Climate Change and Energy Taxes

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1. More Than a Scientific Consensus

A persuasive scientific consensus on global warming, the likelihood of consequent climate change, and the probable causes, has crystallised in recent years. The emergence of this consensus has received widespread attention and has already provoked intense political debate and initial policy responses. Most climate scientists would now accept (Easterbrook, 2006) that

(i) There has already been a significant temperature increase;

(ii) The temperature increase is continuing, and is large enough to have already triggered climate change;

(iii) The cause, with high probability, is human agency, through greenhouse gas emissions, especially of CO2.

There is less agreement about the extent and consequences of climate change, or about the likely speed of the process. But there now appears to be adequate ground to justify an acceleration in measures to reduce emissions in absolute terms, a conclusion which would have been contested until relatively recently. The extent of this scientific consensus is surveyed in non-technical terms in Hansen (2006).

But a second and equally significant consensus has also emerged, this time amongst economists, on the form which these measures should take. National and international action to date has tended to focus on quantitative interventions, such as the Kyoto protocol, the EU Emissions Trading System, and the various industry-level voluntary agreements to limit emissions. Let us call these Q-type policies. There is an untypical degree of accord in the economics profession that this is not the most promising policy architecture. Economists favour policies which focus on harnessing market forces through price signals (P-type policies), especially through taxes on carbon and other emissions.

A feature of the phenomenon of global warming is that each unit of greenhouse gas emitted does the same damage at the margin: hence economic efficiency requires that the same value should be attached to each unit of emission reduction, anywhere in the world, and from whatever source. Existing policies, including the international agreements and the domestic policies of individual governments, do not meet this criterion. Indeed some emissions are actually subsidised, some are taxed at too low a rate, and some emission reductions are being purchased at too high a cost.

It is increasingly clear that the Kyoto approach and its offshoots, including the EU’s emissions trading system, are in serious trouble. The failure of the USA to accede to Kyoto is a well-known limitation, but many acceding countries are failing to stay inside their allocated limits. These limits have in any case been overtaken by events, and US accession would make relatively little difference at this stage. Kyoto would not deliver what the climate scientists now feel is necessary, even if all countries to which it is addressed (essentially the OECD countries and the former Soviet bloc) were to comply in full.
Moreover there is mounting evidence that the Kyoto architecture leads to policies which do not promote the selection of least-cost abatement strategies.

In these circumstances the temptation for policymakers is always the intensification of existing policy. If the patient is not responding, increase the dosage. The economics consensus is saying that the medication is not appropriate and needs to be changed. The economists’ preferred solution, a harmonised international carbon tax, is a silver bullet, aimed at the principal source of the climate threat.

2. What is Wrong with Kyoto (and other Q-Policies)?
There has been a misplaced emphasis on the failure of some countries, notably the USA, to sign up to Kyoto, and on the failure of some signatories (including Ireland) to make adequate progress toward respecting the emission ceilings allocated to them.

The reality is that the Kyoto Protocol will not achieve an adequate reduction in emissions even if it is fully implemented. Moreover it is not self-evidently the least-cost method of achieving whatever reductions it may bring about. The principal weaknesses in the Kyoto approach have been summarised in a recent paper by the Yale economist William Nordhaus (Nordhaus 2006).

- **Arbitrariness**: ‘….the policy lacks any connection to ultimate economic or environmental policy objectives’. Freezing emissions by reference to some arbitrarily-chosen historical level, even if all countries participated, does not relate to identifiable goals for concentrations, temperature, potential damage or abatement cost minimisation.

- **Incomplete Application**: ‘Base year emissions have become increasingly obsolete as the economic and political fortunes of different countries have changed’. Developing countries are exempt, and it has been calculated that just four, China, India, Brazil and Mexico, would generate the equivalent of total world emissions of the year 2000 if their economic growth ever brought them to the current emissions per capita level of the USA (Kahn and Franceschi 2006). A base-year approach penalises fast-growing economies and those which were energy-efficient in the base-year. It benefits slow-growth economies, thus encouraging a spatial mis-allocation of economic activity, and those, such as Russia, which were energy-inefficient in the base-year. This partly explains why Russia joined and the USA did not. P-type policies avoid the need for baselines altogether.

- **The Weitzman Problem**: The marginal costs of emission reduction are uncertain, and likely to be nonlinear (for example may rise steeply the more reduction is sought). The marginal benefits, while also uncertain, are likely to be linear, because of the stock-flow nature of the problem. Over a wide range, unit benefits should be invariant to scale. Low curvature of the benefit function relative to the cost function implies that P-type policies are superior to Q-type policies, Weitzman (1974).

- **Price Volatility**: Since under a Q-policy the supply of emission permits is fixed, and demand possibly quite inelastic in the short-run, there is a risk of price volatility. This has been the experience with the (otherwise successful) SO2 regime in the USA, and with experience to date of the EU’s tradeable CO2 permit scheme.

- **Tax Inefficiency**: Quantitative interventions which do not raise revenue will worsen the pre-existing efficiency losses caused by the tax system, without providing revenue which might be used to mitigate them. A Pigouvian carbon tax provides revenues which can address this issue a framework of overall revenue neutrality.
· **Patronage and Corruption**: Systems which involve the discretionary award or grandfathering of emission rights are more prone to patronage and corruption (patronage which has been criminalized) than tax-based systems. Countries with a poor anti-corruption record such as Russia and Nigeria are likely to have a surplus of exportable permits under Kyoto and the ‘clean development mechanism’ respectively. Auctioning, rather than allocating, permits is preferable, but is rarely chosen under Q-type systems, and was largely eschewed in the design of the EU’s CO2 system.

· **Accounting Problems**: Setting quotas and measuring compliance is not straightforward, and is a problem in developed as well as developing countries. Unlike straightforward tax evasion, where the incentive for the taxpayer to evade is balanced by the incentive for the tax authority to collect, fiddling a quota system is a positive-sum game for the participants. The buyer gets genuine permits, the seller gets cash, and the national Government may not care. There have been scandals in emissions markets in advanced countries with well-developed legal systems, including the United States.

There are objections to tax-based systems too. These include

· **Monitoring**: Aside from the setting of the correct level of the tax, compliance is an issue. What is to stop a country from collecting the tax but offsetting its impact through other subsidies or regulations? Germany could increase the already large coal subsidy, Ireland could continue with the obligation to dispatch peat-fired power stations regardless of emission cost, spreading the burden through an inefficient electricity tax? Methods for computing and monitoring ‘net carbon taxes’ would be required.

· **Dealing with Pre-Existing Taxes**: Global efficiency requires that countries which already levy carbon (or equivalent) taxes are credited for so doing. Nordhaus argues that Europe currently has *de facto* carbon taxes substantially higher than those in the USA. Some countries appear to have negative taxes. Indonesia spends $12 billion per annum on fuel subsidies.

· **Absence of a Quantitative Target**: A carbon tax system does not explicitly limit emissions. But there is no ‘correct’ level of emissions, and the setting of the tax is itself a kind of price discovery process. The initial price will have to be adjusted in order to target the ultimate objectives of environmental policy, which are temperature and climate, rather than the volume of emissions.

3. What is Wrong with the EU’s Emissions Trading System?
The European Union’s cap and trade system has now been in operation since the beginning of 2005. It covers emissions from the European powergen industry plus other large industrial emitters, including cement, steel and the pulp and paper industries. The ETS illustrates some of the criticisms of Q-type policies made by Nordhaus and others. Emission permits, which are tradeable, were gifted to specific companies in the sectors covered based on historical emissions. There have been controversies about these allocations, both between and within countries, and allegations that the resultant rise in electricity and other prices has delivered windfall profits to shareholders. But perhaps the most interesting experience is the time-series for CO2 prices.

**Chart: Carbon Dioxide Price in Europe since January 2005.**

Prices have been notably volatile, with the Spring 2006 collapse attributed to revelations that emissions for 2005 in some member States had been lower than expected, and complaints (from those caught with long positions!) about data
reliability. There is also considerable uncertainty about what happens after 2007, when the existing scheme runs out.

The European system has also attracted criticism on grounds less evident to the naked eye. The Cambridge economist David Newbery (2005) has pointed out that controlling the quantity rather than the price of carbon reduces the elasticity of demand for gas, amplifies the market power of gas suppliers and the impact of gas prices on electricity prices.

As the system is introduced, gas price will rise, since it has lower emissions than the other ‘swing’ fuels. This causes a switch to coal, but since this has higher emissions, the price of permits will rise, provoking a further rise in the price of gas. Using UK data, he reckons the ETS has increased the market power of gas suppliers (for which read Gazprom) by about 50%. Thus there has been a transfer of rent from Europe to Russia consequent on the choice of a Q-type policy by the European Union.

This casts an interesting light on the sharp run-up in gas prices which occurred in 2005, the first year of the new system. Newbery concludes that the European Commission should either fix the price of permits, standing ready to buy or sell (create) permits at that price; or simply opt for a carbon tax.

4. Getting to a Harmonised Carbon Tax
International agreements are difficult to negotiate and enforce, whether of the Q- or P-variety. A particular difficulty with the carbon tax has been the scepticism of electorates in developed countries about the credibility of Government commitments to revenue-neutrality. They simply do not believe that the proceeds of a new tax would be used to reduce existing taxes. The politicians would find worthy purposes for the new revenue, they suspect, and the overall tax burden would rise.

But the recent avalanche of publicity about global warming may be creating a window of political opportunity, in the sense that electorates may be more receptive to a well-argued and credible package. Specific detail in advance about the tax remissions could smooth the way for a move to P-type policies, and public acceptance of environmental taxes should not be assumed to be lacking.

Domestic policy initiatives along these lines are feasible. The German Government managed to sell an excise duty increase on automotive fuels balanced by a cut in fixed taxes (purchase taxes and annual licenses) on motoring. Aviation is largely untaxed, due to the Chicago and other Conventions. The extension of VAT to aviation would not be greatly inferior to an excise duty, given the impossibility of fuel substitution (energy taxes are less efficient than carbon taxes the greater the substitution possibilities, as in power generation, where the fuels are perfect substitutes). The EU could explore the introduction of VAT on the airline industry, currently exempt (as distinct from zero-rated).

Marine bunkers are currently largely untaxed internationally, as are propellant fuels used by trains and (in some cases) buses in Ireland, some industrial fuel oils, and agricultural diesel. VAT and excise exemption, or liability at the lowest rate, is a subsidy to certain consumer fuels, for example home heating oil. It would be open to the Irish Government, and to other European Governments, to construct a minimum tax regime, where any forms of carbon-intensive energy use currently subsidised, untaxed, or taxed at too low a rate, would be taxed at least up to the equivalent of a carbon tax, with the proceeds explicitly earmarked in advance for specified reductions in pre-existing taxes, such as the overall VAT rate or payroll taxes. An extension of the VAT base at European level could accompany such a change.

There are many countries around the world which actually subsidise carbon-intensive energy uses. For example, the forecourt price of autofuel is below the ex-refinery price in many oil-producing countries. A minimum tax initiative by developed countries could act as a powerful demonstration project in seeking to persuade their Governments to accede to a harmonised worldwide carbon tax. As Nordhaus points out, international transfers and burden-sharing arrangements would also be necessary.

5. The Government’s Energy Green Paper
The Irish Government published its Green Paper on Energy Policy on October 1st. The principal components included:

- A target improvement of 20% in energy efficiency by 2030.
- A shift in power generation to 30% renewables, mainly wind, by 2030.
- A continued ban on nuclear power station construction.
- No divestment of power stations or transmission assets by the Electricity Supply Board.

Detailed policy measures to attain the 20% energy efficiency improvement, or the switch to renewables, are not specified. A 30% reliance on renewables, of which well over 20% would need to be wind, would have significant cost implications, which are not drawn out in the Green Paper. These include the capital and operating costs, not just of the wind units, but also of the back-up dispatchable stations, the transmission infrastructure costs, and the cost impositions on conventional generation deriving from intermittent running. Thus ESB National Grid (2004):

‘We estimate that for a system with a peak of 6,500 MW, and a generation portfolio comprised of open and combined cycle gas turbines, and no WPG, that the total annual generation costs would be €1.28bn. When WPG is increased to 1,500 MW, the total generation cost increases by €196m. per annum to €1.48bn.’

Note that, with low availability due to intermittent running, an installed capacity of 1,500 MW of wind would not come close to the Government’s Green Paper target. I estimate this would require perhaps 4,000 MW of WPG, with costs to match. The proposed switch to wind needs to be costed and compared to alternatives. It is not self-evident that a high reliance on wind is the least-cost abatement strategy available in Ireland.

The most immediate alternative, nuclear, is firmly ruled out in the Green Paper. In the two decades since Chernobyl, safety fears and (until recently) the low cost of alternative fuels virtually halted nuclear power plant construction around the world. But there have been no more Chernobyls, oil and gas prices have soared and there is a consensus that something must be done about global warming. The result has been a revived nuclear industry. Thirty plants are under construction around the world, mainly in Asia but also in several European countries, including Bulgaria, France, Finland and Poland. The 17% nuclear share in world electricity output had been expected to decline steadily due to plant retirement and the low build rate. But life extensions and expansions to plant capacity are under way in many countries which, combined with new construction, have led the International Energy Agency and others to predict that the nuclear share will stop falling, and could begin to rise on some forecasts. Several further countries, including the United Kingdom, seem likely to lift their moratoria on nuclear plant construction.

The Government’s recent Green Paper asserts that minimum nuclear plant size is 1,600 MW, which it notes would be large relative to the Irish market of about 6,000
MW. This assertion is however not accurate. There were 440 nuclear plants operating worldwide at end-2005 with an average capacity of 841 MW. Plants currently under construction include two at 951 MW each in Bulgaria and one at 300 MW in Kazakhstan. Next-generation designs emerging from Toshiba and Westinghouse seem to anticipate demand for plant sizes about 1100 MW, but smaller units are technically feasible. The extent of cost diseconomies with smaller plants is clearly important.

There are few other technology choices available which would have the impact on total emissions of a switch to nuclear power. Total national emissions of CO2 from all sources would fall about 16% if nuclear’s share in power generation were increased from zero to the typical EU-25 share of about 30%. The current saving in CO2 emissions in Europe from nuclear power stations is almost equal to the total emissions from private road vehicles across the continent (Irish Academy of Engineering, 2006).

The Green Paper devotes less than a page to the option of nuclear power, which it dismisses. It would be desirable if, prior to the finalisation of the Government’s plans, a comprehensive analysis of the nuclear option could be prepared.

Finally, the Green Paper dismisses the advice in the recent Deloitte report, previously tendered by both the Competition Authority and the Commission for Energy Regulation, that there should be divestment of ESB assets in generation and transmission, the better to encourage the emergence of a more competitive marketplace.

The Green Paper’s silences are notable. One concerns peat, a fuel source for power generation with CO2 emissions even higher than coal. At high carbon prices, and even with gas prices at recent high levels, the peat-fired stations would not necessarily be dispatched in a true competitive market (McCarthy, O’Dwyer & Troy 2006). State support for these high-emission stations contrasts sharply with Government’s stated intentions, including support for low-emission renewables.
The Economics of the Bonzer Wheeze

In the schoolboy comics of my youth, whenever the hero became ensnared in an insoluble dilemma (surrounded by hostile tribes, out of ammunition), the solution was called a ‘Bonzer Wheeze’ (eg a daring leap across a previously unnoticed canyon). The politically unpalatable dilemma created for governments by global warming has created a sellers’ market in Bonzer Wheezes.

A recent example of a Bonzer Wheeze is the campaign to somehow get rid of SUVs. SUVs have fuel consumption per kilometre travelled about 15% poorer than saloon cars of similar engine size, according to a recent report, Sustainable Energy Ireland (2006). If these vehicles were substituted with saloon cars, emissions would, on the face of it, fall. The back of an envelope is enough space to calculate how much. Private cars, including SUVs, contribute 24% of all energy-related CO2 emissions from Irish transport, which sector in turn is responsible for 33% of all energy-related emissions. Thus private road vehicles contribute only about 8% of all energy-related CO2 emissions. About 6% of private non-commercial vehicles are SUVs, and the hypothesised substitution would cut total emissions from this section of the road fleet by under 1%, since they would be substituted by vehicles whose emissions are not dramatically lower. The cut to total national energy-related CO2 emissions would be under 1% of 8%, that is, under .08%. This calculation is generous to this particular Wheeze, since many of the substitute cars would be deployed pulling trailers and horse-boxes, for which they are ill-suited and in which activity they would deliver poorer fuel economy than assumed.

We can calculate how many Bonzer Wheezes, along the lines of the switch from SUVs to saloon cars, would be needed to cut national energy-related CO2 emissions by a seriously useful amount, say 30%. The answer is about 400 Bonzer Wheezes, stretching bureaucratic ingenuity unreasonably.

London’s Lord Mayor, Ken Livingston, clambered aboard the anti-SUV bandwagon in July, suggesting that the city’s daily congestion charge, currently £8, should be £25 for Chelsea Tractors. Tim Harford, in his Financial Times column (Harford 2006) noted that emission permits were trading around £7 per tonne CO2 at the time, and computed the price of a tonne of CO2 implied by the Lord Mayor’s proposal. The answer is £25,000 per tonne.

Dublin will shortly have a road tunnel from Dublin Port to the city outskirts. It has cost approx. €800m., or $1 billion. A justification (apparently an afterthought) for this project advanced recently is that it will shorten journeys and thus cut emissions. The back of my envelope suggests the emissions cut cannot exceed a few hundred thousand € per annum, irrelevant given the scale of the project.

There are two difficulties with Bonzer Wheezes. The first is that they are unlikely to make a worthwhile impact on emissions. The second is that they may not belong to the class of least-cost abatement strategies.
6: Concluding Remark

P-type policies lack the certainty of command-and-control, and Q-type policies appear to offer a half-way house. In particular, there is something reassuring about being able to say that harmful emissions will be reduced by a stated percentage. But the impossibility of predicting precisely how a carbon tax will affect quantities is not a drawback, it is one of its attractions: get the signals right, and markets will discover solutions that may not be obvious, but which are likely to be the best.

Writing in a completely different context, that of aviation industry liberalisation in the United States in the 1980s, Alfred Kahn put it thus:

‘The essence of the case for competition is the impossibility of predicting most of its consequences’ (Kahn 1983).

Competitive, liberalised, energy markets, with externalities corrected by Pigouvian taxes set at sufficient levels to address the climate challenge, will do a lower-cost job than quantitative interventions, or any number of Bonzer Wheezes.
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