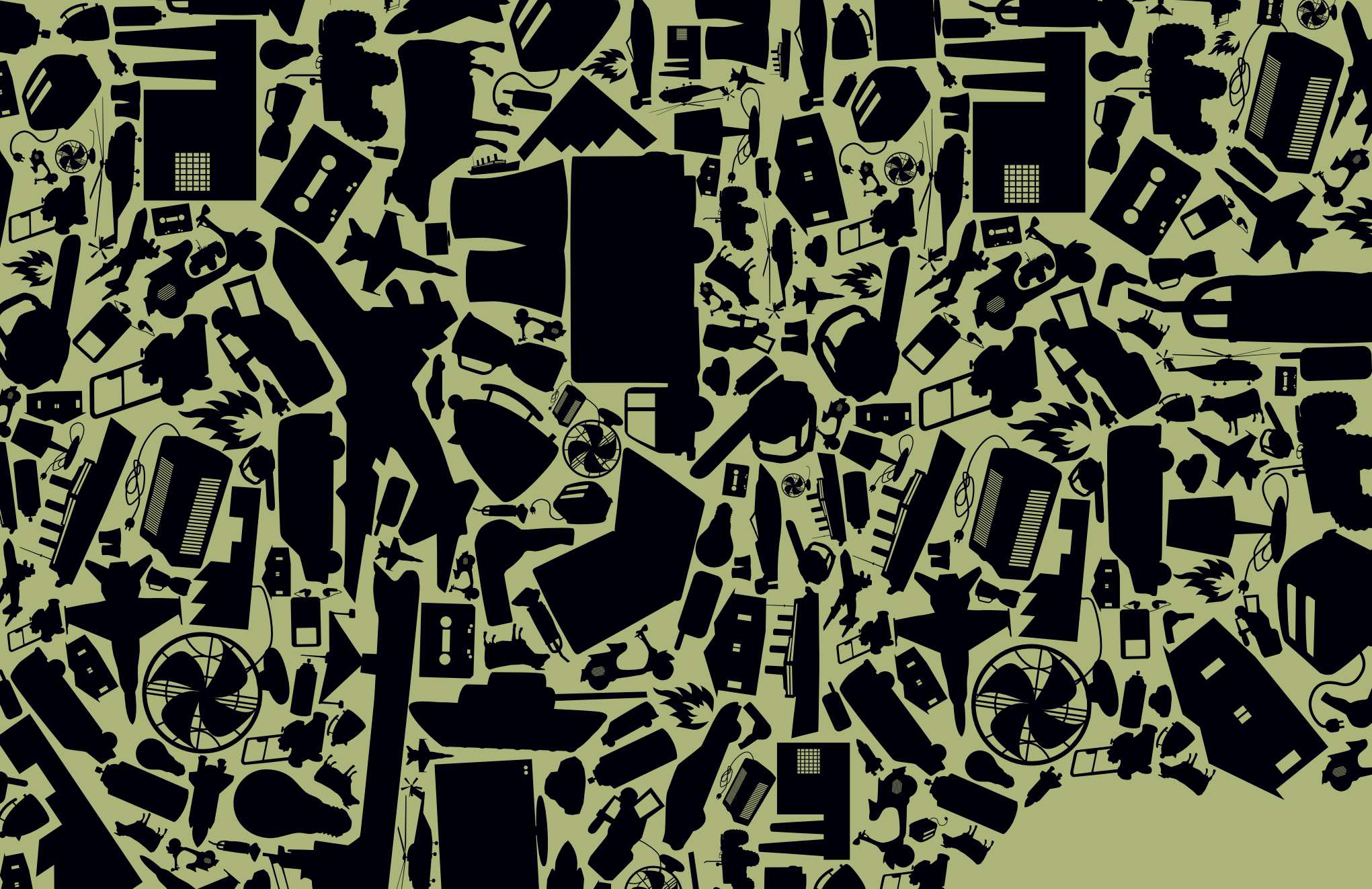
A lot of hot air?

Les Coleman compares a carbon tax and tradable emission permits as controls on greenhouse gases and concludes in favour of a carbon tax.



During the 1980s scientific consensus emerged that concentrations of greenhouse gases such as carbon dioxide, methane and water vapour in the earth's atmosphere were rising. Carbon dioxide (CO_2) gained the most attention because it was assumed to arise from burning fossil fuels and was the most significant man-made greenhouse gas. Because increased greenhouse gases are expected to warm the Earth's atmosphere, an international political consensus emerged that it was desirable to control emissions, through either a carbon tax or tradable carbon emission permits.

EVALUATING TAXES AND TRADABLE PERMITS

It is generally accepted that a tax and a trading scheme would have similar costs, and each would be more economically efficient than regulation. The principal difference between the two lies in adjustments they force on the carbon-based energy supply chain: under a tax the price of emissions adjusts, whereas emission volumes adjust under trading. Carbon burners seeking to avoid the tax or permit cost must reduce consumption or switch to less carbon-intensive energy sources (for example, coal to natural gas, gas to nuclear). The major impact would be on coal consumption as it contains almost twice the amount of carbon per unit of energy as natural gas.

A vexing equity issue with permits and taxes is how to deal with existing carbon-intensive energy producers. As power stations are long-lived and purpose-built for specific fuels, it can be prohibitively expensive to convert a coal-fired power station to natural gas, but the emission charges may make the plant uneconomic.

Another important issue relates to 'carbon accounting', which measures the amount of CO_2 emitted. At this stage there are no easily deployed sensors that can cheaply and effectively measure CO_2 emissions, and they are calculated simply by multiplying the amount of fuel used by its carbon content. Thus neither taxes nor permits can police emissions that don't involve burning, such as land clearing, leaks from storage sites, or venting of inert CO_2 that is removed from natural gas at the well-head.

TAX ON CARBON BURNING

Imposing a tax on CO_2 emissions would be relatively simple as it does not require additional infrastructure beyond the current excise system. The first step is to fix the rate of tax, which modelling typically indicates should be around $80–100 per tonne of CO_2 to limit emissions in 2050 to 1990 levels, but could be as low as $40 per tonne or in excess of $500 per tonne. At $100 per tonne (and 3.7 tonnes of CO_2 from burning one tonne of carbon), this involves a tax of around $35 per tonne of coal, 2 to 3 cents per litre of petrol or diesel, and so on.

A second step is to remove distortions to existing energy consumption, such as indirect subsidies that advantage one fuel or region over another. Australia currently has a complex system of state-based royalties and taxes for onshore production of coal, oil and natural gas, and a Commonwealth profit-based tax system for offshore production. These need to be harmonised.

The emission tax then needs to be collected through the Tax Office, which should be a simple and efficient process providing consumption details can be collected. The existing excise system will be modified to collect an emissions tax from carbon burners, and payments checked by the Tax Office through income tax returns. Unless carbon burners illegally evade tax, this will cover all CO_2 emissions from vehicles to power plants.

Once the tax regime is established, the government would need to monitor emission reductions against targets and adjust the tax accordingly. Any change needs to be considered carefully, however, because a major advantage of a carbon tax is the relative certainty of its impact.

There are two potential shortcomings to an emission tax. The first is establishing the appropriate tax level in the absence of a market for emission permits.

The tax rate needs to be determined using economic modelling or experience from another jurisdiction or tax type. However, demand elasticities vary between economies and over time, so maintaining the right tax level is challenging.

The second shortcoming is the natural reluctance of taxpayers to pay more taxes. This could be mitigated by using the carbon tax revenues to offset less efficient taxes like payroll or land taxes. Moreover, the tax is a direct impost on environmentally damaging activities and should be welcomed, much as are taxes on other private goods with damaging externalities such as tobacco.

TRADABLE EMISSION PERMITS

In marked contrast to the simplicity of introducing a carbon tax, trading requires a new infrastructure that will enable emission securities to be transferred and a mechanism to identify and penalise breaches of emission caps. A number of steps are required to achieve this. The first step is to design the security. This will include the definition of 'emission', recognising that a narrow definition (for example, from power stations) does not include all emitters and so may be less efficient and equitable. By contrast, a broad definition would require the purchase of permits by non-stationary carbon burners (particularly drivers) and stationary non-burning emitters (such as carbon storage facilities).

The number of emission permits must be determined, which seems simple: decide target emission volumes for a range of dates, then issue permits with a total face value equal to the volume of current emissions, with expiry dates that reduce emissions to meet future targets. For example, if the objective in 2007 is to reduce emissions to 20 per cent below current levels by 2020, then issue permits equal to 2007 emissions, with two per cent expiring each year between 2011 and 2020.

The theoretical benefit of permits is that they can be traded so that emissions are reduced by parties that can do so most efficiently. This requires a secondary market which can manage the peculiarities of emission securities, plus weaknesses that have historically crippled regulated markets. In relation to the latter, it is important to note that artificially structured markets have lost billions of dollars for regulators and investors. The most extreme examples have been foreign exchange markets with fixed exchange rates that precipitated countless runs on currencies. But partially regulated markets are also open to manipulation: for instance, California's electricity house of cards lost US$30 billion between 1999 and 2001. The risk of a poorly designed emission trading market is that it transfers billions of dollars to canny speculators without any environmental benefit.

There are two practicable structures for an emission trading market. The first is private, such as the annual permit auctions run since 1994 by the US Environmental Protection Agency (EPA) for sulphur dioxide emissions from power plants.

Alternatively a conventional market structure can be set up like the one in the European Climate Exchange (ECX). The market trades EU allowances (EUAs) which give the right to emit one tonne of CO_2. As shown in Figure 1, contracts for settlement in December 2008 are currently trading at around €13 but have traded above €30. While the market is new and only limited in operation, it illustrates an important weakness in carbon trading which is its uncertainty.

Any trading framework needs to recognise that emission securities have several unique features. Unlike most market-based securities – such as shares, gold futures or electricity contracts – emission securities do not relate to a physical or underlying product. Second the supply of emission securities is under government control and not limited by nature (as with gold) or economically-justified investments (as with electricity generating capacity). The security does not provide an income stream (either as dividends or a physical asset for sale or use) but represents an authority to carry out an otherwise illegal act. Thus normal valuation methodologies, like pricing a security at the present value of the future income stream discounted at a risk adjusted opportunity cost of capital, cannot apply.

An essential success factor for any market-based system is confidence in its integrity. Thus emission securities and markets need to be properly constituted and supervised to avoid evasion or manipulation. This raises concerns over the global emissions trading scheme envisaged under the Kyoto Protocol which will be run by United Nations Supervisory

Committees with sweeping powers. Considerable effort will be required to reassure investors given the UN's history of administrative lapses, and chronic distortions in other global markets under political influence such as agriculture.

Because of the unique features of emission permits, a particularly difficult decision is the mechanism to allocate them. The two most commonly suggested methods are by auction, and allocation to existing emitters. A public auction mimics the process used to allocate many other public goods ranging from oil exploration licences to shares in government companies. The auction price would be the average cost of emission reductions and should equal the present value of the tax that would be required to meet the emissions cap. The secondary market price would represent the marginal cost of emission reductions.

Other decisions involve parties that would be permitted to bid for permits; and what (if any) floor price should apply. Bidders may be limited to investors with a direct interest such as existing major fossil fuel burners; or they may include any qualified party which would introduce speculators. As limiting bidders reduces liquidity and may facilitate collusion, a floor price should be imposed and all qualified parties permitted to bid.

An alternative is allocation of permits to existing emitters in proportion to their recent emissions, which is a process termed 'grandfathering'. This has two shortcomings. First, it does not impose a direct penalty on CO_2 emissions, although they have an opportunity cost equal to the market price of the permit. Second, there is a windfall transfer of funds to existing emitters which receive a potentially valuable emission permit for free.

In terms of monitoring the permit process, the Tax Office (or perhaps an environment department) will annually determine emissions from each CO_2 source and check them against permits. However, unless prohibitive transaction costs are introduced, emission trading will be limited to large stationary emitters like power stations and cement plants; thus small, mobile emitters such as cars will not be regulated, even though they make a significant contribution to emissions.

In summary, a system of tradable emission permits requires establishing a new infrastructure that can issue emission securities, monitor and penalise unauthorised emissions, and trade the securities. Not only will this infrastructure be expensive to establish, it can have only limited coverage. Although a permit system offers the theoretical benefit of using the market mechanism to reduce emissions, this seems small in light of the costs and inefficiencies it will impose.

Figure 1: IPE carbon emissions future price
Source: Bloomberg

Table 1: Comparing carbon tax and tradable emission permit regimes

CRITERION
Simplicity of implementation
Precision of emissions reductions
Certainty of future costs of emissions reduction
Coverage of CO_2 emissions
Risk of market abuse
Geographical applicability
Equitable treatment of existing emitters

SPECIAL CASE? EXISTING EMITTERS

As noted earlier, a challenging policy issue is how to deal with CO_2 emitters who have made long-life investments in the absence of a tax or permits, but have not yet achieved a reasonable return. Equity points to some compensation, particularly for firms producing or burning coal. There are two practical solutions: recycle part of the taxes or permit costs; or delay imposition of the tax or emission cap until a return has been achieved which might be (say) 20 years after the average date of commissioning of the plant that was in use when the impost was announced.

Compensation would be through an annuity that offsets loss of profit, but is kept separate in the emitter's accounts so that it can be returned to investors or used to build lower emission replacement plant. As the payment preserves the firm's current wealth, it does not disadvantage historical investment decisions. At the same time it highlights the cost of carbon emissions and so provides an incentive to reduce emissions.

Consider a $35 per tonne tax on coal that cuts consumption by a third. Coal producers or coal-fired power stations would receive a payment equal to fixed costs and profits of up to $35 per tonne for each tonne of coal below the pre-impost level. Producers whose average profit and fixed overheads are less than the tax will cease production immediately. Other producers will pass on part of the tax and suffer a demand drop so that the decline in their marginal profit and overhead equals the tax. Thus firms can choose to burn coal and pay the tax or reduce consumption; in each case they receive profit foregone. All CO_2 emitters will have an incentive to reduce emissions and compensation will be no more than a third of the tax revenue.

What happens when permits are auctioned? Emitters whose average profit and fixed overhead are less than the cost of the permits will not bid and so cease production. Other emitters would buy tradable permits which cost less than their marginal profit and overhead, and will pass on this cost until demand drops and the decline in marginal profit and overhead equals the permit cost.

Because this compensation mechanism is complex and subject to considerable uncertainty, it leads to the second solution which involves 'grandfathering' where existing emitters continue as usual until their return has been achieved. Either imposition of the tax is delayed or cost-free permits are issued. While this appears administratively simple, weaknesses are that it delays cost pressures to reduce CO_2 emissions, and sets up a cost imbalance between existing

TAX REGIME	TRADING REGIME	PREFERRED REGIME
Easy, through extension of existing excise tax arrangements	Complex, requires new institutions and technologies to facilitate and monitor compliance	Tax
Moderate, subject to accurately establishing tax rate	High, but exposed to potential market abuses and limits to coverage	Trading
High, subject to accurately establishing tax rate	Moderate, as subject to market forces	Tax
Comprehensive including mobile sources and non-carbon burners	Limited to large burners of carbon fuels	Tax
Low, as abuse involves excise tax evasion	High, as emission volumes cannot be policed; and potential abuse of emission permits	Tax
Global, with national variations in tax rate	Global, subject to controls on market abuse	NA
Simple, if tax delayed; otherwise more complex, involving annual compensation payments	Simple, if free permits granted; otherwise more complex, involving annual compensation payments	NA

Given the absence of doubt that a carbon tax would limit greenhouse gas emissions and crippling weaknesses in a system involving tradable emission permits, it is surprising that the latter seems the preferred solution both here and overseas.

and new producers that would distort energy investment decisions. Moreover, if tradable permits are provided at no cost, the emitter receives both adequate return on investment *and* valuable emission permits. Thus if permits are issued to existing emitters, they should be *non-tradable*, in limited volumes and with a lifetime that provides a return on investment after which emitters surrender the permits.

WHICH IS THE BEST SOLUTION?

Environmental problems are longstanding but have been hugely reduced since the first Earth Day in 1970. Policy makers now have extensive experience and it has consistently been shown that the most effective policies are controls and taxes. Consider the car, which is perhaps the most environmentally and socially damaging technology of all time. Its externalities have been slashed using controls (everything from mandated emission reductions to compulsory seat belts) and taxes (such as fuel excise and speed cameras). The same is true for smokestack emissions, oil spills, pollution and a dozen other environmental problems.

It is simple to see how a tax would control greenhouse gases. Impose a penalty of about $100 per tonne of carbon dioxide emissions, which could be phased in and incorporate recycling of the taxes to subsidise restructure of the energy industry. It would shrivel carbon emissions, just as small cars blossomed in the shadow of Europe's high fuel taxes.

Given the absence of doubt that a carbon tax would limit greenhouse gas emissions and crippling weaknesses in a system involving tradable emission permits, it is surprising that the latter appears to be the preferred solution at the international level and in Australia, with its strongest advocates found among diplomats and financial market operators.

For diplomats, emissions trading is a logical development from the international consensus that has emerged over climate change and is consistent with past interventions to rectify transnational problems. Financial market operators, too, have developed expertise in mechanisms to trade unconventional products (including sulphur dioxide emissions at the Chicago Climate Exchange) and see carbon trading as a logical extension of their existing business.

Neither diplomats nor market operators, though, have as much at stake from weaknesses in emission trading as do investors and emitters. Thus it is useful to compare the advantages and disadvantages of the alternative regimes. Table 1 extends the discussion above to evaluate tax and trading systems against a variety of criteria, particularly simplicity, certainty, transparency and efficiency. The conclusion is quite clear: taxes are more efficient than a permit system on all but the single criterion of precision in emissions reduction.

In conclusion, the most efficient policy to reduce global CO_2 emissions would be to set target emission limits for each country and extend existing excise tax systems to impose a tax on carbon consumption that modelling indicates would achieve the emissions target. The complexities inherent in an international emissions trading scheme, the costs of implementing a completely new infrastructure and significant potential weaknesses in emission markets make it obvious that a simple tax would be far more efficient than a permit system. Any advocates of emission trading need to much better justify their proposal.

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