action*. The point here is that there are other actions available which could be taken by Australia to reduce the possible undesirable *effects* of higher average surface temperatures in Australia and climate change more generally, even if we may not able to do anything about the alleged *causes* of those effects.[9] The marginal benefits to Australia of such appropriately chosen *damage prevention measures* will likely be positive, at least in some states of the world.

For example, suppose that one of the anticipated adverse effects of higher average global surface temperatures on Australia is a reduction in existing sources of potable water in a major population centre. In this scenario the benefit of any action can be easily measured as the consumption benefits

[8] Parish (1972) p 36. As discussed earlier, $CO_2$ is vital for the flourishing of life on earth and is not a "pollutant" in the commonly accepted meaning of that term. Nevertheless, we will use the term for convenience.

[9] The idea that one particular economic activity can "cause" social costs was completely demolished by Coase (1960). Those individuals whose wellbeing is reduced by pollution could just as easily be said to "cause" social costs. Indeed, to the extent that polluting activity is also associated with economic benefits, the *absence* of pollution also "causes" social costs or an absence of benefits. Social costs are exactly that – social. They are not "caused" by any single party or activity.

of fresh water. Reducing Australia's $CO_2$ emissions will have absolutely no effect on these possible benefits – marginal benefits of emissions reductions are always and everywhere zero in this scenario, for reasons discussed earlier. On the other hand, building new dams, desalination plants, and so on may have positive benefits (depending on the state of the world that actually eventuates). These (appropriately discounted) expected benefits could then be weighed against expected costs in the usual way.

In the global warming debate these actions often come under the general heading of *adaptation*, but this terminology does not quite encompass the above scenario or what Parish was actually referring to. Adaptation implies that one waits passively until an adverse consequence is observed before acting. But, as the above scenario indicates, damage prevention measures can take place in anticipation of possible adverse climatic conditions, well before those events actually occur. This is real "risk management" in action. In contrast to the policy of reducing emissions, these measures may constitute an "insurance policy" that actually offers the prospect of a positive payout if adverse circumstances occur.

**5. Conclusion**

The choice between active damage prevention, passive adaptation and emissions reduction (or possibly a combination of all three) should be governed by an assessment of the relative costs and benefits of each particular policy proposal. In all likelihood the benefits of investment in damage prevention are likely to be much greater than emissions reduction, because Australia is such a small contributor to the global stock of greenhouse gases. Because any adverse economic effects of higher average global surface temperatures on Australia are likely to be localised and seasonal, investment in damage prevention measures offers a more sensible approach and a more appropriate use of valuable resources than emissions reductions.

To date there seems to be have been very little formal empirical work conducted on the relative costs and benefits of emissions reductions versus damage prevention measures for Australia, and there has been very little - if any - serious discussion of these issues among economists or policy makers. All attention has been focused on the false dichotomous choice between drastic emissions reductions on the one hand, and doing nothing on the other.

Damage prevention measures are a more flexible option that can be implemented in a more decentralised fashion, by individuals (via insurance markets and by individuals taking advantage of their knowledge of local conditions and self-insuring) and by State and Local governments. In contrast, the policy proposals contained in the Shergold Report (and the recent announcement made by the Prime Minister) envisage the establishment of at least one new Federal bureaucracy to monitor individual and aggregate $CO_2$ emissions and enforce the obligations embodied in each individual emissions permit. Despite all the politically-charged fanfare, the policies examined in the report will do absolutely nothing to reduce any future adverse effects of higher average global surface temperatures on Australia.

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