
Tax and Climate Change

The main reason for the recent reawakening of interest in the economics of environmental taxation has been concern about climate change. Man-made emissions of carbon dioxide and other greenhouse gases have harmful environmental spillovers. The analysis in the previous chapter suggests policymakers should aim to achieve a consistent price for carbon (equal to the cost to society of emitting a little more of it) through a tax or a system of traded permits.

In fact, things are much more complex than that. This chapter begins by setting out briefly the most important facets of climate change which should drive policy choices. We go on to consider the role of pricing, the choice between taxes and tradable permits, and how the price should be set. The role of other instruments is then briefly considered and a way forward for policy in the UK is suggested.

11.1. CLIMATE CHANGE—THE ISSUES

This is no place to go into the science or indeed all the economics of climate change in any detail.¹ However, it is important to understand the nature of the challenge that requires policy action.

¹ An overview of the science is provided by the report of the Committee on Climate Change (2008) and by the Intergovernmental Panel on Climate Change (2007). An exposition of the economics can be found in the Stern Review (Stern, 2006).

First, climate change is distinguished from other environmental issues by the potential scale of the problem and the current degree of uncertainty about the process. There is broad scientific consensus that climate change is occurring as a result of the accumulation of carbon dioxide (CO₂) and other greenhouse gases (GHGs) in the atmosphere. What is uncertain is the effect that this accumulation will have on global temperatures, the level at which the accumulation will stabilize if no corrective action is taken, and the economic and social damage that will result. The choice of appropriate policy has to be framed in the context of this uncertainty.

The quantity of GHGs in the atmosphere is generally measured in terms of parts per million (ppm) of carbon dioxide equivalent (CO₂e).² Since the mid 19th century, atmospheric concentrations have grown from 285ppm to about 430ppm CO₂e. Over the past decade, concentrations have been growing at about 2.5ppm a year. Without action, economic growth (particularly in developing countries) is forecast to increase this rate to 3–4ppm a year over the first half of this century. This would take atmospheric concentrations to 580–630ppm by mid century and 800–900ppm by the end of the century.³ Table 11.1 provides estimates of the probability of global temperature increases at different concentration levels of CO₂e.⁴

Second, this is a global issue in two senses. Climate change would affect the whole world, though some parts would suffer more than others—notably the poorer countries of Africa and the developing countries of Asia. The problem is also global in the sense that it is the total worldwide emission of GHGs that matters, not where they are emitted.

No single country (other than perhaps the US and China) can make a significant impact on this global problem just by cutting its own emissions.

² Other GHGs have different effects on global warming by comparison with CO₂. For example, one molecule of methane has an effect on global warming (over a 100-year horizon) 25 times that of one molecule of CO₂, while nitrous oxide has an effect 298 times that of CO₂ and the rarer HFCs, PFCs, and SF₆ have effects many thousands of times as great (Intergovernmental Panel on Climate Change, 2007, table 2.14). Total concentrations of all these GHGs are generally shown as CO₂ equivalents.

³ These figures are taken from Stern (2009, 25–6).

⁴ These estimates change as the science advances. The recent past has seen an increase in the estimated probability of higher temperature rises.

Table 11.1. Probabilities (%) of exceeding temperature increases, relative to 1850, at various stabilization levels of CO₂e

Stabilization level (ppm CO ₂ e)	Temperature increase					
	2°C	3°C	4°C	5°C	6°C	7°C
450	78	18	3	1	0	0
500	96	44	11	3	1	0
550	99	69	24	7	2	1
650	100	94	58	24	9	4
750	100	99	82	47	22	9

Source: Stern, 2009, 26.

Certainly, the UK, responsible for about 2% of global emissions, cannot.⁵ So a global solution is required. The construction of such a solution is well beyond the scope of this book. We focus on the appropriate domestic UK response and the role of tax and pricing within that. The international context is relevant, though, when assessing the relative merits of taxes and trading.

Third, to return to one of the distinctions mentioned in the previous chapter, the problem of greenhouse gases is a *stock* problem rather than a *flow* problem. Most GHGs, in particular CO₂, remain in the atmosphere for a long time. And the scientific evidence shows that it is the quantity in the atmosphere that matters for the impact—rather than, for example, the amount that is emitted in any one year. This, in addition to the timescales and uncertainty involved, makes selecting an appropriate price for emissions particularly tricky.

One final issue that needs to be borne in mind is that there are two different ways to think about a country's emissions. One is to consider only emissions that occur domestically—resulting from coal burnt or petrol consumed in the UK, for example. The other is to consider the embedded carbon content of what is consumed in the UK—i.e. to take account of, say, coal burnt in the manufacture of goods produced in China but consumed in the UK. Nearly all policy debate is framed in the former way and UK targets

⁵ Source: US Energy Information Administration, <http://tonto.eia.doe.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=90&pid=44&aid=8>.

refer to emissions that actually occur in the UK. But ideally we might want to focus on the latter.⁶ Reducing emissions in the UK by shifting high-carbon manufacturing abroad does not address the global problem.

This is not an issue we focus on here. The complex web of global trade agreements makes imposing additional taxes on imports with high levels of 'embedded carbon' formidably difficult. This difficulty is greatly enhanced by the huge complexity in measuring the embedded carbon. There are great advantages, in this situation, in imposing taxes 'upstream', i.e. using an origin system to tax emissions at the point at which they are produced. This points again to the need for global agreements to make that happen.

11.2. PRICING MECHANISMS

The central policy challenge in controlling the accumulation of GHGs is to impose a consistent price on emissions. This should result in efficient decisions over how, when, and where emissions reductions take place, removing the need for politicians to make decisions about where cuts should occur.

In an ideal world of full information and perfectly competitive markets, that would be all that was required. But in the real world, other policies will also be needed. But the more we deviate from the price mechanism, the greater the danger of high policy costs, pork-barrel politics, and inefficient distributions of reductions in emissions. As Helm (2008, 233) has argued, 'Economic efficiency and political expediency are likely to conflict in climate-change policy ... the case for market-based instruments is especially great'.

11.2.1. Taxes or 'Cap-and-Trade'

As we have seen, pricing can occur through either tax or cap-and-trade mechanisms. In an international context, two practical considerations favour

⁶ This is a version of the 'origin' versus 'destination' debate that we also discuss in relation to VAT and corporate taxation.

trading. The first is that it already exists. The Kyoto Protocol is, in effect, an attempt to apply emissions trading between sovereign states, while the EU's Emissions Trading Scheme (EU ETS) has created a well-established and active carbon trading market within Europe. The second reason to favour trading is that applying taxes on any kind of international, let alone global, basis is not likely to be popular with sovereign states.

Trading mechanisms can also create substantial flows of private money around the globe, which may be desirable if we see value in helping poorer countries to reduce emissions. Under current arrangements, a scheme under the Kyoto Protocol called the Clean Development Mechanism (CDM) allows rich countries effectively to pay for emissions reductions in poorer countries through, for example, the use of cleaner technology in power generation and to set those reductions against their own targets.⁷

In addition, our previous analysis of the different properties of tax versus cap-and-trade systems also points to preferring a cap-and-trade-type solution at a global level because the consequences of emitting 'too much' could be exceptionally serious. That said, experience of the EU ETS would also suggest that there might be a case for a price floor in the system, perhaps provided through the tax system. A hybrid between price- and quantity-based mechanisms may have attractions both theoretically and in practice.

Finally, credible global caps on emissions may be necessary to overcome one of the particular problems created by the fact that emissions result from the burning of exhaustible resources—oil and coal. An expectation of rising taxes clearly increases the incentive to extract and sell fossil fuels now rather than wait for a time at which taxes may be high enough to significantly reduce the pre-tax price that can be achieved by producers.

The global nature of the climate change problem, then, probably pushes us towards international cap-and-trade systems as the main way to achieve a sensible carbon price. But there may well be a case for a hybrid system with some price underpin. And in the end, the relative roles of tax and trading are likely to be determined on a pragmatic basis. Taxes may be easier to implement in particular circumstances, countries, or regions. The main point is that pricing carbon is vital.

⁷ The current CDM is most imperfect and has, with some justification, been subject to criticism. It is not our purpose here to review that, simply to state that some form of effective mechanism is important.

11.2.2. The UK Context

Policy in the UK has a long way to go to achieve a consistent price for carbon. Indeed, the range of policies and emissions sources is so complex that it is hard to say what the effective carbon prices are. To start with, consider where emissions in the UK are physically created (for example, at a power station) and the purpose for which they were created (for example, for domestic or business use). Table 11.2 shows figures for emissions in 2006 broken down in both ways. Since 1990, on the source measure, emissions from energy supply, business, and agriculture have been falling fairly rapidly as a result of changing fuel mix in energy supply and changing mix of businesses and agricultural practices. Emissions from transport and domestic heating have risen.

But emissions from these different sectors are priced very differently. Those from electricity supply are priced through the EU ETS. Those created by business directly may be: caught by the ETS if large enough; priced at a low level through the climate change levy (CCL); covered by Climate Change Agreements (see later); or entirely unpriced. Electricity used by business may be priced through both the ETS and the CCL. Businesses and public sector organizations that are large energy users, but not large enough to be covered by the CCL, are covered by a trading scheme known as the Carbon

Table 11.2. Greenhouse gas emissions by source and by end user, 2006

Source	Emissions (MtCO ₂ e)	End user	Emissions (MtCO ₂ e)
Power stations	185	Business	211
Transport	153	Transport	158
Industry	122	Residential	156
Residential	85	Agriculture	52
Agriculture	45	Public	22
Services	28	Waste management	22
Waste management	22	Industrial process	18
Refineries	16	Exports	16
Land use change	-2	Land use change	-2

Note: MtCO₂e = million tonnes of carbon dioxide equivalent.

Source: Committee on Climate Change, 2008, xxiii.

Reduction Commitment (CRC). Their electricity use will be priced through both the EU ETS and the CRC. Emissions from agriculture—mostly non-CO₂ gases, particularly methane and nitrous oxide—are not subject to any pricing at present.

Emissions from road transport are priced at a very high level through excise duties on fuel, though to what extent these duties are intended to reflect GHG emissions, as opposed to their impact on congestion spillovers, local air quality, and accidents, is unclear (we come to this in the next chapter). Air transport is about to be brought into the ETS and is also subject to a separate air passenger duty. Emissions from electricity consumed by households are priced through the ETS, whilst those from gas used principally in domestic heating are not priced at all. In effect, emissions from domestic gas and electricity use are subsidized because VAT is not charged at a full rate.

Other policies affect electricity prices too. The Renewables Obligation requires electricity suppliers to source a certain proportion of their electricity from renewable generation. This is more expensive than conventional generation. In 2009, the then government estimated, on central assumptions, that its total Renewable Energy Strategy would increase domestic electricity bills by 15% and domestic gas bills by 23% by 2020.⁸

One way of quantifying differences in implicit taxes is illustrated in Table 11.3. This shows, for 2009–10, how the implicit tax per tonne of CO₂ varies not only between gas, electricity, and transport fuel, but also between electricity from different sources and between business and domestic users. VAT is not included in these calculations—either as an additional tax or, because it is charged at a reduced rate, as a subsidy.

The first column in the table is an estimate of CO₂ emissions per kilowatt-hour (kWh) of energy produced.⁹ For gas and electricity, the second column is an estimate of the impact of the Renewables Obligation (RO) on electricity prices per kWh.¹⁰ The third column is simply the 2009–10 rate of the climate

⁸ Department of Energy and Climate Change, 2009a.

⁹ Source: Annex A of *Digest of United Kingdom Energy Statistics, 2010*.

¹⁰ The buyout price in 2009–10 was £37.19 per megawatt-hour (MWh), the obligation was for 9.7% of electricity to be from renewables, and all suppliers purchased buyouts. So the effective ‘tax’ on the marginal MWh is 9.7% of £37.19 per MWh, which is 0.36p per kWh.

change levy. For the EU ETS, we take the government's central estimate¹¹ of £22 per tonne of CO₂ to estimate the cost of the ETS per kWh of electricity.¹²

Table 11.3. Implicit carbon taxes, 2009–10^a

Fuel type	CO ₂ emissions: g/kWh	RO: p/kWh	CCL: p/kWh	ETS: p/kWh	Implicit tax: p/kWh	Implicit tax: £/tonne CO ₂
Electricity (business)						
Coal	910	0.36	0.47	2.00	2.83	31.13
Gas	393	0.36	0.47	0.86	1.70	43.14
Nuclear	0	0.36	0.47	0.00	0.83	∞
Renewables	0	0.00	0.00	0.00	0.00	–
Gas (for heating, business)	184	0.00	0.16	0.00	0.16	8.91
Electricity (domestic)						
Coal	910	0.36	0.00	2.00	2.36	25.96
Gas	393	0.36	0.00	0.86	1.22	31.18
Nuclear	0	0.36	0.00	0.00	0.36	∞
Renewables	0	0.00	0.00	0.00	0.00	–
Gas (for heating, domestic)	184	0.00	0.00	0.00	0.00	0.00
Transport fuel	CO ₂ emissions: g/kWh	CO ₂ emissions: g/litre	Fuel duty: p/litre	RTFO: p/litre	Implicit tax: £/tonne CO ₂	
Petrol	240	2,303	56.19	0.54	246.33	
Diesel	250	2,639	56.19	0.54	214.96	
Aviation gasoline	238	2,226	34.57	0.00	155.30	
Aviation turbine fuel	245	2,528	0.00	0.00	0.00	

^a The table should be interpreted with care. Electricity consumers, for example, do not buy their power from a particular power station that generates electricity using a single fuel, but rather from a supplier that has a particular mix of fuels. In terms of electricity, the interpretation of the table should be: 'In a world where all electricity were produced from the same fuel source (coal, gas, nuclear, etc.), what impact would various policies have on the price and what implicit carbon tax does this give for that source given the CO₂ emissions it generates?'

Source: Johnson, Leicester, and Levell, 2010.

¹¹ See Department of Energy and Climate Change (2009b).

¹² e.g. coal-fired power generates 910g CO₂/kWh. This is 0.00091 tonnes of CO₂, which, at a price of £22 per tonne, would cost 2.00p/kWh.

The motor fuel taxes are simply duty rates applying at the end of fiscal year 2009–10 plus a small addition for the Renewable Transport Fuels Obligation (RTFO), a scheme similar to the RO in electricity supply which requires fuel suppliers to include a proportion of biofuel (3.6% in 2009–10) in their fuel.¹³

The results are rather telling, with very big differences in implicit carbon tax by source. Gas directly used by domestic consumers attracts no carbon tax, while electricity used by business and produced from gas attracts a tax of £43 per tonne of CO₂. Electricity from different sources differs in implicit tax because of the way in which neither the RO nor the CCL distinguishes between different fossil fuels but the ETS does.

While it is difficult to put the implicit subsidy from the reduced VAT rate in the same format, one way of looking at its relative importance is to observe that the electricity bill for a consumer with average consumption was £461 in 2009.¹⁴ The cost with a full rate of VAT would have been £515.88. The difference, £54.88, is an estimate of the subsidy households receive from the reduced VAT. Ofgem estimates that the cost of the RO and ETS for the same consumer would have been £36.¹⁵ So the VAT subsidy is bigger than the total implicit carbon tax. This is for electricity consumption—there is no implicit carbon tax on gas for the VAT subsidy to outweigh.

Finally, note that the very large numbers calculated for petrol and diesel should be taken with a little pinch of salt since the main externality associated with driving is actually the congestion caused, and hence a large part of this tax should be seen as a tax on congestion rather than on carbon.

In sum, policy towards the pricing of greenhouse gas emissions remains highly inconsistent, creates different prices for different sources of emissions, and even effectively subsidizes some. There is scope for considerable improvement. We now discuss some of the main pricing instruments in turn.

¹³ The figure in the table is based on this 3.6% obligation and a buyout price of 15p a litre. In fact, no buyouts were purchased in 2008–09 and only two in 2009–10, so this represents an upper-bound estimate.

¹⁴ Department of Energy and Climate Change, 2010.

¹⁵ Ofgem, 2009.

The EU Emissions Trading Scheme

The EU ETS covers about half of total emissions in the UK and three-quarters of industrial emissions—largely those from electricity generators and other energy-intensive firms. Figure 11.1 illustrates.

The scheme was established in 2005, with a first phase covering the period 2005–07, a second phase from 2008 to 2012, and a planned third phase to cover 2013–20. The price of the tradable emission allowances (EU allowances or EUAs) fell to zero in 2007 as it became clear that permitted emissions exceeded annual emissions. Some tightening in the second phase needs to be followed by still tighter caps in the third if significant cuts in emissions are to be achieved.

Because it puts a cap on emissions across the EU (other than through the ability to purchase project credits, which allow reductions to be bought from other countries), the ETS limits the value of other policy instruments applied to the same emissions. Consider, for example, the role that a domestic tax on electricity consumption might play in reducing carbon emissions. It will push up the price of electricity in the UK, thereby reducing demand. However, electricity generators in the UK are members of the ETS. So any cut in demand for the electricity they produce, and therefore in their

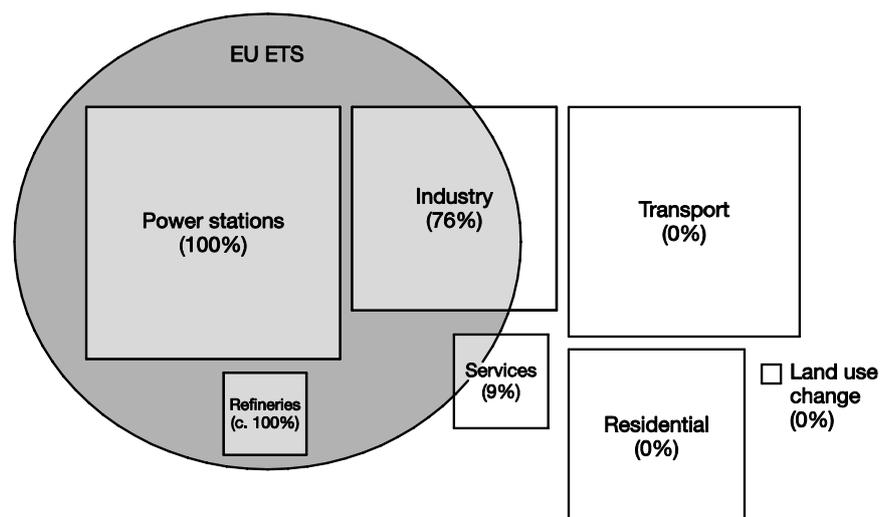


Figure 11.1. Coverage of the EU Emissions Trading Scheme by UK sector

Source: Committee on Climate Change, 2008, 150.

demand for EUAs, will *increase* the availability of EUAs in other member countries and have no effect on overall emissions across the EU. So any additional policy that increases the price of electricity in the UK can only have positive environmental consequences if it has a *dynamic* effect in the sense of making it easier to reduce future emissions caps.

It is not clear that a number of policies implemented by the UK government have been thought through in this context. The Carbon Reduction Commitment is one. It targets energy use by large non-intensive users of electricity—large retail businesses and service industries, for example—creating a cap-and-trade mechanism amongst them. This may reduce electricity use in this sector but it *cannot* reduce emissions across the EU unless either the ETS cap is not biting (in which case the central plank of policy has failed) or there are genuine dynamic effects on future caps (for which there is little firm evidence, and which seem a shaky basis on which to introduce an expensive new policy).

More generally, for as long as the ETS remains a central plank of policy, a national carbon tax is not likely to be effective in reducing overall emissions. It would reduce emissions in one country by subsidizing emissions elsewhere. That is not to say that such a tax may not be efficient or necessary to help meet *domestic* targets. This serves to illustrate a problem to which we will return—that of how to assess the role of national targets in the context of an international trading scheme.

Whilst this is not a book about the design of cap-and-trade systems, the ETS is so central to the pricing of carbon emissions that it requires some attention. The way in which it interacts with other pricing policies is particularly important, as is the fact that its coverage is less than complete. The setting of emissions caps and the allocation of permits also matter.

In the first two phases of the ETS, individual countries proposed national emissions caps to the EU, based on their calculations of the level of emissions implied by 'business as usual'. There are obvious incentives to 'game' the system here. In the first phase, there was a shortage of allowances in only a small number of countries (including the UK). For the second phase, the European Commission rejected the proposed caps initially put forward by most member states because they would not between them have created enough scarcity. A more centralized allocation mechanism is proposed for

the third phase.¹⁶ Even so, the difficulties in setting caps and the extent to which the system is open to political lobbying can hardly be exaggerated.¹⁷

Once caps are set, permits have to be allocated to firms. This has been done by 'grandfathering'. Polluters are given permits reflecting their past levels of emissions. This may have been important in the early years of the scheme to ensure acceptance by industry, but it is clearly undesirable going forward. During the second phase, it is estimated that free allowances will create windfall profits of £1.6 billion annually for the UK power sector.¹⁸

Auctioning is preferable. It raises revenue for the government and it does not confer competitive advantages on incumbents. The current plan is to auction half of allowances in 2013, with all allowances in the power sector being auctioned by 2020.

A system that covers a greater proportion of total emissions is also preferable. We currently have a dual pricing system: half of emissions are in the ETS and half out, with aviation due to join in 2012. The result is a range of effective carbon prices. As we discuss in Section 11.2.3, the dual system can create particular problems in the context of 'binding' emissions targets, which are now key pillars of climate policy.

Finding some way to increase price stability and certainty going forward is also likely to be important. Uncertain and variable prices may render the price signal too weak to drive major investment decisions by energy and other companies. Figure 11.2 illustrates this by showing how prices changed over the period 2005–08, including the collapse in price to zero during the first phase of the ETS.

Two strategies might increase the degree of stability. One is to expand carbon markets across activities, time, and regions so as to deepen them and increase information flows and liquidity. Deeper and more liquid markets tend to be more stable. In line with our more theoretical discussion in the previous chapter, a price floor (and perhaps a ceiling) is also likely to be valuable, at least in the shorter term.¹⁹

¹⁶ See <http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/796>.

¹⁷ There are many complexities to this issue, including the role of project credits allowing reductions to be bought from other countries, which we ignore here.

¹⁸ Committee on Climate Change, 2008, 149.

¹⁹ Also proposed by the Committee on Climate Change (2008, 156).

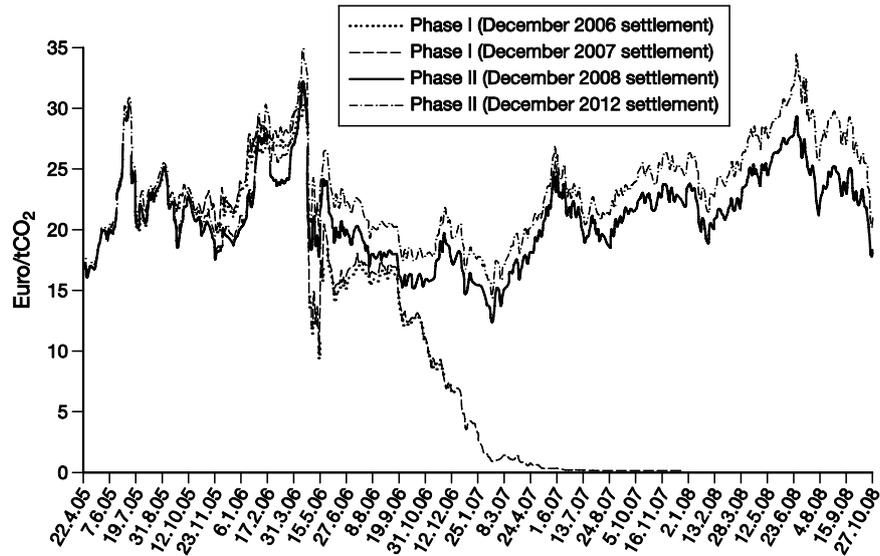


Figure 11.2. Allowance price evolution in the EU ETS, 2005–08

Source: Committee on Climate Change, 2008, 150.

Taxes on Domestic Energy Consumption

As we have argued, the existence of the ETS makes the case for the imposition of an additional tax relatively weak unless it is the only way of achieving a reasonable degree of price stability.

But important sectors of the economy are not currently covered by the ETS, including the use of gas in domestic heating. There may be specific areas where tax incentives can motivate further behavioural change—for example, to buy more energy-efficient goods. And then, of course, we need to confront the fact that the imposition of VAT at a reduced rate of only 5% on domestic energy (gas and electricity) effectively *subsidizes* energy use relative to other forms of consumption.

In this respect, the UK differs from most other EU countries. Largely because we impose VAT on domestic fuel at such a low rate, taxes account for less than 5% of the cost of domestic electricity in the UK, which is very low by EU standards.²⁰ The result is that while the pre-tax electricity price in

²⁰ Source: Eurostat, *Data in Focus 23/2008: Environment and Energy* (http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-QA-08-023/EN/KS-QA-08-023-EN.PDF).

the UK is slightly above the average of the EU-27, the post-tax price is below the average.

The main reason for eschewing taxes on domestic energy consumption has always been distributional. On average, poorer households devote a higher proportion of their spending to energy than do richer households. This is illustrated in Figure 11.3. Domestic fuel has become a much less important part of total spending over time, and particularly so for poorer households, but it still takes three times as big a share of the spending of the poorest households as of the richest. So concerned was the last government about the fuel costs for poorer households that it had a specific target to reduce numbers in ‘fuel poverty’.²¹ But bear in mind that since 1970, average internal home temperatures have increased by a remarkable 6°C, from 12°C to 18°C.²²

From an economic point of view, we might want to distinguish between those who simply have a preference for using more energy (for example, to keep the house warmer or to run more electric goods), those who need to use more energy because their house is poorly insulated, and those who need

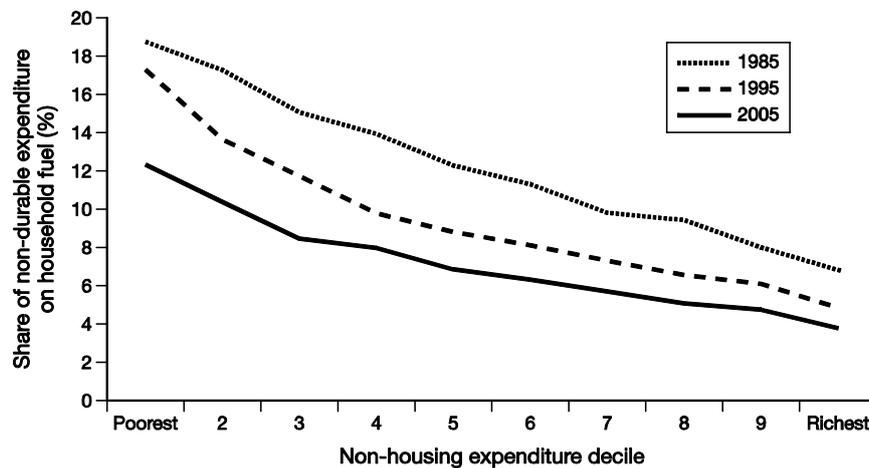


Figure 11.3. Share of non-durable expenditure devoted to domestic fuel, by expenditure decile

Source: Fullerton, Leicester, and Smith, 2010.

²¹ Fuel poverty is defined as a situation in which a household needs to spend more than 10% of household income on all domestic fuel to heat its home to an adequate level of warmth.

²² Committee on Climate Change, 2008, 217.

more energy because they are old or sick. There is no obviously good reason to subsidize the first group. The second group might need help to make their homes more energy efficient. If their homes cannot be made more fuel efficient, they may simply need financial support, as is likely to be the case for the last group.

Some of the money raised by taxing domestic energy use could be used to compensate poorer households by raising benefits and cutting other taxes. The problem is that, whilst this would compensate people *on average*, it would still leave many poorer households (i.e. those that use significantly more energy than the average) somewhat worse off. As we discussed in Chapter 9, one would also need to be very careful about potential effects on work incentives from such a reform.

The problem is illustrated in Figure 11.4, which shows the pounds-per-week losses that would be experienced by households at different points in the income distribution if VAT on fuel were to be increased from 5% to 17.5%. For each income decile, the bars show average losses and the lines

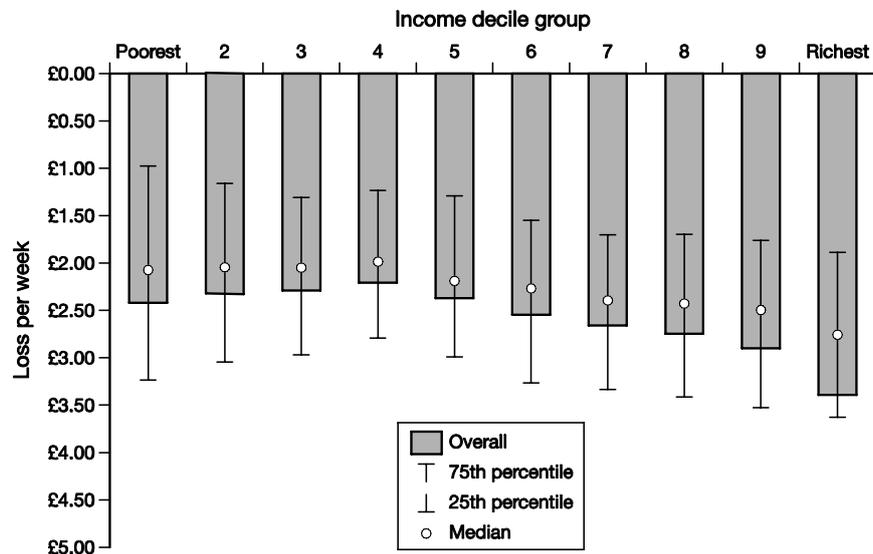


Figure 11.4. Losses from imposing VAT at 17.5% on domestic energy consumption, by income decile

Note: Income decile groups derived by dividing households into ten equal-sized groups according to their disposable income adjusted for household size using the McClements equivalence scale.

Source: Authors' calculations using the IFS tax and benefit microsimulation model, TAXBEN, run on updated data from the 2007 Expenditure and Food Survey.

show losses at the 25th, 50th, and 75th percentiles. For the poorest group, median losses are just over £2 per week, but a quarter of households in this group would lose well over £3 per week.²³

As Simon Dresner and Paul Ekins—long-time proponents of a carbon tax—have shown,²⁴ it is not possible to provide effective compensation through the benefit system to *all* low-income households by using money raised from such a tax. They conclude that a long-term programme of improving energy efficiency in such households would be a prerequisite for a significant tax rise. Such an approach might help avoid some of the opposition that stymied the attempt to impose the full rate of VAT on domestic fuel in the early 1990s.

That said, it is worth remembering that many other countries have bitten the bullet and imposed VAT on energy consumption. Raising VAT to the full rate of 20% would increase effective energy prices by just over 14%. Market fluctuations and the apparent long-term increase in energy prices since 2006 have been much more dramatic than that. As of 2008, three existing policies—the EU ETS, the Renewables Obligation, and the Carbon Emissions Reduction Target²⁵—already increased electricity bills by an estimated 8%,²⁶ but in a way that is much less visible to the general public and which therefore excites less opposition (even though there has been no explicit compensation). And, as we have seen, proposals to increase the use of renewable energy sources will lead to this cost increasing over time.

Overall, there is a strong case for extending VAT at the full rate to domestic fuel consumption—just as there is a strong case for a more uniform VAT generally. While there is a functioning ETS, there is not a strong case for any additional tax on electricity consumption. But while gas remains outside the ETS, there is a case for an additional tax on gas consumption. To equate roughly to the effect of the ETS in 2009, such a tax would need to be in the region of 10% of gas price. This would require some of the money raised to be used on compensation and measures to improve insulation and energy efficiency.

²³ Though see Chapter 9 for a discussion of how to interpret these sorts of figures.

²⁴ Dresner and Ekins, 2006.

²⁵ A description of the last can be found at http://www.decc.gov.uk/en/content/cms/what_we_do/consumers/saving_energy/cert/cert.aspx.

²⁶ Ofgem, 2009.

Climate Change Levy

There is one particular tax in the UK that it is worth dwelling on briefly here, if only because of its name. The climate change levy, introduced in April 2001, is a tax on the supply of energy to business, paid by users. Electricity is taxed at the same rate whether generated by gas, coal, or nuclear power, despite their very different carbon emissions. Lower rates are charged on direct use of gas, solid fuel, or liquefied petroleum gas (LPG), and some exemption is available for electricity generated from renewable sources. The CCL was forecast to raise around £700 million in 2010–11.²⁷

The CCL has a number of interesting features. First, it is closer to being a tax on energy consumption than a tax on greenhouse gas emissions. Second, its introduction was accompanied by a 0.3% cut in employer National Insurance contributions (NICs) so as not to increase the overall tax burden on business; in fact, the cut in NICs has been worth rather more than the money raised by the CCL. Third, it was accompanied by Climate Change Agreements (CCAs) that allowed energy-intensive businesses to reduce their CCL liabilities by 80% in exchange for agreeing to meet energy efficiency targets. Fourth, some of the money raised by the CCL (already more than exhausted by the National Insurance cut) was hypothecated to funding the Carbon Trust,²⁸ an organization set up by government to provide advice and support to business on saving energy. Fifth, the CCL applies only to business. Finally, in the first five years of its operation, it was not indexed in line with inflation, thereby reducing its real value (and presumably impact) year on year.

In these respects, the CCL has interesting parallels with other actual and proposed ‘green taxes’. The political economy of their introduction seems to be such that cutting other taxes, hypothecating revenues, and focusing on business tend to be important elements of their design. And taxes that require annual uprating are less likely to maintain their real value than proportional taxes—such as VAT—which automatically rise with prices. The use of Climate Change Agreements alongside the main CCL reflects both

²⁷ http://budgetresponsibility.independent.gov.uk/wordpress/docs/hmrc_receipts_300610.pdf.

²⁸ The logical conundrum created by the hypothecation of revenues that were more than negated by the reduction in another tax is just another of the absurdities that tend to go with efforts to hypothecate tax revenues.

concerns over international competitiveness of energy-intensive industries and a view that there is a role for improved information and advice in reducing firms' energy use. Like many other aspects of tax policy in the environmental field—including the free allocation of emissions trading allowances—the scope and structure of CCAs and the scale of the reduction in the main tax rate that goes with them inevitably attract intense lobbying.

The CCL is a flawed tax. In the compromises that are central to it—exempting households entirely and energy-intensive industries by 80%, cutting other taxes, hypothecating non-existent revenues, creating opportunities for lobbying—it mirrors the compromises that governments have deemed necessary to many environmental taxes. But it forms a small and complex part of a rather incoherent overall system.

11.2.3. The Carbon Price

We have so far avoided discussing the appropriate level of the carbon price. The unwary reader might think that this is a relatively straightforward issue.

Much effort has been expended in the calculation of a so-called social cost of carbon (SCC), defined as the present value of the future costs associated with the emission of an additional tonne of carbon. Unfortunately, the SCC is likely to have only limited use in informing policy decisions, not least because of the range of estimates produced. Watkiss and Downing (2008, 101) conclude that estimates of the SCC 'span at least three orders of magnitude, from zero (or even below) to over £1000/tC, reflecting uncertainties in climate impacts, coverage of sectors and extremes, and choices of decision variables (notably over discount rate, equity weighting and climate sensitivity)'. It is indeed possible to take a range of different views about all these things, which is why there is considerable disagreement among economists about the appropriate response to climate change, and in particular over how much effort it is worth investing in abating emissions now, as opposed to in the future, and hence what price we should effectively be putting on carbon.

To complicate matters further, estimates of the SCC also depend on the assumed path of future emissions. The damage caused by additional carbon emissions depends on the level at which GHGs stabilize in the atmosphere.

For example, if we end up with concentrations of GHGs stabilizing at 450ppm CO₂e, then the damage done by each additional tonne emitted will be less than the damage done by each additional tonne emitted if we end up stabilizing at 650ppm. Damage rises more than in proportion to the increase in atmospheric concentration.

The problem relates to risk and uncertainty and how they are taken into account. An explicit way of doing that, adopted by the Stern Review, is to choose a target for atmospheric GHG concentrations, on the basis of what we know about the costs of possible climate change scenarios at various levels of concentration and what we know about the costs of meeting that target. If we go along with Stern's recommendation, that a target in the broad range between 450 and 550ppm CO₂e would be appropriate, then an appropriate price for carbon would be the marginal abatement cost of the most expensive technology required to achieve that outcome.

A target stabilization level in effect underlies many countries' approaches to climate policy, not least in the UK where the government has taken on a 'binding' commitment to reduce emissions by 34% below 1990 levels by 2020. These targets frame the debate about policy and the role of prices and other instruments in reaching the targets. In this context, the UK government has moved away from thinking about setting appropriate carbon prices by reference to measures of the SCC, towards defining prices by reference to the price needed to achieve the targets. There is an internal consistency to this position, but of course it depends on a belief that the targets are themselves in some sense 'right'. And most of the uncertainties and judgements that make calculating the SCC so difficult and controversial also make determining the correct emissions target difficult and controversial. But if we do have reduction targets, then it makes sense to price carbon so as to achieve those reductions.

The EU has also set itself targets, for 20% emissions reductions by 2020 (or 30% if a global agreement is reached), and caps within the ETS itself will need to be set so as to ensure the ETS sectors play their appropriate roles in meeting these targets. One important issue for countries such as the UK, which have set themselves stringent domestic targets, is that the effective price put on emissions reductions outside the ETS will need to be higher than that on those inside. Indeed, the most recent government guidance on

this subject²⁹ suggests that while the traded price of carbon in the EU ETS might be £25 per tonne of CO₂, the appropriate price to use in the non-traded sector in order to achieve UK targets would be £60 per tonne of CO₂. Going forward, the appropriate carbon price will likely increase as the cost of technologies required to meet increasingly stringent targets rises.

This divergence results from the fact that half of UK carbon emissions are traded across the EU and half are susceptible only to UK policy, whilst UK targets are set independently. This creates obvious inefficiencies. Too much will be done in the non-traded sector and not enough in the traded sector. Furthermore, there are no plans to impose a consistent carbon price through a tax or any other mechanism on the non-traded sector. The importance of bringing more emissions within the ETS, of pricing those left outside, and of setting UK targets as consistently as possible with EU policy should be obvious.

11.2.4. Other Policies

This is a book on tax, and we have focused on the role of taxes and other pricing mechanisms in climate change policy. In a perfect world, pricing might be sufficient. But it is worth noting, briefly, that this is not a perfect world and these are not the only policies that will be needed either nationally or internationally 'given the risks, urgency, inertia in decision making, difficulty of providing clear and credible future price signals in an international framework, market imperfections, unrepresented consumers, and serious concerns about equity'.³⁰

Internationally, policy will need to focus on supporting and accelerating technological change and it will need to take account of market failures and problems in information, transaction costs, and so on. In any case, the abundance and cheapness of coal in countries such as China suggest that technological solutions, including especially developing means of capturing the CO₂ that is emitted in producing electricity, will also be needed. Indeed, support for such technology is absolutely crucial to climate change policy.

²⁹ Department of Energy and Climate Change, 2009a.

³⁰ Stern, 2008, 23.

In non-energy-intensive sectors, pricing through the tax system is unlikely to be enough to drive action. There are multiple barriers to households and non-energy-intensive businesses responding to increased energy prices, including lack of information and ‘hassle costs’ associated with improving energy efficiency—for example, through installing insulation. The costs of any kind of trading schemes for such large numbers of small emitters will be excessive.³¹ Pricing will also be difficult to implement in some sectors, such as agriculture, where there are multiple sources of emissions and where very particular behaviour patterns matter a lot—for example, in determining the quantity of nitrous oxide emissions, it matters not only how much fertilizer is applied but also when it is applied. Regulation is probably the right *economic* instrument in many of these instances.

Governments use numerous non-price policies. In the UK, these include support for technology (particularly demonstration carbon capture projects), obligations on energy suppliers to improve the energy efficiency of many of the households to which they deliver, obligations on use of biofuels in petrol, increasingly stringent building regulations, and direct support for renewable sources of electricity generation. There are also various minor tax policies in these domains, with a range of tax breaks and subsidies for energy efficiency investments and, for example, stamp duty exemptions on zero-carbon homes.

It is not for us, here, to judge the right combination of non-tax policies, but two points are important. First, the range of policies needs to be coherent and related to the specific market failures in each case. The case for using policies other than a consistent price signal always needs to be made. Second, and more important, it is crucial that other policies do not get in the way of pricing. At EU level, there are real dangers of this happening. Not only do we have the ETS, but we also have a 20% emissions reduction target, a 20% renewables target for energy supply, and a 20% energy efficiency target, all for 2020. This gives the wonderful ‘20-20-20 by 2020’ slogan. (There is also a 10% target for biofuels by 2020.) Unfortunately, while this might make a lovely slogan, it does not make for great policy. If policy is really designed to meet these targets, there is every chance that the ETS itself will be undermined by the renewables target and that GHGs will be abated at much

³¹ See e.g. Department for Environment, Food and Rural Affairs (2008).

higher cost than would have been achieved with the ETS as the main instrument.

11.3. CONCLUSIONS

We are a very long way from having a coherent approach to the pricing of greenhouse gases in the UK, as in most countries. Many emissions are not priced at all—those from domestic gas use being the most obvious, but also those from agriculture. Indeed, the reduced rate of VAT on gas and electricity consumption implies a significant subsidy. There is a wide range of effective prices on other emissions. And we ignore completely emissions ‘embedded’ in imports. On the other hand, there is a trading system up and running at the European level, which is moving to embrace more sectors and to include more auctioning of allowances. It is likely that an ETS extended to other sectors, with allowances auctioned and with caps set more effectively, will be crucial to achieving an effective and consistent treatment of emissions in an international context. Wider international agreements on pricing and emissions trading are also needed.

As we have stressed throughout, consistent pricing is necessary but not sufficient for dealing with climate change. The list of other policies in place in the UK is a long and complex one. An inchoate mass of regulation and subsidy has been built up bit by bit, budget by budget, ministerial announcement by ministerial announcement. This is partly a political failure, but it also reflects failures in the markets for research and technology development and in the provision of information to consumers, as well as concerns about the effects of pricing on incomes of the poor and on competitiveness.

But only by getting pricing right can we have any confidence that we will make the right choices over which sectors can and should bear particular shares of the carbon reductions that policymakers deem necessary to deal with climate change. That matters because other routes lead to much higher-cost carbon reductions and potential loss of political support. There can be few other places where getting the economics right matters as much.

Specifically with regard to taxes and pricing carbon, we would start by introducing VAT at the full rate on domestic energy consumption alongside, or preceded by, significant investment in energy efficiency and an appropriate compensation package. The EU ETS needs to be improved, bringing domestic gas supply within it if possible. If that does not prove feasible, then an additional tax equal to the expected ETS price should be levied on gas consumption. Full auctioning of ETS allowances needs to be introduced as soon as possible. An important part of the strategy must be to bring much more stability to the ETS price, if necessary by imposing a price floor. A much simpler single pricing system for emissions not covered by the ETS is also required.

Between them, these policies should both bring some more rationality to the pricing of carbon and raise substantial sums of money. The Committee on Climate Change has estimated that auctioning of allowances in the EU ETS could raise up to £8 billion a year in the UK by 2020.³² The amount raised depends on the carbon price (assumed to be £40 a tonne of CO₂ for the purposes of this calculation) and the proportion of allowances auctioned. Less than 100% auctioning and a lower carbon price could reduce these revenues substantially—to £3 billion with a price of £21 a tonne of CO₂ and some exempt sectors. In the short run, before 2013, sums of well below £1 billion annually will be available. Policy should clearly aim at the top end of this range. Our calculations suggest that charging tax on direct consumption of gas at £40 a tonne of CO₂ could raise around another £3 billion.

In addition, imposing VAT at its full rate on domestic fuel should raise around £5 billion (with a 20% VAT rate)³³ before the cost of any compensation package for poorer households.

³² Committee on Climate Change, 2008, box 11.3.

³³ Source: Authors' calculations using HMRC statistics, table 1.5 (http://www.hmrc.gov.uk/stats/tax_expenditures/table1-5.pdf), adjusting the 2010–11 estimate to reflect the fact that the VAT rate was 17.5% for part of that fiscal year and 20% for the rest.